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ENLARGEMENT FOR RESIDENTIAL TRADE AND INDUSTRY PORTFOLIO VALUATION AND OPTIMISATION WITHIN THE FRAMEWORK OF THE DEMOGRAPHIC DEVELOPMENT IN THE EUROPEAN UNION

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Abstract

This research presents a new methodology to evaluate the development trends of the residential trade and industry up to 2050. In the first step, available data are analysed for the period 1970 – 2050 in order to establish overall tendencies in real estate markets within the European Union. In the second step an expert assessment based on the Analytic Hierarchy Process (AHP) methodology is integrated to reflect the estimation of various expert forecasts. The AHP methodology is based on different variables in the fields of demographic, social environmental as well as build-quality characteristics to imply a widespread perception of the portfolio mix of habitations in 2050. There will mainly be a focus on several European Union countries with potential future-shrinking populations, namely Bulgaria, Estonia, Germany, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia. Furthermore, they will be compared with Spain whose population is expected to increase.

Resumen

Esta investigación presenta una nueva metodología para evaluar las tendencias de desarrollo del comercio y la industria de viviendas hasta el año 2050. En la primera etapa, los datos disponibles son analizados para el período 1970 hasta 2050 con el fin de establecer las tendencias generales de los mercados de bienes raíces en la Unión Europea. En el segundo paso se integra una evaluación de expertos sobre la base de la metodología analítica Hierarchy Process (AHP) para reflejar la estimación de las distintas previsiones de los expertos. La metodología AHP se basa en diferentes variables en los campos de la demografía, las características de calidad de construcción ambientales, así como sociales. El objetivo es inferir la percepción generalizada de la mezcla de la cartera de viviendas en 2050. El enfoque se ha desarrollado sobre varios países de la Unión Europea con un previsible descenso demográfico futuro: Bulgaria, Estonia, Alemania, Hungría, Letonia, Lituania, Polonia, Rumania y Eslovaquia. Además, se comparan con España cuya población se espera que aumente en el futuro.

Resum

Aquesta recerca presenta una nova metodologia per avaluar les tendències de desenvolupament del comerç i la indústria d'habitatges fins a l'any 2050. En la primera etapa, les dades disponibles són analitzades per al període 1970 fins a 2050 amb la finalitat d'establir les tendències generals del mercat de béns inmobles en la Unió Europea. En el segon pas s'integra una avaluació d'experts sobre la base de la metodologia Analytic Hierarchy Process (AHP) per reflectir l'estimació de les diferents previsions dels experts. La metodologia AHP es basa en diferents variables en els camps de la demografia, les característiques de qualitat de construcció ambientals, així com socials. L'objectiu és inferir la percepció generalitzada del mix de la cartera d'habitatges en 2050. L'enfocament s'ha desenvolupat sobre diversos països de la Unió Europea amb un previsible descens demogràfic futur: Bulgària, Estònia, Alemanya, Hongria, Letònia, Lituània, Polònia, Romania i Eslovàquia. A més, es comparen amb Espanya la població del qual s'espera que augmenti en el futur.

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A.D.	Anno Domini
AG	Incorporated company (Aktiengesell-schaft)
AHP	Analytic Hierarchy Process
a.m.	Ante meridiem; mornings
ANP	Analytic Network Process
ARDL	Autoregressive Distributed Lag
ASFR	Age specific fertility rate
Ass.-jur.	Assessor juris
BBR	Property name of "Federal Office for Building and Regional Planning"
BBSR	Property name of "Federal Institute for Research on Building, Urban Affairs and Spatial Development"
B.C.	Before Christ
BPIE	Property name of "Buildings Performance Institute Europe"
BVE	Property name of "Bauverein der Elbgemeinden"
CEO	Chief Executive Officer
CI	Consistency index
CIBSE	Property name of "The Chartered Institution of Building Services Engineers"
Cp.	Compare
CR	Consistency ratio
CUREM	Property name of "Center for Urban & Real Estate Management"
Dipl.-Betr.	Graduated economist (Diplom-Betriebswirt)
Dipl.-Ing.	Graduated engineer (Diplom-Ingenieur)
Dipl.-Oec.	Graduated economist (Diplom-Ökonom)
Dipl.-Päd.	Graduated pedagogue (Diplom-Pädagoge)
Dipl.-Phys.	Graduated physicist (Diplom-Physiker)
Dr.	Doctor

DVFA	Property name of "Deutsche Vereinigung für Finanzanalyse"
E:CO	Property name of "Complexity & Organization"
EEC	Property name of "European Economic Community"
e.g.	Exempli gratia; for example
eG	Registered cooperative (eingetragene Genossenschaft)
EMF	Property name of "European Mortgage Federation"
ENV	Environmental-Economic Modelling
EPA	Property name of "Environmental Protection Agency"
ERSA	Property name of "European Regional Science Association"
ESPON	Property name of "European Observation Network for Territorial Development and Cohesion"
Et al.	Et alii
Etc.	Et cetera
ETF	Exchange Traded Funds
EU	European Union
e.V.	Registered association (eingetragener Verein)
FDW	Fischer-Dipasquale-Wheaton model
FM	Facility Management
FOM	Property name of "Hochschule für Oekonomie & Management"
GDP	Gross domestic product
GdW	Property name of "Bundesverband deutscher Wohnungs- und Immobilienunternehmen"
GIS	Geographic Information System
GmbH	Limited liability company (Gesellschaft mit beschränkter Haftung)
GREMF	Global real estate mutual funds
HSBC	Property name of "Hongkong & Shanghai Banking Corporation Holdings"
IB	Intelligent Building

IMF	Property name of "International Monetary Fund"
Inc.	Incorporation
ISO	Property name of "International Organization for Standardization"
JAL	Property name of "Journal of Advances in Linguistics"
km	Kilometre
KMUTNB	Property name of "King Mongkut´s University of Technology North Bangkok"
M.A.	Master of Arts
MSDM	Microsoft Data Management
n.a.	Not available
NIRI	Property name of "National Investor Relations Institute"
NV	Incorporated company in the Netherlands (naamloze vennootschap)
OECD	Property name of "Organisation for Economic Co-operation and Development"
p.	Page
p.m.	Post meridiem; in the afternoon
pp.	Pages
PPP	Public private partnership
PPS	Purchasing Power Standard
PSAM	Probabilistic Safety Assessment and Management
PTI	Price-to-income
REIT	Real estate investment trusts
RERS	Property name of "Real Estate Research Symposium"
RI	Average Random Consistency Index
RICS	Property name of "Royal Institution of Chartered Surveyors"
RWS	Property name of "Rozann W. Saaty"
UAE	United Arab Emirates
UK	United Kingdom
UNECE	Property name of „United Nations Economic Commission for Europe"

UNFPA	Property name of "United Nations Populations Fund"
US	United States
USA	United States of America
USD	United States Dollar
USSR	Union of Soviet Socialist Republics
VAR	Vector auto regression model
VILICO	Property name of "VILICO Investment Service"
vnw	Property name of "Verband norddeutscher Wohnungsunternehmen"

1 Introduction

This chapter offers an initial insight into the research. Therefore, background information, general assumptions, research problems, motivation and the structure of this research are highlighted next.

1.1 Background information

Residential trade and industry assets are a basic need of individuals with the result of assessing housing as a right in several nations all over the world. Though there is a strong focus on the relationship between populations and housing demands, there is no direct interaction between them for two reasons: it is mainly households and not individuals that require real estate and, secondly, the needs of households change over time. Therefore, various correlations can be identified that can clarify the movements detected in housing asset stock on a foundation of household characteristics as well as population and society performance structures. The analysis of housing stock in terms of demographic development is important for gaining an in-depth understanding of housing tendencies, general characteristics and underlying economic factors. This kind of analysis can be crucial for minimising risks, uncertainties and tielts in the medium as well as aiding the long-term development of real estate markets in order to develop public and private investments in this sector with the target of stabilising and advancing future real estate assets (Leal, 2007).

The current demographic development in the European Union has been evident ever since they began a few decades ago. Nonetheless, neither the European political and economic bodies nor the real estate markets noticed this tendency for several years. Nowadays these movements are high on the political agenda.

The demographic transformations confirm a strong general trend of a major modification in the age structures of European Union populations. The size of the younger generations is falling, while the number of elderly people is growing. The main demographic trends indicate low fertility, i.e. below 1.3 children per woman with an average of 1.6 across the European Union. The consequence is that this is well below the replacement rate of 2.1 children per woman with the result of the young generations shrinking. Furthermore, life expectancy continues to increase, predominantly due to enhancements in lifestyle and healthcare for older generations. Since there are large variations among and within countries, there is the prospect for raising average life spans for the less advantaged population clusters. Populations, who are presently the oldest, such as Germany's and Italy's, will age quickly over the next twenty years, before stabilising. Some populaces that are younger at present, typically in Eastern Europe, will undergo rapid ageing and by 2060 will have the oldest inhabitants in Europe (Eurostat, 2011a).

The population of the European Union is increasing and its inhabitants are getting older. On 1st January 2015 its population was estimated at 508.2 million, which was a 1.3 million rise on the previous year (Eurostat, 2015). Nevertheless, although the net migration ratio continued to be the key determinant of population development through contributing 63% to the total population increase in the European Union, the populaces in eight states were already decreasing. Additionally, it is forecasted that the number of inhabitants will continue to fall until 2050 in nine countries, namely Bulgaria, Estonia, Germany, Hungary, Latvia, Lithuania, Poland, Romania as well as Slovakia (European Commission, 2012a; Eurostat, 2011a).

1.2 Hypothesis of the research

As a result of the demographic progresses and correlations with housing building stock and economic conditions of the residential trade and industry markets within the European Union, there is the assumption that the demand for real estate assets in the real estate sector is changing and will do so in the future. Hence, real estate assets would vary over the years, especially in the above-mentioned nine European Union countries with declining population rates. The consequence would be that some clusters of residences would become unusable and need to be demolished in certain areas. On the other hand, there would be real estate clusters with the option of modernization to make them senior-compatible. In urban areas there could be the opportunity to increase the number of real estate assets in order to cater to demographic change.

In consequence, the hypothesis includes from the supply perspective a high necessity for modernized and new construction residential trade and industry assets as well as low shares of current, extrapolated real estate assets for the future decades in order to stabilise and increase real estate assets as well as realise the future demands of real estate occupants.

1.3 Research problem statement

As mentioned before, there is a high requirement to realise developments as well as trends in the residential trade and industry of Europe. Additionally, there is a necessity to establish strategies to stabilise real estate economies with their different interconnections.

Nevertheless, the research in this field is very fragmented. The existing literature on databases used to identify tendencies of real estate markets focuses mainly on special fields such as demographic, space or environmental social segments or focuses on individual areas and regions. Furthermore, the time periods differ between various epochs with the consequence of mainly an absence of overall trends from past to the future periods which are required for gaining an understanding of key developments.

Also the specialised real estate economic literature establishes – comparable to the database literature – a high fragmentation of different characteristics, real estate market areas, time periods and research topics. Therefore, an in-depth as well as broad analysis of residential trade and industry markets is not available. As this kind of literature is highly specialised it is difficult to establish further analyses founded on existent literature.

1.4 Motivation of the research

As the literature in the European housing market is fragmented, respectively outdated, the motivation behind this research is firstly to establish a detailed overview of real estate trends from the past decades until future time periods.

Secondly, having identified overall market trends, effective portfolio strategies for each country have to be established in order to stabilise, protect and develop the real estate assets of European states. Saaty's Analytic Hierarchy Process is the methodology used for this. As there is a strong demographic development with the consequence of future declining populaces in nine European Union countries, the motivation is to focus on effective portfolio strategies for these countries in contrast to Spain, which has a growing population. Also Croatia as a European Union member since 2013 has future declining population structures. Nevertheless, this country is not covered by this research as its databases are severely limited, which hinders a deep analysis of it.

Therefore, an in-depth assessment of real estate resources is required. Furthermore, strategic measures of portfolio management have to be available in order to concentrate on strategies for the future to hedge these real estate assets. The target is to focus on future strategies within the basis year 2050, as this is a secured database future year.

The research question includes the target of the ideal residential trade and industry portfolio for mainly countries with shrinking populations in the European Union until 2050.

1.5 Structure of the research

In the first stage of this study, the *literature research chapter* offers a broad overview of existing literature in the field of database research and specialist real estate literature. The research design and methodology includes different research stages. Various literature is highlighted with a brief introduction to the research; furthermore, the strengths and weaknesses of research are analysed to reflect the research gap. This chapter also looks at different real estate research segments as well as diverse international researchers.

The second step comprises a *theoretical framework of determining factors in real estate markets*. In this chapter, issues such as the real estate market with its characteristics and economic conditions, demographic key drivers, decision-making processes and portfolio management are outlined in order to garner a basic understanding of these special issues.

The third stage is a *secondary analysis* from the basic year 1970 to the future year 2050 in order to realise overall demographic, space and environmental social characteristics over an 80-year period. This analysis reveals developments for each analysed country. Additionally, it offers a comparison of tendencies between countries in order to identify if there are mainly equalities or inequalities.

The fourth step is a description of the *methodology* developed in this research to formulate future real estate strategies. The research focuses on the methodology of Saaty's Analytic Hierarchy Process (AHP), which is described in detail. Furthermore, this part leads on the establishment of this methodology for the residential trade and industry sector.

In the fifth stage, a primary *empirical part* based on the Analytic Hierarchy Process is realised. Within this chapter, the interview results of the pairwise comparisons of 15 branch specialists are highlighted and analysed. Additionally, for a proof of the stability and consistency of these results, variance analyses as well as sensitivity analyses are carried out.

In the sixth step, a *holistic model* for the ten analysed European Union countries is created with the result of a scoring table that shows the priority ranking of the branch specialists. Moreover, as the aim of this study is to derive overall real estate strategies in markets with demographic developments, there is a creation of a holistic algorithm as well as a general mediator model. In addition, the mediator analysis again proofs the performance of the interview results.

In the final stage, a *critical appreciation, overall results as well as a future outlook* round off the research.

2 Literature research

As mentioned before, it is essential to establish a widespread perspective of the real estate economy, its significant variables, past as well as the future trends of residential trade and industry economies and the importance for its asset valuations. The methodologies of this study focus mainly on a secondary market analysis as well as a primary empirical analysis based on the AHP methodology to form ideal future real estate portfolios mainly for EU countries with shrinking populations in contrast to Spain with a growing one. Therefore, different research fields have to be concentrated on in order to comprehend the real estate issues in the related research fields.

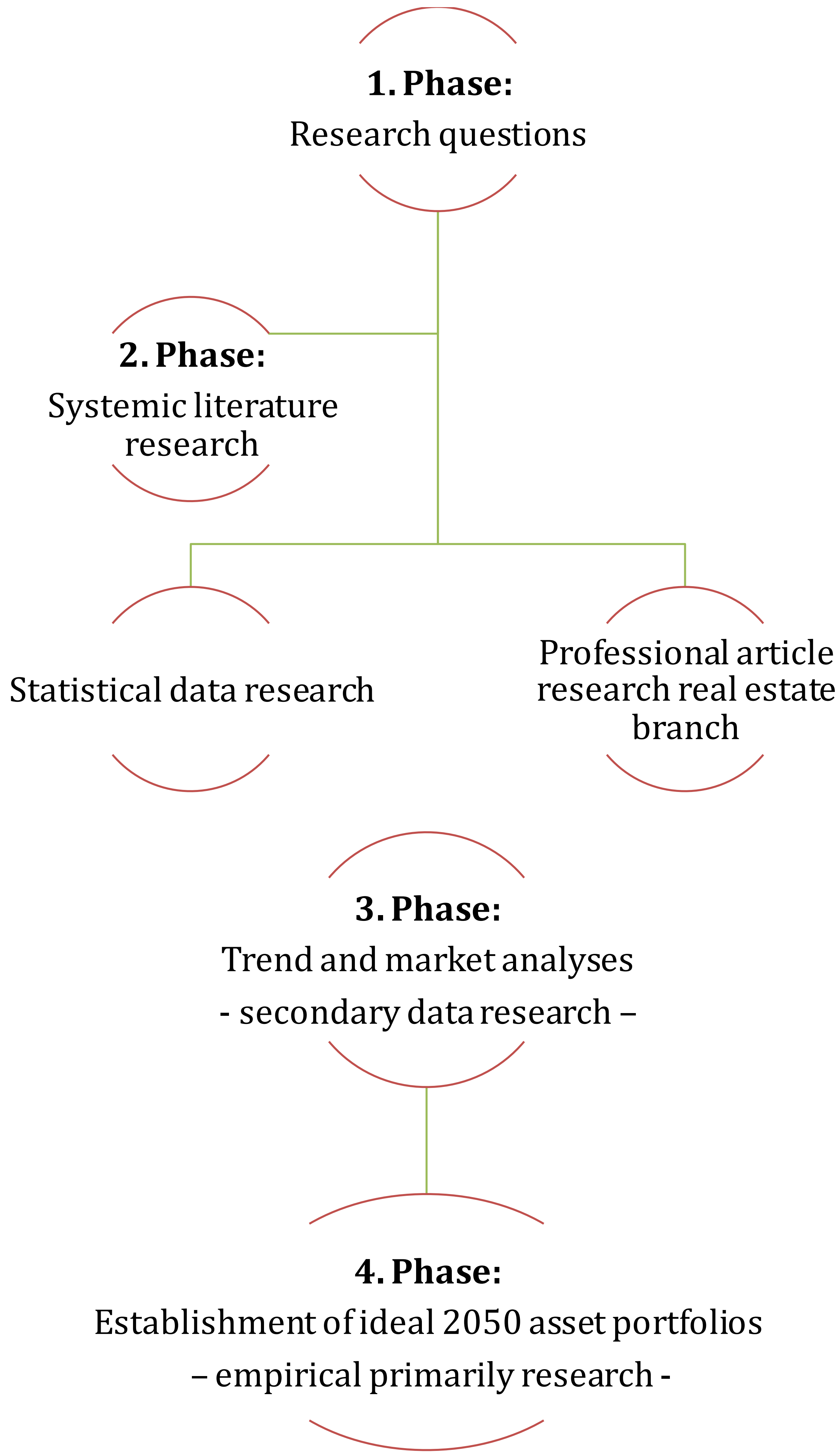
2.1 Research design and methodology

In the first stage, relevant research questions have to be formulated to realise the literature research. The following literature research questions form the general foundation for this research:

- What are the different trends in the residential trade and industry?
- How far it is possible to safeguard and stabilise future real estate assets in countries with mainly shrinking populations?
- Which future custom-oriented circumstances are necessary?

As a consequence of a definite content, a systemic literature research is revealed. Therefore, statistical data research for the secondary trend and market analyses as well as researching professional articles in international journals to establish the empirical primary research are fundamental as demonstrated in the following figure:

Figure 2.1 Phases of literature research



Source: Own analyses

Literature research in this broad economic field comprises different stages. In the first, real estate databases have to be searched in order to realise the past, present and future habitation trends of the real estate sector, especially in residential trade and industry. Therefore, various keywords are used that represent different real estate fields, e.g., demographic, building, social, financial and economic features, trends and developments.

To research these overall tendencies, alongside the literature study of reference and specialist books in libraries, research using the Internet via search platforms such as those of national and international branch alliances, European organisations and governmental institutes has to be carried out. In this stage keywords such as Europe, demographic, space, environment etc. are used.

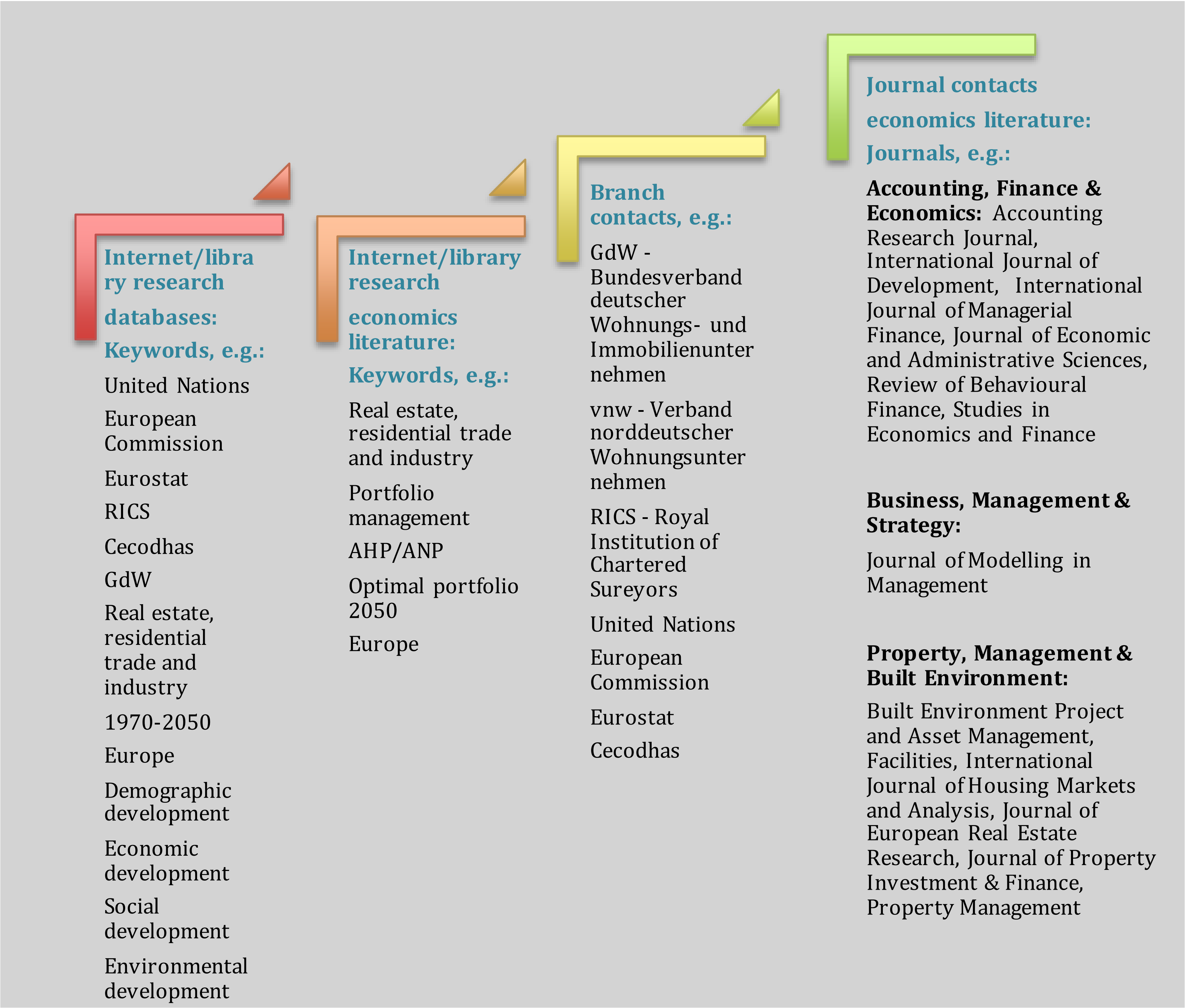
In the second step, an overview of the economic literature provides a broad view of current research in this field. Hence, again research using libraries and the Internet are good means for gleaning initial information. In this phase keywords, e.g., Analytic Hierarchy Process, Analytic Network Process, optimal portfolio 2050, etc. are useful.

The third stage involves contacting national and international branch organisations to get additional material and information on research, analyses and perceptions to round off the knowledge within the branch. Significant branch contacts are realised with national and international organisations such as Cecodhas, Eurostat and the European Commission.

In the fourth step, journal research of various international journals from competitive editorials is essential for closing the gap between current literature and the research by this study. In this step the literature analysis embraces papers by authors from all over the world. Additionally, library research using Thomson Reuters' Endnote software package allows exploration of the inventory of international libraries – e.g., the university libraries of Cambridge, Freiburg, Hamburg, Oxford, Pennsylvania, Barcelona and Valencia, to complete the literature findings. In total, nearly 2,000 literature sources are evaluated for this study with diverse literature from Europe, Asia, America, Africa and Australia.

The following figure illustrates the different stages with an explanation of keywords, contacts as well as journal examples:

Figure 2.2 Stages of literature research



Source: Own analyses

2.2 Analyses of the literature content and literature review

As mentioned before, analyses by literature content and reviews are divided into two different parts, statistical data research and professional article research within the real estate branch. These analyses are outlined in the following.

2.2.1 Analyses of database research

In the aforementioned stages of the database research to realise market and trend analyses, various literature as well as data of differing quality are available.

Generally, international research institutes such as Cecodhas Housing Europe, Eurostat and the Federal Institute for Research on Building, Urban Affairs and Spatial Development, establish databases for residential trade and industry trends. Furthermore, public organisations research in these fields, e.g., the European Commission and United Nations as well as national and international branch alliances, for example RICS – the Royal Institution of Chartered Surveyors.

Nevertheless, information and databases are very fragmented as the literature focuses mainly on specialised fields such as demographic, space or environmental social segments. Moreover, in parts the research focuses on single areas – e.g., particular cities, regions or metropolises – or country clusters – for example, groups of countries or huge areas of countries – and illustrates general European tendencies without a detailed focus on individual countries. The time periods vary between the different epochs with the result of research illustrations of the past, current or future industry trends. The basic database years differ among the diverse literature and sometimes data are not available. In addition, definitions of variables with similar titles across various researches occasionally do not have the same content or foundation. Consequently the usage and composition of the available quality of researched databases and information required to realise overall trends from past to future time periods is difficult and the classification of this kind of literature research is greatly hindered.

For an overview of the different literature, there is a literature review for the secondary market and trend analysis of this study.

There are various research results in the field of **demographic development**. Some literature focus on **special regions**, such as Germany, or individual European clusters, e.g., developed versus undeveloped countries, urban places and cities or Europe in total without a separation into different country trends. This kind of literature is highlighted as follows:

According to Gräf (2007) from Deutsche Bank Research, there will be essential future projections with significant changes for the residential trade and industry, mainly in the fields of housing demand and especially space of households and living space.

The author focuses in a clear manner on the challenges of demographic movements over the coming periods and highlights important future shifts in the real estate branch. Furthermore, he outlines the significance of future strategies.

Nevertheless, the recommendation to shift society towards more children, globalisation and immigration is very superficial and, therefore, rather unserviceable. Therefore, a study could be established to stabilise the high necessity of a strategy change in the real estate branch to meet the demands of future populations. Nonetheless, the research is a first step, but further in-depth research for future asset portfolios has to be carried out.

Barghoom (2008) provides a more descriptive article of the demographic development in relation to the social as well as public sector and resulting public spending.

The paper illustrates a high necessity of the public and politicians to focus on the relevant changes in society and requests support for the real estate branch so it can meet the basic needs of the populace.

Nevertheless, the article offers no additional awareness of further real estate fields, which are also influenced by the demographic development and obtains data from just small databases.

The Federal Ministry for Regional Development, Bundesministerium für Verkehr, Bau und Stadtentwicklung (2010), outlines the necessity to supply city advancement in Western Germany to respond to the demographic changes. The paper offers a national code of practice in the context of spheres of activity and public financial assistance, which are a positive projection as well as strategy to protect real estate assets and the basic needs of the population.

The study strongly reflects the importance of political support in the monetary field of real estate asset management.

Nonetheless, it only covers a limited region of Germany. As this region contains a special real estate market and branch challenges, the research is not transferable to the rest of Germany or Europe.

Hoffmeyer-Zlotnik et al. (2010) validate the effects of socio-economic developments, households as well as demographic standards for the Federal Statistical Office in an international comparison. An empirical part plays an important role in this research. For a definition of regional demographic standards, interviews as well as questionnaires are realised to evaluate the demographic variables such as sex, age, family status or education and job, in an international context.

The research utilises extensive databases in these special market fields and includes demographic standards.

Nevertheless, besides comparisons with the sample census and other research of, e.g., the research institute Eurostat, a final focusing and conclusion are absent.

A national institute, the Federal Institute for Research on Building, Urban Affairs and Spatial Development (2011) highlights the housing and property markets of Germany and includes the conditions of current and future market trends in the German region with a focus on property, economic and environmental changes.

The paper contains an in-depth analysis of the German market, in parts in a comparison with other European countries. Furthermore, it establishes different regional tendencies with a foundation of widespread tendencies in real estate markets.

Although the research offers just a national context, the demonstration of the risks and hazards of significant future trends are also explicitly illustrated in countries with a stable economic foundation.

The Federal Ministry of Internal Affairs, Bundesministerium des Innern (2011), publishes research mainly in the fields of German demographic development, fertility and mortality rates, migration, urban and rural areas until 2060.

This report of the federal government of Germany includes important real estate segments, e.g., development and shrinkage, regional development and political boundaries of real estate assistance with the conclusion that there will be changes in terms of the populace living longer, stabilisation of growing perspectives, social equity and the preservation of the political capacity to act.

Although these objectives look plausible, an in-depth explanation is lacking as to how these targets for future periods will be realised.

The institute Federal Statistical Office of the Federal Government and the Federal States, Statistische Ämter des Bundes und der Länder (2011), deals with the demographic background and in addition illustrates the significant development of private households until 2025.

It contains detailed research for different German states. Additionally, a future focus until the basic year 2025 illustrates future tendencies in these research fields.

As the study again highlights a particular region of Europe and focuses on future trends for the next 10 years there is no possibility for a far-ranging future outlook.

The Federal Statistical Office of Germany, Statistisches Bundesamt (2015b) is one of the official research institutes in this area and its data form the foundation of various research papers and articles. This institute researches and publishes diverse future assumptions of population shrinkages, changes in age structures and migration rates until the year 2060. The paper offers a widespread perspective of research matter.

Furthermore, it outlines various mathematical quotients and scenarios of past, present and mainly future developments that rounds off an in-depth future study.

However, the research focuses on Germany as a region. In addition, the key research comprises population development and basically does not cover economic and real estate areas with the consequence of an incomplete area to focus on the real estate economy.

The branch alliances of the residential trade and industry conduct research in the field of economic development. For example, the German umbrella organisation GdW Bundesverband deutscher Wohnungs- und Immobilienunternehmen (2010, 2011, 2015a) focuses on real estate databases and trends, and highlights the importance of this branch, the development of real estate supply, demand trends and the situation in the markets.

The target of the research is to establish a result of current and future demands for environmental and building features to meet the demands of individuals and households.

Nevertheless, the research lies in the area of Germany and does not consider the European context.

Besides the aforementioned research on individual countries, there are also various studies of **country clusters** in Europe as shown below.

McMorrow and Roeger (1999) offer a comparison of the European Union, the USA and Japan within the field of economic consequences as well as ageing populations and demonstrate the early significance of these issues.

The interaction of demographic and economic environmental areas highlights the strong importance of an overall strategic projection in the residential trade and industry.

Nonetheless, these authors focus on the European Union as a whole and utilise sources from different research institutes such as Eurostat and the OECD – the Organisation for Economic Co-operation and Development, which makes it a secondary analysis.

Mirkin and Weinberger (2000) from the Population Division of the United Nations focus on the demographic changes in Europe and the world and cluster the countries mainly into developed and less developed regions in the fields of population ageing, dependency ratios and urbanisation trends mainly until the future year 2050.

The research highlights the different market importance of the real estate branch and the interaction between different variables.

As there are different past and future basic years and a strong clustering is fulfilled, there is a lack of detailed information on demographic trends of particular European countries. Consequently, only basic information is generally available to offer a first overview of significances in the dynamic future markets.

The United Nations Expert Group Meeting on Social and Economic Implications of Changing Population Age Structures, the United Nations (2005) uses a complex method to illustrate the demographic trends of different time periods in the fields of diversity, population changing, age structures and demographic transition, but mostly describes world clusters such as Asia, Europe and developed and less developed countries.

Hence, an additional thorough analysis of different developments and shifts within Europe is not available. However, the data are gleaned from primary research and illustrate important overall tendencies in the housing branch.

Kabisch et al. (2008) from The Helmholtz Centre for Environmental Research deal with different city clusters such as Leipzig, Brno, Lódz, Bologna and Liverpool and demonstrates the trends and challenges of demographic change as well as different definitions of household structures.

The study develops a first insight into real estate challenges. Furthermore, it illustrates different developments of important urban areas in different countries that demonstrate homogeneities as well as heterogeneities of various spatial clusters.

However, a widespread view of the field of Europe is not obtainable with the consequence of only a superficial perception of the developments.

The European Housing Forum (2010) illustrates recommendations towards the European Union in the fields of changing lifestyles, new trends and housing exclusion. This qualitative research offers diverse views of branch specialists with the conclusion that housing policy has to be realised at national level and that the European Union should play a supportive role through the interchange of best practices as well as funding mechanisms.

The study highlights the overall challenges of real estate markets and demonstrates the high importance of public and political bodies interacting within the different fields of housing economies.

The paper provides a practical overview, but is again superficial in that it does not offer in-depth recommendations for the future of the European Union. Furthermore, within the European Union there is no differentiation between tendencies of individual countries and, therefore, the recommendations only embrace initial projections with any additional recommended actions.

The United Nations Economic Commission for Europe – United Nations Population Fund (2011) publishes a practical guide for countries in Eastern Europe with a research report on the migration situation in an area of Europe in comparison to Central Asia.

Because there is a reflection of particular parts of Europe in a single issue, it is suitable for practical handling and not as a basis for theoretical research. Furthermore, as the main focus lies on the migration situation, tendencies are limited as this economic part is rather uncertain for a development of future trends.

Cecodhas (2012) as an European research institute demonstrates in a qualitative methodology the demographic trends of Europe in the social area and embraces various articles of branch practitioner. The contents offer a widespread perspective of the generation mix in housing, solidarity between generations as well as care services and the active life for elderly populations.

The paper illustrates different views and, therefore, the necessity of an understatement and development of preparing future real estate assets for the countries and, therefore, highlights the challenges and the different requirements of housing in the European Union.

The paper demonstrates the significances as well as diverse attitudes of specialists in different real estate fields. Consequently, it offers a widespread perspective of expert positions.

Nevertheless, it is limited by the special qualitative views of the branch experts.

The European Commission (2012b) conducts different research in the field of demographic development. The research report includes European integration, demographic and social challenges, the territorial typologies, economic prospects and future trends of Europe.

The reflection of the various fields in the real estate branch offers a widespread focus on relevant economies.

Nonetheless, as the focus is strongly on Europe as a whole and uses only a minor share of available databases, this research also offers an initial basic overview of the issue until 2050.

The statistical organisation of the European Union, Eurostat (2012c) describes the European Union 27 as a whole cluster. The guide for populaces embraces, e.g., demographic change and regional disparities of Europe for future periods, but does not offer special and detailed developments of individual European states.

However, the study contains primary research and offers different areas of real estate markets and a first overview of the market tendencies in the European Union.

Another study by Eurostat (2012e) focuses on European cities in a very detailed manner, but again neglects the further areas of the different countries.

Nonetheless, this study is also based primary on research databases and functions as a foundation for other research in this field.

Andreev et al. (2013) illustrate in the technical paper of the United Nations the demographic components of future population development, also for future decades until 2100.

The in-depth analysis includes various specialised tendencies as well as variables. Furthermore, it develops various trends for different future basic years that realises an extensive market perspective.

Nevertheless, it deals with country clusters such as Asia, Europe and Oceania and is not specific enough for a study on individual countries and their different developments.

The Anthony Rae Foundation (2013) deals with population analyses and issues in a statistical manner. The time periods range from 1950 to 2050. The key content of the paper is a concept for understanding the population trends.

As the paper offers a widespread range of time periods, the tendencies illustrate strong population shifts and the importance of a movement in the residential trade and industry economies.

Because the study illustrates the worldwide trends as well as shifts in Europe in total, the basic factors of individual European countries are not available with the consequence of an absence of detailed analysis.

A report by the United Nations (2013c) involves the demographic determinants, population ageing, age groups and intergenerational transfers until the future year 2050.

The report also highlights the future years with a widespread perspective of future tendencies for the next 35 years.

As the focus is again on clustered regions, special tendencies inside Europe could not be identified.

The territorial scenarios and visions for Europe are illustrated by ESPON European Observation Network for Territorial Development and Cohesion (2014b), a European Commission research network. The widespread research of proposed European Union targets, existing strategies and European megatrends emphasise the developments until the year 2050 in an in-depth manner.

It presents different research areas that are significant for the housing markets and also highlights the necessity of establishing strategies to respond to the diverse shifts.

However, this research also validates the explanations for the whole cluster of Europe and ignores the specified analyses of individual European countries.

Besides the aforementioned research on individual countries, respectively country clusters, there are also studies on the **individual states** of the whole European Union that offer in parts deep insights into European tendencies.

Lesthaeghe (2000) from the Population Division of the Department of Economic and Social Affairs of the United Nations for an expert conference on policy responses to population ageing and decrease, e.g., studies areas such as demographic issues, household formation as well as replacement migration with a general overview of recent trends and in parts future developments.

The study embraces widespread variables of the demographic development in the European Union with the result of an overall overview of important demographic features in European populaces.

However, as the databases focus on selected issues, the information in this field is limited.

The United Nations carry out essential research in the area of demographic development in the European Union. A special research report was published by the United Nations (2004) outlining a broad study of the demographic changes and population density until 2300 using 5-year projections.

As the study offers an extensive perspective of various future basic years, a deduction of further trends and challenges is available. In parts this report establishes country world clusters and as well as less developed regions, which hinders the data research of individual European countries.

Nevertheless, this report offers a broad perspective of the demographic world for past and future time periods from 1950 until 2300.

In their study prepared for the European Population Conference, Schoenmaeckers and Kotowska (2005) focus mainly on the challenges to social policy. The research deals with different scenarios and simulation exercises of European clusters as well as individual countries based on their own calculations. The research areas are generally age structures, economic activities and pension systems. Regarding policy responses the authors place greater emphasis on demographic development as a way to ensure financial sustainability in Europe.

The study helps to realise the significance of policy strategy in the housing market with a focus on a more detailed handling within the different markets.

Although the recommendations highlight a high necessity of political interactions, they do not offer detailed advice for the future of the European Union.

There are various studies by the European Commission, Europäische Kommission (2006). The study deals with the demographic future of Europe and the challenges of member states to manage the situation. The mainly qualitative research outlines critical contents, e.g., the high necessity of innovative future strategies, as current strategies are unstable from the editor's point of the view.

The paper illustrates the high necessity for a response to changing living demands in the European Union. These explanations provide impulses and awareness of the European situation and supplement existing literature.

However, additional information and real estate areas are not available, which hinders the utilisation of this study.

Lachman (2006) from the Urban Land Institute focuses on institutional real estate investors and the global markets and compares European countries with Asia, America and Australia. While the main focus is on current tendencies, in parts also future movements until 2050 are illustrated, which results in ambiguous overall information.

Furthermore, the comparison of Europe with other countries reveals a strong significance of shifts and developments in the European real estate markets.

However, the study lacks clear direction, which hinders the outcome of potential strategies for markets today and in the future.

The discussion paper by Münz (2007) from the Hamburg Institute for International Economics deals mainly with current and future issues of expected changes in total populations, demographic ages and migration. The author establishes a clear overall picture of Europe since it faces, compared to other regions, rapid demographic ageing. The statistics provided in the appendix illustrate detailed information about individual states until 2050.

The analysis offers an in-depth insight into the demographic movements of countries in the European Union. Furthermore, it also forecasts tendencies for decades in the next 35 years.

In parts the databases are based on secondary sources such as the United Nations; the foundation of other data are primary research by the author. Especially the attached databases provide a clear picture of the differences between European countries, but the focus is on the demographic development with an absence of additional fields such as economic situations.

Hilbers et al. (2008) from the International Monetary Fund analyses house price developments in Europe with an emphasis on market development, house price development in selected countries of Europe and also empirical approaches in these segments. The authors provide a detailed overview of this financial segment of the real estate economy.

It highlights the challenges of monetary shifts and market situations in Europe.

However, the study works generally with the basic foundation year of 1985=100 that backdates various time periods and could falsify current tendencies.

Hoßmann et al. (2008) study the demographic development, growing imbalances, demographic shifts, and low fertility rates within the European Union as well as in specific states.

The detailed analysis clearly demonstrates the different tendencies between the countries using secondary sources such as Eurostat. The authors evaluate high potentials for Europe in the areas of family policies. They highlight the necessity of reaction by policy makers in the different countries of the European Union, and recommend that real estate strategies be derived.

Nevertheless, there is an absence of detailed future recommended actions for the different countries.

Also the research institute Eurostat has produced various studies on Europe. One of its reports (2010a) concentrates on European databases in the area of demographic change within Europe. The yearbook embraces various relevant fields, e.g., economy, health, living conditions and social services and outlines significant tendencies in these milieus from mainly 1998 until 2008. This yearbook is also the foundation for the resulting research with basic figures on the EU up to 2014 (Eurostat, 2015a).

Therefore, it offers a widespread overview of the different areas of housing and economic milieus of this area of real estate economies of the European Union. Furthermore, the study embraces European trends with a 10-year timeframe.

Nevertheless, future tendencies are not available in this context.

Eurostat (2010c) focuses on household structures in the European Union. Key contents are household compositions, partnerships and the synthesising of household differences.

The research includes in-depth insights into this special topic and offers important information for further research in demographic or housing areas.

Databases of the different countries are presented, but include the European Union 25 as well as the basic year 2007 with no additional time periods, which limits the trend situation of inhabitants in the European Union.

The working paper by Linz and Stula (2010) of the Observatory for Sociopolitical Developments in Europe deals with the demographic change in Europe, but also offers an important overview of the responsible bodies for demography in the European Union and its programmes and initiatives.

The paper contains a listing of relevant institutions and bodies in the field of real estate. It outlines current situations and directs to descriptive executions with an absence of continuative and critical focuses of current and future contents.

The Ministry of the Interior and Kingdom Relations (2010) differentiates in detail the European populations and offers housing statistics as well as economic purposes. In parts the statistics also outline past and future tendencies between 1985 and 2050.

However, the main issues focus on current databases. The utilised sources of these secondary analyses are mainly derived from Eurostat. The different trends and developments of the diverse states of Europe are visible, but as a result of the dissimilarity between different basis years a complete view of past, present and future progress is not possible.

The branch research institute of Europe, Cecodhas (2007, 2011) illustrates in a thorough manner the demographic change in Europe in the context of social housing. The profiles of each European country offer databases in the social housing sector, housing market trends, state involvement, the socio-demographic trends and housing and social exclusion.

The studies contain in-depth information and databases of every country in the European Union and outline various relevant variables in the housing context.

Nonetheless, the social housing environment plays a key role, as it is a special field in the residential trade and industry and, therefore, a limited area of research.

An additional research report by Eurostat (2011b) paints a statistical portrait of migrants in Europe with foreign-born populations, foreign populations and second-generation migrants and, therefore, outlines another special field of demographic development. Furthermore, this area of development is a foundation for further research in the field of demographic and economic movements.

As the only basic year is 2008, the importance of this area is described in a limited manner.

Lanzieri (2011) researches for Eurostat a century-long view of the ageing structures of European countries and illustrates ageing indicators within the European Union from 1960 to 2060. As a result of the differentiation of the various tendencies of all European countries, a detailed differentiation is derived in this article.

Furthermore, a widespread tendency over a time period of 100 years is available that highlights relevant trends in this context.

As the study embraces the special field of demographic development in the European Union, other areas such as economic or environmental features play a minor role with a limited utilisation for an overall overview of tendencies.

The organisation OECD – Organisation for Economic Co-operation and Development (2011) focuses in its article on the sizing challenge of future demographic trends and long-term care costs and, therefore, highlights the social milieu of demographic development until 2050.

The paper thoroughly analyses the importance of the demographic development, the increasing care sector as well as monetary challenges. Furthermore, the study includes tendencies until the future basic year 2050 that allows the possibility of a general overview of these different shifts in the European Union.

Because the research article deals partly with different clusters as well as in other cases with individual countries and different time periods, a detailed focus of the demographic development is absent.

Using Eurostat statistics, Rybkowska and Schneider (2011) concentrate on housing conditions in Europe and illustrate housing deprivation rates, overcrowding rates and housing costs, which are a special branch issue and highlight European challenges in the real estate sector.

It places a strong focus on the financial monetary issue and represents significant variables in this economic area of real estate markets.

Because the basic year is exclusively 2009, the information of housing conditions is limited.

The synthesis report by the Szaló et al. (2011) from the Hungarian Presidency of the Council of the European Union basically underlines the impact of demographic trends on regional and urban development in Europe and outlines the role of the European Union concerning demography, migration policies and natural population movements.

In parts there are detailed analyses of the various countries of Europe conveying an understanding of different demographic streams. In other cases, clusters or metropolises are focused on that limit a detailed perspective of European changes. Basically, current databases are the foundation of this research. Occasionally also past and future data are utilised, which prevents a consistent view on European trends.

The content of the role of the European Union is descriptive and contains no advanced recommendations or action plans.

The core area of The National Institute on Aging, National Institutes of Health of the U.S. Department of Health and Human Services (2011) covers special fields of the demographic developments in the European Union such as humanity's ageing, new disease patterns, disability and health care and focuses, therefore, on the social context.

As this context is a significant part of the residential trade and industry, it shows the high importance of different shifts in the interaction of demographic movement as well as the growing tendency of health care. Therefore, also other trends of housing demand are highlighted.

Although the authors devote past, present and future databases and information, the different contents are briefly analysed with a minimum of data, which hinders a detailed overview of this social demographic framework.

Another author of Eurostat, Vasileva (2011), focuses on the age distribution of foreign and foreign-born populations of the European Union 27. As this field is a special context that is a foundation for further research such as in the field of demographic development, it offers important information for the residential trade and industry.

The basic year is 2010 and past and future databases are not available, which limits the perspective of an overall tendency of this article.

A study of the European Commission (2012a) with its ageing report demonstrates economic and budgetary projections for all European Union member states, mainly from 2010 until 2060. Furthermore, a resulting research outlines assumptions and prognoses from 2015 until 2060 (European Commission, 2014). The detailed analyses focus on issues such as demographic and macro-economic assumptions, health care expenditure as well as long-term care and, therefore, contain in-depth present and future movements in the demographic and, in parts, economic fields.

It strongly highlights the relationship between demographic development and social housing and, therefore, the necessity for future housing strategies. Furthermore, relevant data from 2010-2060 are illustrated that are important tendencies in this branch.

With a lack of past databases, an overall view of the demographic situation is not available.

A demographic overview is established by Eurostat (2006, 2011a, 2012a) in order to realise a summary of the national reports on the demographic development in mainly the current basic years. It embraces a description of the key situations of every country in the European Union, which allows a structured and detailed evaluation of the states.

The brief description of the different countries in the European Union presents a general picture of different situations and circumstances and highlights the differences between states.

Because the demographic contents are illustrated in a strongly summarised methodology, an in-depth view and advancing tendencies are not realisable.

A special field of demographic shifts is the territorial typologies of Europe, which are highlighted in another study by Eurostat (2012d). Urban clusters, urbanisation and area typologies with the current basic year are established.

The study focuses in an in-depth manner on relevant real estate fields in the environmental sector. Furthermore, it illustrates the market sector of urban development.

This particular topic rounds the milieu of demographic development in a significant way, but is based only on current situations with an absence of additional past and future trends.

The matrix of UNECE – United Nations Economic Commission for Europe – Statistical Division Database (2012) includes various data of private households by measurement and household type for the period 1980 to 2010.

The research is built on a broad range of information and databases and enables a focus on demographic development. Furthermore, past and present trends are shown that draw attention to significant shifts over the last 30 years.

Nonetheless, the focus is on the demographic development, which is a special area. Additionally, future years are not developed, which limits the scope of the research.

The different studies by the United Nations (1974, 1985, 1995, 2001, 2012), illustrated in the compendium of housing and human settlement statistics with a focus on the real estate economy, offer large databases for Europe. The research covers, e.g., household clusters, rural and urban locations, tenure status, and constellation of dwellings, configuration of habitations as well as housing consumptions. As such databases are rare, they build an important basis for research in the residential trade and industry in the European Union.

The reports outline a deep analysis of every country in the world mainly with a focus on the current basic year of each research, which somewhat hinders the overall view of tendencies of different decades.

As the research offers descriptive databases, further conclusions are not available.

Robustillo et al. (2013) from the European Commission focus on the social situation of the European Union with data extracted from Eurostat. Key issues are population change and age structures, fertility, mortality, migration as well as marriages and divorces.

The research includes the trends of the individual European Union states from mainly 1960 to 2012. The study includes in-depth databases from the different countries and illustrates trends as a result of available past and present information, but ignores future tendencies with the outcome that additional trends are not visible.

The UNFPA – United Nations Populations Fund (2013) offers detailed databases of the ageing indicators across the world, different regions and the European Union countries for the current time period as well as the future until the basic year 2050 for the areas of population development, life expectancy and ageing clusters.

The data are primary researched and offer a widespread view of these demographic variables for all European countries and their individual tendencies.

Nonetheless, although the analysis is detailed and offers a great deal of information, it does not interpret these databases. In addition, the researched context is a limited part of the real estate branch, which hinders the general overview of real estate markets.

A broad database research is offered by the United Nations (2013a) that deals with population trends until the future years 2050 and 2100. It outlines comprehensive tables with world population trends, fertility, mortality, international migrations and assumption contents.

The research offers a detailed foundation for the residential trade and industry and is also the information for additional secondary analysis of various authors. Basically, the basic years reach from 1950 to 2100, but the study also realises additional basic years in special demographic fields. Hence, the different basic years occasionally hinder the database research for defined and fixed basic years.

Alongside special demographic areas, the United Nations (1971, 1982, 1992, 2002, 2011, 2013b) also establish a mostly significant database foundation in the demographic milieu as well as in the areas of economic, environmental social and real estate economy. With its demographic yearbooks, widespread fields of various basic years are established with contexts of populations, general mortality, nuptiality, life tables and international migration. The data reach from quarterly information to average annual databases for countries all over the world. The tables mainly divide male, female and both sexes and illustrate the total numbers as well as ratios and developments and also introduce the special definitions of the various research fields.

These yearbooks offer a broad perspective of demographic development. As these papers are published regularly, the data are up-to-date and form a solid foundation for all research related to the demographic development. The databases are available for all European countries and realise the potential to interpret different circumstances and differences of the states.

The research databases offer deep and detailed analyses of developments, but highlight the particular basic year of each yearbook with an absence of further interpretations.

Geohive (2014), the internet platform of the United Nations, Department of Economic and Social Affairs, realises a data collection of the past and future population of Europe with various basic years in a 10-year overview from 1950 until 2050 that illustrates an in-depth study in this special demographic field of Europe.

Nevertheless, the other trends are not validated.

The Population and Vital Statistics Report of The United Nations (2014) is a statistical paper that highlights world clusters as well as all individual states of the world for principally the basic years 2011 and 2012 in an in-depth manner.

Because the whole world is illustrated, the development of Europe in comparison to the rest of the world is visible, which indicates a widespread knowledge of demographic issues.

However, the current tendency is demonstrated with an absence of past and future shifts.

Besides the aforementioned literature with a key focus on the demographic development, also literature for the **space characteristics** is available. Nevertheless, the literature in this field is very limited.

Economidou (2011) from the Buildings Performance Institute Europe studies building quality, energy efficiency, renovation situations as well as residential challenges in the European Union and offers an analysis of potentials as well as present and future real estate programmes until 2050. The main policy recommendations feature actions such as the establishment of a leading role of the public sector, the formation of a renovation fund as well as the harmonisation of data collections within the European Union.

The primary research outlines significant data and conclusions in the area of building contents. It is aimed mainly at the architectural content, but also focuses on policy and economic indicators that rounds the focus on space characteristics. Furthermore, it also outlines future tendencies until 2050 with a focus on building quality effects in the European Union.

Nonetheless, there is a key emphasis on the current development that restricts a total view on this context.

Also the final report by Kaderják et al. (2012) demonstrates in this special field the necessity of the refurbishment of all buildings by 2050. Contents are, e.g., the building refurbishment problem, market facilitation and regulatory instruments.

As the focus embraces deep elements of the building quality sector, the study represents important research for the residential trade and industry within the European Union.

Nevertheless, the authors deal with different clusters of the European Union, which hinders a detailed perspective.

In the area of **environmental social criteria**, there is again a variety of literature available as outlined next. Also in this context, the literature contains databases of regions, clusters as well as Europe with its special countries described in detail. The studies that comprise **regions** are mentioned in the following analyses.

Della Vigna and Pollet (2007) study the effect of the demographic shift and the belongings on profits and returns across the industry. The article contains a view on economic consequences and profitability.

Consequently, it highlights the necessity of monetary stability also within demographic shifts. Nonetheless, it is research conducted in a universal systematic that does not determine a specialised framework.

Hence, the study reflects a common perspective, but hinders a detailed overview of this financial context in the European Union.

Carrera and Beaumont (2010) from the Office for National Statistics also focus on a single region, namely the United Kingdom and examine the household and wealth situation there with an emphasis on trends in the economy, household income and household wealth.

The research highlights the importance of household development as well as economic outcomes, but again looks at only a single region within the European Union.

Geißler (2010) of the research institute Robert Koch Stiftung analyses the social structure, development as well as theoretical explanatory models. The author examines the social disparities, income development and social classes in Germany and demonstrates high future shifts of economic environments.

The study outlines relevant connections between the social development as well as economic shifts that are essential for research in the real estate markets of Europe.

As the research is focused on Germany, it has limited validity, but realises significant perceptions of challenges also in European countries with a predominantly stable economic situation.

Dechent and Ritzheim (2012) mainly analyse the monetary situation of the residential trade and industry of Germany with a special focus on price indices of 2011 with an application of an online survey in relation to European requirements. The result of this research is a more effective and efficient possibility of database research within a time period that is not retrospective.

The necessity to research real estate assets continuously develop in a clear way in this study.

Nevertheless, a future perspective to safeguard the assets is not available, but the study offers a profound foundation of databases and price information.

The Federal Centre for Political Education, Bundeszentrale für politische Bildung (2013) carries out a social study of, e.g., social structures, inhabitants, living conditions and economic interaction.

The study covers different fields such as demographic, space and environmental characteristics.

The data are exclusively from the basic year 2011 and cover developments in Germany with the result of a limited utilisation of this information.

The Federal Statistical Office, Statistisches Bundesamt (2015a) constantly publishes price indices of the real estate branch. The study offers a deep research of various prices of different types of assets and shows development from 2005 until 2015.

However, the basic year is 2005=100 and, therefore, the databases are not up-to-date. Moreover, the data are limited to the region Germany.

Besides the literature research with individual European regions, again a minor share of literature relating to different **clusters** is available, which is outlined below.

An article by Siegmund (2008) interprets the landed property prices of Eastern Europe and the continuance of the management in dynamic markets. The research contains brief analyses of selected European countries and reflects the interaction between public advancements and the growing tendencies of real estate markets.

The reflection of the interaction between real estate markets and public responsibility is analysed in a clear manner.

As there it looks at European clusters and just current price developments, the content of this article is inadequate.

For an international conference Piatkowski (2009) examines the area of the great transformation between 1989 and 2029 and highlights topics such as global projections, total bank credits, growth rates, investments and innovation performances for clustered regions of Europe as well as the rest of the world.

The strong focus of the paper is on economic and financial environments. As the author outlines developments from the early year 1500, it does not contain a profound synthesis of significant advances in the world.

The disadvantage is the different basic years, which vary widely. Individual countries are not in the focus of the study, which also hinders a specialist view on economic tendencies in different European countries.

The OECD – Organisation for Economic Co-operation and Development - also with its researchers Chateau et al. (2011, 2012), offer widespread studies of the environmental context until 2050. For example, they deal with socio-economic developments and health and the environment and indicates intense perceptions of this topic. The basic years are 2010 as well as the future foundation of 2050; in parts there are also additional basic years established in 10-year steps.

The studies embrace widespread perspectives of different fields of the residential trade and industry in Europe and, therefore, build a foundation for additional research in that area.

Nonetheless, the research field is specialised and the authors analyse country clusters, e.g., OECD, South and Southeast Asia etc. Therefore, a focused interpretation of particular European countries is not possible.

ESPON – European Spatial Planning Observation Network of the European Union (2014a) deals with mid-term targets of demographic developments until 2050. The study offers a deep world's framework of the stated content.

The different environmental scenarios also demonstrate a far-reaching imagination. Furthermore, 2050 offers an in-depth perspective of different future scenarios.

Nevertheless, it illustrates a small and special research segment of a polycentric Europe that embraces a minor part of relevant issues.

Wilkinson (2014) from the RICS – Royal Institution of Chartered Surveyors focuses on the real estate content of building sustainability and highlights a methodology for measuring sustainability in the building environment over time. Issues are the mirroring of building codes, building performances and national standards. The author concludes that the realisation of a commitment to building is challenging and the environment is fragmented, diverse and complex.

This research briefly reflects the environmental challenges of the real estate branch with its diverse fields and special issues. Additionally, it looks at a particular innovative real estate area, especially the sustainability of real estate assets that rounds off the perspectives of these asset markets.

Nevertheless, the study mainly focuses on the United Kingdom and Australia and, therefore, is of limited use for European research.

Alongside the aforementioned research in the economic and environmental area, which highlights several regions or clusters in the European Union, there is also literature obtainable for particular and individual European countries that focuses on the differences and various tendencies of **special states** as analysed below.

A regular national report on housing developments in the European countries is published by Norris and Shiels (2004) from the company The Housing Unit. It comprises key economic trends, state expenditures and characteristics of housing stock.

This paper embraces deep insights into economic shifts especially of different areas of the residential trade and industry. It also offers a broad overview of different European countries with the possibility of a comparison between European states. Additionally, it covers the different real estate fields of housing, economic and public segments that offer a widespread perspective of real estate markets.

A disadvantage is the current view of detailed information with an absence of further decades with the possibility to evaluate important trends in this field.

Cecodhas (2008) publishes a report about the welfare transformation and challenges of the social housing sector in Europe and highlights different past and present time periods. This analysis is a secondary study in a special field of real estate environment with mainly past basic years.

Additionally, the databases comprise in parts the overall European area and sometimes special country examples, which hinder a deep overview of the European tendencies. Nevertheless, they also offer a substantial view of the social housing segment and their economic challenges that focus on the importance of handling real estate markets in the European context.

Also Eurostat (2008) publishes an environmental economic study with an overview of European price statistics and containing consumer and producer price indices, purchasing power parities and construction cost indices. The key statistical year of the research is 2007, but it also embraces in parts past years between 1997 and 2000. The study utilises various important databases of economic developments in the real estate branch, which is a foundation for additional research in the European Union.

However, because the basic years vary between the different economic fields, a widespread perspective of different trends for equal years is not possible. Furthermore, future years are also not researched.

The income and living conditions are deeply analysed by Eurostat (2010b). Living conditions, household structures, poverty risks as well as income situations are outlined. The foundation is different basic years that make trend analyses difficult. Furthermore, besides time periods, past and future tendencies are absent.

Nevertheless, the databases as well as graphics demonstrate in a clear manner the difficulties of the European countries and furthermore highlight a significant field of the economy and challenges for European populations. Because different authors focus on the aforementioned issues, various perspectives are highlighted offering a broad perspective of this part of the economic field.

The United Nations website, Geohive (2010), offers deep and widespread databases of different issues, also in the environmental context. The demonstration of urban and rural shares of European countries between 1950 and 2010 establishes a focused view on this research area and offers fundamental information over a long period of 60 years.

Nonetheless, the data embrace a special real estate market field; furthermore, it includes no additional future periods, which limits the findings of this research.

Dixon (2011) from the Oxford Institute for Sustainable Development looks at the field of transitions in the built environment of urban areas until the future year 2050. The outcome of this study is, e.g., the efficient usage of resources, the restoration and maintenance of the urban environmental quality and the enhancement of human wellbeing with a strong focus on effective and innovative partnerships between the private and public sectors.

The article reveals a high necessity for environmental issues and also follows tendencies into future periods. Additionally, it contains a relatively innovative topic such as building sustainability that completes the field of real estate assets in European markets as a reflection of demand circumstances.

However, it does not outline recommendation activities and, therefore, is mainly descriptive justified.

A statistical research paper from Eurostat (2012b) also places emphasis on the European economic area. Contents such as major regional differences within countries, administrative boundaries of gross domestic product and the results of private household incomes are illustrated for 2008/2009. Action recommendations, e.g., more accurate reporting on inequalities, development of European sustainable development and extended national accounts to environmental and social issues are finally established.

This primary research offers a profound analysis of economic issues.

As it focuses on 2008/2009, additional tendencies are not represented, which hinders an overall view of Europe.

Furthermore, Eurostat (2012f) offers a widespread perspective with the Eurostat yearbook covering different issues such as economy and finance, population, health and living conditions as well as social protection.

It establishes a broad analysis for the European Union 27 for current time periods, mainly until 2010. The disadvantage is again a different handling of basic years that differ from one issue to the next and develops a difficult standardised perspective of European development.

Nevertheless, it fulfils a detailed overview of economic differences between European countries.

In addition, Eurostat (2012g) also carries out research into the economic context of Europe. With a statistical study the institute outlines the gross domestic product as well as the purchasing power standards of the European Union for the basic years 2009, 2010 and 2011.

Although this part of economic research is conducted in depth, it only illustrates a limited topic of the economic development of Europe and the present time period with an absence of past and future-estimated developments. Nonetheless, the research offers significant economic variables for the valuation of real estate assets in Europe.

The company HSBC – Hongkong & Shanghai Banking Corporation Holdings (2012), is also active in the research field of international development and global economics. Its Global Research Department establishes a study of economic belongings with research in the size of economy, income per capita, economic infrastructure and inflation rates for the current basic year 2010 as well as the future year 2050 and, therefore, offers important information on European tendencies in this sector.

It mirrors significant economic databases that are the basis for further research in Europe's housing markets.

However, the past periods are neglected and also additional information of economic frameworks is not highlighted in this research.

The residential market report of the company Patrizia (2012) focuses on the real estate economy, the financial markets and the performance of European residential with an illustration of the strong differences of real estate markets in Europe.

This study offers a first overview of different tendencies and financial challenges in the European residential trade and industry economy, but focuses only briefly on the current time period. Therefore, a detailed impression of Europe's economic situation is not possible.

Another article from Eurostat (2013) relates to the growing tendencies of the gross domestic product per capita and clarifies the databases of all individual countries of the European Union 28 with basic years 2010, 2011 and 2012.

Also in this case the research involves a small particular field of economic importance and hinders a total picture of tendencies as the current situation is stated and additional basic years are not available.

The primary study of the future population density of Geohive (2013) illustrates databases of areas, population quantities and humans per square metre for every single country.

As this information provides additional information on environment, these data complete this part of residential trade and industry. The research is a detailed study that highlights profound perceptions.

Nevertheless, as the study comprises databases, the additional environmental situations are not explained and interpreted.

Lorenzo (2013) from the EMF European Mortgage Federation reflects topics such as mortgage lending, residential lending, house prices and indices as well as interest rates and highlights the strong financial perspective of the residential trade and industry, which is one of the key fields in the housing markets of Europe.

It offers an in-depth quarterly overview of the different European countries but covers exclusively the period 2010 to 2013 and, therefore, a limited timeframe of databases, as future tendencies are not available.

Parlasca (2013), a member of the RICS – Royal Institution of Chartered Surveyors – carries out research in the economic fields of housing consumption as well as rental and owner-occupied housing in Europe and shows a revision of long-term trends in the housing sector with the conclusion of a growing importance of housing expenditure in Europe.

Nonetheless, long-term trends are not visible as the time period is outlined from basically 2000 to 2010, respectably 2011 and, therefore, the tendency reflects a maximum of 11 years. Also the conclusion is descriptive and activity recommendations are not available.

An article by Rubinson (2014), chief economist of RICS – Royal Institution of Chartered Surveyors – highlights primary the occupier sentiment index and the investment sentiment index as well as the capital value expectations on the basis of survey questionnaires.

The article offers a perspective on an upswing in the real estate branch across the globe, but its usability is hindered as the main issue focuses on commercial real estate assets.

Nevertheless, it illustrates a high significance for the overall real estate branch.

The statistical annex of the European Commission (2015) is a deep data study of specific European values such as employment, private consumption and price deflators.

This study is published quarterly and, therefore, the data comprise a current and continuous research status. Therefore, a widespread tendency of economic information is available.

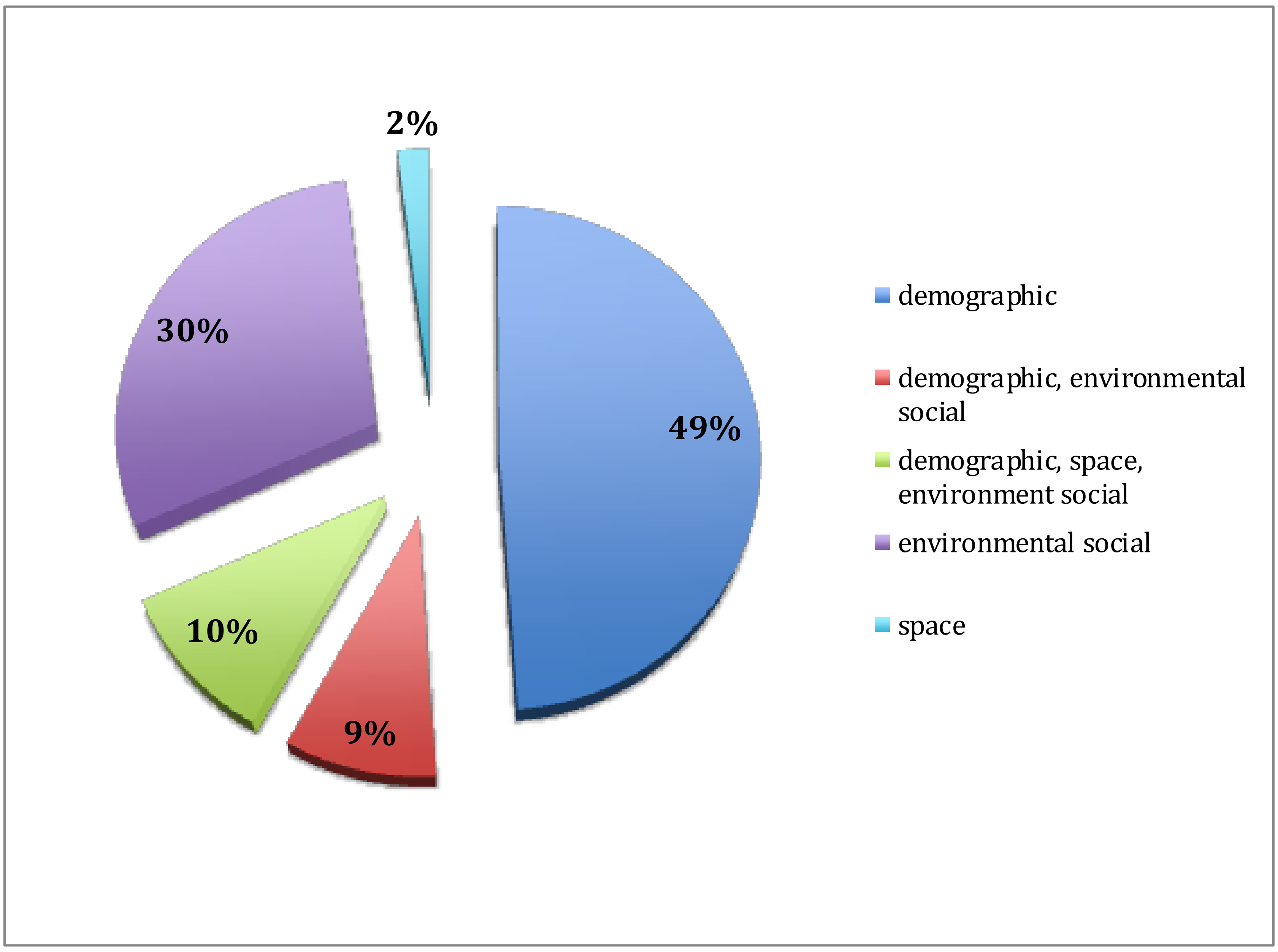
The tendencies reflect past years from 1960 until current periods. Nevertheless, future trends and analyses of the databases are not obtainable.

As illustrated before, there are various studies, information and databases of the demographic, space and environmental social context. Nevertheless, the studies comprise mainly single contents, special real estate areas, different time periods, country clusters and definitions. An overall tendency of the significant residential trade and industry statistical values over a long-term period is not available.

The databases and information of literature are in the main highly fragmented. This hinders a focus on the overall past, present and future real estate tendencies in the total aforementioned various areas. Consequently, a widespread view is not available with the result of a limited focus of trends in the housing markets of Europe. This restricted emphasis could develop insufficient strategies in the housing sector as a nescience of significant developments.

The fragmented structures of the available literature are demonstrated next.

Figure 2.3 Fragmentation of database research: Shares of characteristics

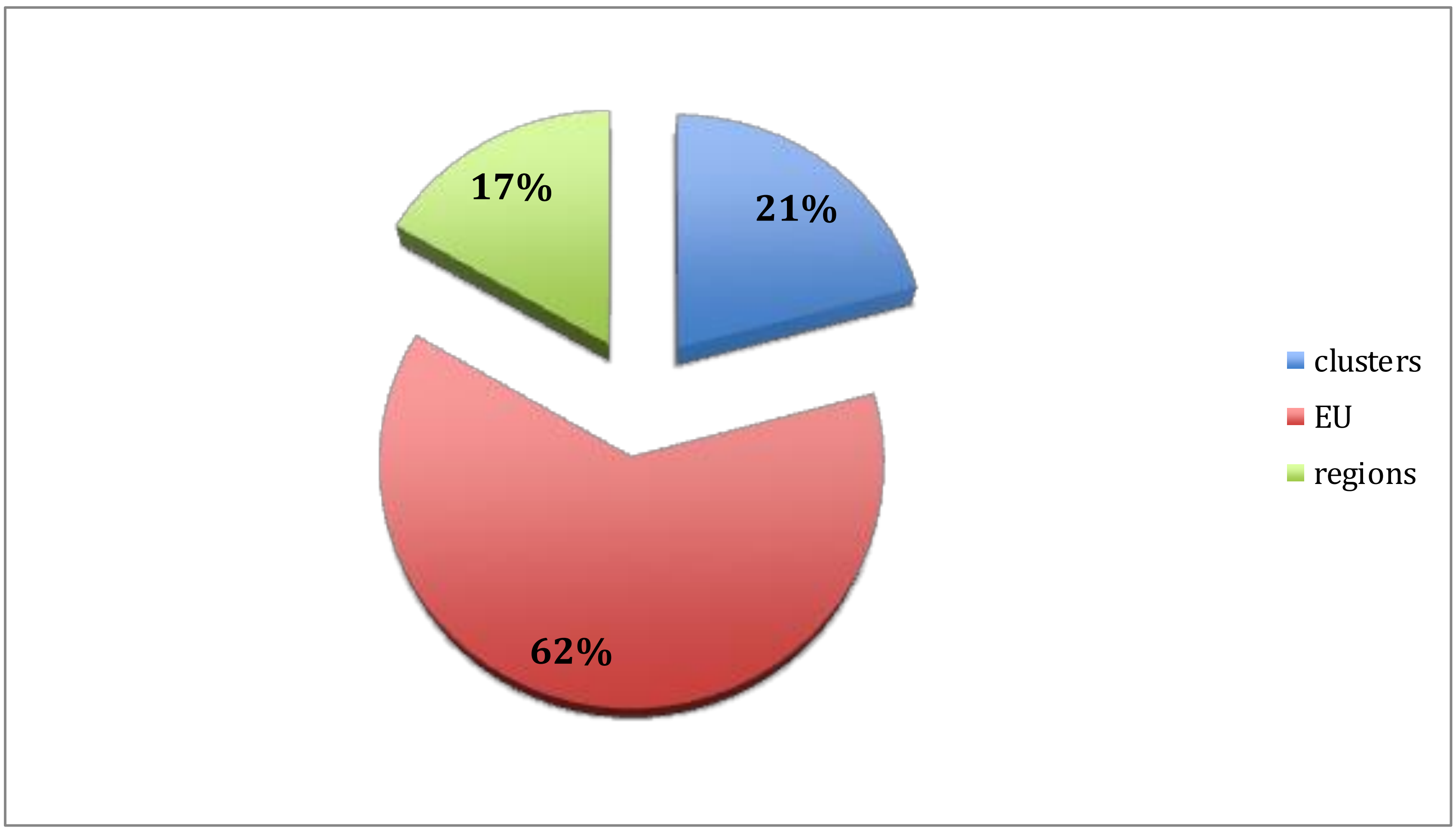


Source: Own analyses

The figure demonstrates in a clear way the shares of different real estate segments that are highlighted in the aforementioned literature. Consequently, around 49% of these studies focus on demographic characteristics and about 30% on the environmental social context. The literature in the space area is scant at only 2%. A small number of studies establish more than one characteristic in Europe's real estate market.

Furthermore, also the European regions are outlined in a somewhat fragmented manner in the mentioned studies. Around 62% contain detailed information of the individual countries of the European Union. 21% of the literature works with country clusters and 17% with different single regions. Also this fragmentation reduces the opportunity for in-depth research within the individual countries in the European Union. This kind of fragmentation is reflected in the following figure:

Figure 2.4 Fragmentation of database research: Shares of areas

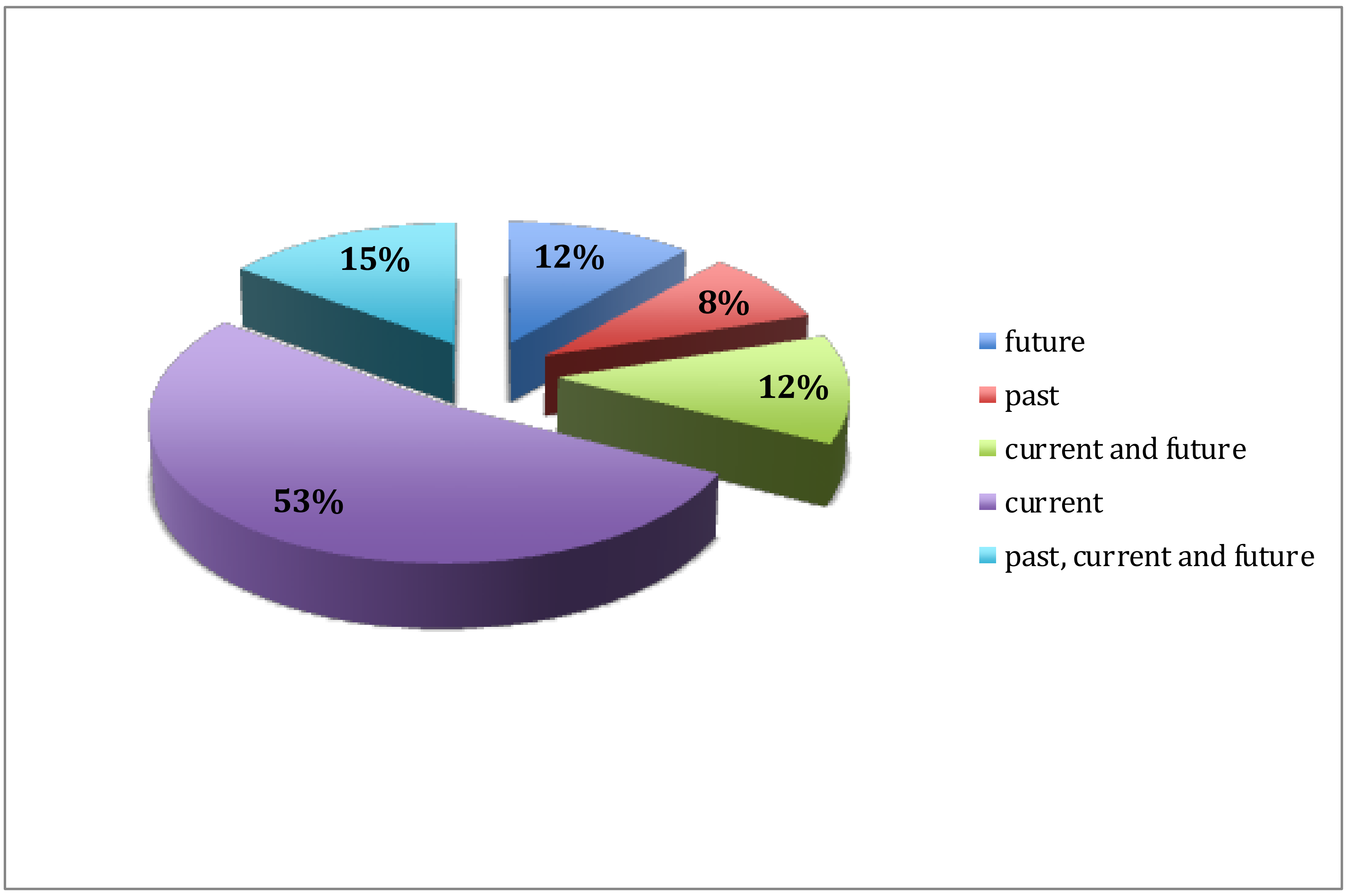


Source: Own analyses

Another challenge of data research is the foundation of basic years. The studies mentioned highlight different basic years and diverse time periods. 53% of the literature reflects current databases. 15% outlines past, current and future information. 12% of the research realises current and future as well as just future basic years. The past situation is outlined with a percentage of 8%.

This result mirrors a strong inequality of information that limit also a widespread and detailed research in this context as highlighted in the figure below:

Figure 2.5 Fragmentation of database research: Shares of time periods



Source: Own analyses

As analysed earlier, there is a high necessity to establish a secondary market and trend analysis, summarised together with the aforementioned databases and information, in order to realise overall specific past, present and future trends and foundations of European real estate economies to evaluate significant shifts, hazards and strategies for real estate portfolios for the future, as analysed in the following chapters.

2.2.2 Analyses of specialist literature

Also in the specialist literature, the issues of the researchers are fragmented. They comprise mainly different methodologies, business areas, time periods and regions as outlined later.

In contrast to the literature research of databases and trend information, where the different regions play some important roles and where selected within these locations, in this next part of specialist literature the real estate areas contain the key relevance. Therefore, the following literature research is clustered in terms of fields of demographic, space and environmental social characteristics.

Unlike data research, where information is available about the **demographic development** in the European states and the real estate branch, this segment is limited in the housing economy literature as outlined below.

Della Vigna and Pollet (2007) examine profitability in the area of investor response. The authors take into account demographic development and resulting changes in the demand of populaces. In the study a model of inattention to information is illustrated within the framework of the distant future.

The study contains a strong correlation between the demographic development and the shift in demand that implies a significant projection for economies. The researchers give a strong argument for the importance of demographic development and neighbourhoods as well as social housing economy in the residential trade and industry in Europe. Furthermore, it reflects the necessity of financial involvement to meet the demands of individuals.

Nevertheless, the expenditure category of residential development is one of several economic fields and, therefore, it is illustrated in a superficial manner.

Schlömer (2009) from the Federal Institute for Research on Building, Urban Affairs and Spatial Development within the Federal Office for Building and Regional Planning in Germany highlights demographic development from a spatial point of view. The study contains deep insights into the interaction between demographic movements and spatial necessities for present and future circumstances.

The research focuses mainly on the environmental component of demographic variables. Related issues such as social or economic characteristics are marginally touched upon. Furthermore, it reflects in general the German population and has limited significance for the widespread field of real estate development.

Nevertheless, it reveals a high necessity of demographic development for the residential trade and industry, which displays a fine grasp of these significant circumstances also for the future years.

The German Federal Ministry of Transport and Construction and Urban Environment – Bundesministerium für Verkehr, Bau und Stadtentwicklung (2010) creates a national code of practice for the region Germany in the context of demographic development. The research highlights a special real estate market and analyses in detail financial responsibilities of political bodies to respond to the changing demands of inhabitants in the housing market economy.

Although it is a key variable of the real estate economy, further market developments are not in the focus of the research, which hinder a widespread perspective of the economy. Furthermore, it is a specialised area of research for the German market and, therefore, not transferable to other countries as an in-depth analysis of political support programs are evaluated.

The demographic changes in housing markets are highlighted by Lim and Lee (2013). The target of the research is to develop procedures that respond to the demographic changes in the housing segment with variables such as aging, future possible movements and housing policies. The study analyses age-specific fertility ratios through an utilisation of socioeconomic indexes. Furthermore, three scenarios in the context of fertility rate, future population and the future housing demand are outlined.

The paper offers a long-term-oriented perspective of the demographic development in the housing sector by using the Mankiw-Weil model. The paper develops an innovative field of economic and demographic development. Furthermore, it shows the strong correlation between the demographic changes, future shifts and political support systems for countries. The paper offers in-depth information on real estate markets using different scenarios offering diverse perspectives. Also the establishment of socioeconomic indexes realises a quantitative valuation of demographic circumstances.

Nonetheless, the study is focused on the Korean market, which limits the generality of this research. Furthermore, the purpose is an economic perception that neglects other real estate fields such as building quality and environment and hinders its usage for additional real estate segments, especially in the housing market of the European Union.

Eichholtz and Lindenthal (2014) carry out a study in the context of demographics and human capital in relation to demand for housing. The paper examines how demand for housing assets depends on variables such as age at household level. Additionally, a cross-sectional survey of English households is conducted with the result that the demand is determined by the human capital of the household and that the growth in housing demand occurs in line with the age of the individuals. Additionally, the paper illustrates that demographic movement, especially in countries with shrinking populations, leads to heterogeneous demands for diverse housing features.

The research focuses on the demographic challenges of populations in the residential trade and industry sector. In addition, demographic development and individual's demands are highlighted.

Nevertheless, the survey is realised exclusively by English households with a potentially different focus than other populations as a result of cultural or economic effects. Furthermore, another research limitation is a strong perspective for household demand, which hinders that of individual real estate demands of occupants. Consequently, a widespread analysis of future real estate assets for single persons is difficult to evaluate.

For Leung et al. (2014) the variable of care components for the elderly generation in its housing is essential for establishing a competitive advantage in the real estate branch. The paper investigates the main variables of facility management in care and attention in rapidly ageing societies. The study focuses on Hong Kong with the objective to collect significant databases. Furthermore, a questionnaire survey is realised in order to gain an understanding of the current situations and demands of elderly people. The creation of housing components for elderly generations in the context of the housing sector is one of the relevant indicators for meeting the demands also for future elderly generations.

The study establishes the interaction of the growing number of elderly people and the necessity to respond with additional housing features to stabilise real estate assets also in future decades.

Nonetheless, the care-variable is an aspect besides further areas. Therefore, a widespread perspective cannot be made from this study. Additionally, the research takes place in the Hong Kong region with the possibility of contrasting markets in other regions such as rural areas. Furthermore, the Asian market could feature more changes and consequently challenges than that of the European Union, which limits the findings for other housing market segments. As the questionnaire is realised with Asians, the demand as a consequence of culture is different to European demands of senior individuals, which again limits the utilisation of this study for European markets.

Also the studies of other authors (e.g., Castell, 2014) outline special areas for the elderly populace, respectively people with disabilities with a strong focus on services or architectural features to respond to the special needs of these housing users.

The research focuses generally on the growing demand for additional housing segments. Furthermore, the authors mainly show the demand for changing housing qualities, modernizations, senior-compatible components and services to realise a lifelong living within the inhabitants' own dwellings. Such studies contain important information as they highlight the widespread changing demands of especially future generations. Additionally, they reflect the strong necessity to fulfil changes in the housing economies to improve the real estate assets.

Nevertheless, commonly economic or additional demographic features such as household developments or demands of younger members of the populace play minor roles, which hinders a widespread view on dynamic residential trade and industry markets.

As the research in demographic literature demonstrates, demographic movement is seen as a strong indicator in the real estate branch and as an important relationship between changing age structures and, therefore, developing real estate demands that stand in correlation to each other. Nonetheless, a focus on other areas that influence real estate markets is usually neglected, respectively plays minor roles. Additionally, often a special field is evaluated such as the elderly, sick persons or individuals with handicaps or disabilities. While attention is given to the space and in part the social and the environmental area, often the economic and financial variables are minimised with an absence of in-depth reflections of a widespread field of housing markets. Furthermore, special regions are highlighted with a limitation on the overall area of the European Union as the outlined areas contain special conditions that could not be transferred to other locations.

An additional field of specialised literature alongside demographic development is the **building component sector** that contains housing lifecycles, building materials or housing building processes to stabilise real estate assets today and also in future periods. The literature is often of a technical nature and reflects a significant sector of real estate economy of housing markets in the European Union. Although there is a bigger field than the demographic development available, the quantity is again – similar to the demographic sector – limited. Relevant literature is shown below.

Aznar Bellver and Caballer Mellado (2005) apply a multi-criteria method for the real estate field of farmland within the methodology of the Analytic Hierarchy Process. This research specialises characteristics of farmland in different areas of Valencia. The criteria include productivity, soil quality and access.

The study highlights a strong correlation of real estate outcome and the quality of properties and consequently contains the necessity of these market segments to establish real estate assets. As it is a minor and highly specialised field of real estate research, an application for further segments is limited.

Nonetheless, in the area of productivity and product quality, an utilisation for residential trade and industry for European countries could be possible and, therefore, this research is advantageous for additional studies also in the housing sectors.

Chen et al. (2006) present a multi-criteria decision-making model based on the Analytic Network Process (ANP). The target of this research is to support lifecycle-oriented assessment within dissimilar clarifications of intelligent buildings with the result of a new model that regulates the overall procedure of the lifecycle assessment. The indicators of the ANP model are variables such as waste disposal, lighting, construction materials and building architectural design.

This model with its building rating system is able to deal with values and interrelationships of the indicators. Furthermore, it offers a deep analysis of the building sector and establishes various variables for it. It demonstrates a high requirement for lifecycle-oriented evaluations and places a great deal of attention on this technical segment in order to stabilise building properties.

Nevertheless, it contains exclusively a building-quality perspective and eliminates further real estate asset variables, which limits the utilisation of this model.

Chauhan et al. (2008) publish a study on the housing sector using the Analytic Hierarchy Process. The special field comprises mass housing planning and resident's selection to establish a decision-making. Moreover, a case study of the Surat urban area is outlined.

The study contains mainly the planning process, but also outlines in parts environmental, social and financial components.

Nevertheless, the research involves a single minor real estate field and highlights a small quantity of variables such as unit level, neighbourhood, financial situation and building material. Further economic or demographic perspectives are not available, which limits the outcome of decision-making.

The researchers Chen and Khumpaisal (2009) outline the application of the Analytic Network Process in the risk management for urban regeneration projects. Additionally, they implement a case study of a residential and commercial mixed-used project in Liverpool to illustrate the effectiveness of the ANP methodology. The model contains variables such as social needs for new development, constructability, land contamination and lifecycle value and focuses, therefore, on various significant topics of the real estate economy.

The research contains the correlation between the social basic needs of living and lifecycle and new construction developments, which outlines a widespread perspective in this kind of real estate market.

Nevertheless, as these milieus are specialist, there is the responsibility of in-depth databases to evaluate the issues in a professional manner. Furthermore, e.g., demographic development does not play a role in the hierarchy of this research and, therefore, means the usage of the model is limited.

The institute EPA – United States Environmental Protection Agency (2013), publishes a study of an analysis of the impacts of real estate lifecycles and the potential for impact avoidance within the sector of single-family homes that is a special field of the residential trade and industry branch. Topics, e.g., the estimation of lifecycle environments and the lifecycle impact analysis illustrates a clear emphasis on building materials and asset phases in the technical sector of real estate investments.

It highlights mainly in an in-depth manner the technical development and impacts and challenges in the construction phases.

Nevertheless, the financial, environmental, economic or demographical development do not have importance in this research, which limits the perspectives in the real estate market as the research contains one of different further real estate issues.

In the field of housing, using the ANP methodology, Safari et al. (2013) establish additional research. According to the researchers, in the modern development of management science, an "evaluation network is unavoidable so the lack of an evaluation network in different dimensions of organisation using resources and facilities, staff, objectives and strategies is considered one of the symptoms of organisation illness". Consequently this approach identifies different dimensions of active housing in the special region of Arak city. There are various housing criteria established such as cost per square metre, time preparing apartments, number and measurement of habitations and quantity of building blocks compared in an empirical part with seven interviewees.

The study places a strong focus on the interaction between building qualities, financial dimensions and resulting strategies of the real estate branch and, therefore, argues there is a high responsibility to interact in this market segment.

Nevertheless, as this study comprises the mehr or social housing sector and also contains company and member criteria, the real estate focus is limited. Moreover, the case study illustrates a special region and, therefore, is not a general evaluation of development procedures.

De Andrade Ruiz et al. (2014) research focuses on the challenges in social housing projects basically related to design and construction quality and cost variables. The researched area is Brazil and the aim of the study is to determine whether value growth can be achieved by reallocating costs to the qualities of end-users demand. The target is to develop a procedure that balances costs and the user's value delivery.

The study places an emphasis on the financial and construction view and limits other real estate perspectives such as demographic or environmental variables. Additionally, there is a strong focus on the social housing sector, which is a special field in this branch. Therefore, a widespread evaluation of residential trade and industry markets is not available.

The authors Ho and Addae-Dapaah (2014) publish a research paper to garner an understanding of real estate lifecycles using the mathematical methodology of a vector auto regression (VAR) model. Their key conclusions are that the real estate cycle is different to the business cycle; second, real estate cycles are more inflated in construction and development areas than in rents and vacancy ratios; third, the vacancy cycle tends to dominate the rental cycle; and fourth, new construction assets tend to peak when vacancy also peaks.

The study outlines an important field of real estate subjects and the significance of lifecycles of buildings.

Nevertheless, the authors highlight the key variable of technical lifecycle and exclude mainly economic and demographic aspects. Furthermore, the researched regions are Kuala Lumpur, Singapore and Hong Kong, which are huge metropolises. Rural areas are not included. Furthermore, exclusively Asian cities are covered and the focus is on the special real estate field of the office sector, which hinders a widespread perspective to other areas such as Europe.

Various authors and researchers (e.g., Beckers et al., 2015; Firdauz et al., 2015; Kojo and Nenonen, 2015; Rothe et al., 2015; Schlittmeier and Liebl, 2015; Yung and Chan, 2015) focus attention on the area of evaluation and development of workplaces in the real estate branch with variables such as learning places, space management and built heritage.

The purposes are the developments of commercial real estates for ideal working places for employees as there is a perceived necessity to respond to the changing demands of employees in the business context. Consequently, this kind of literature also results in outcomes of ideal working places in the real estate branch. Although this area is an important future branch, it is specialised and, therefore, its utilisation for the residential trade and industry is limited.

Nevertheless, the significance in this milieu outlines an additional importance in the context of residential trade and industry and living space, which develops into a valuable issue that can be transferred to the context of housing markets.

Another special context in real estate research is service and maintenance aspects as key drivers for successful real estate asset management and to develop competitive advantages in housing markets (e.g., Almahmoud and Doloi, 2015; Enshassi and Shorafa, 2015; Hassanain et al., 2015; Hopland, 2015; Keung and Yiu, 2015; Mesthrige and Poon, 2015). These studies generally focus on the potential of long-term sustainability, poor maintenance, outsourcing and value stabilisation in order to establish a unique selling proposition, respectively unique building feature to remain competitive in residential trade and industry markets.

These kinds of studies often highlight additional product dimensions such as services and management of real estate assets.

Nevertheless, although this is one component for living spaces, there are further areas such as build quality, environmental characteristics and demographic variables that are indicators in the focus of housing aspects that contain minor shares of these researches with a limitation of the housing branch. Moreover, usually measurable evaluations are limited and empirical research includes mostly qualitative statements of real estate participants that make it difficult to establish fundamental tendencies, shifts and outcomes in this area of housing markets.

The aforementioned literature in the area of space characteristics clearly shows that most of the research comprises in-depths studies of technical features and future challenges to meet the demands of individuals in the residential trade and industry. Nonetheless, the papers often outline specialised real estate fields, which limits their findings. Furthermore, they deal mainly with the technical part with an absence of additional housing market areas such as environmental, demographic or economic circumstances. Consequently the research builds one pillar of the market, but additional segments have to be developed to established widespread viewpoints of market situations.

One research field that is highly researched is asset management and portfolio management, for which a lot of literature is available. The section of **environmental social characteristics** is highlighted below. It deals with the relevance of spatial, environmental and urban circumstances, but mainly outlines the special field of financial and economic features. The literature is analysed below.

In the field of marketing applications Wind and Saaty (1980) create the Analytic Hierarchy Process to realise decision-making. Furthermore, a discussion of specific marketing applications such as the distribution portfolio and evaluation of new product concepts are illustrated. The variable hierarchy mirrors criteria and subcriteria such as environmental scenarios, market share, profitability, sales growth and vulnerability and, therefore, places emphasis on monetary decisions of investors for their products.

The study pays strong attention to market potentials, earnings, supply and demand and sales activities within this field that play a relevant role in the stabilisation of market assets.

As it focuses generally on the profit orientation of investors, other components of real estate economies are neglected.

Quan and Quigley (1991) realise an early study in the real estate field of price formation and the appraisal function of markets. The researched transaction model illustrates a self-selection procedure for market participants and an allocation of transaction costs. The model underlines the dissimilarities in market information of suppliers and customers. Its aim is to gain an understanding of the role of property evaluation in dynamic real estate markets. For the authors, market value is crucial to profitability and related methodologies, which focuses on monetary significance, which is the key component of investment portfolios.

This paper demonstrates in a clear way the necessity of available information, the interrelation between market participants and real estate asset values. As this article is basically market value based, there are other perspectives such the social, environmental and demographic views missing.

Nevertheless, this article was published in the early 1990s when the focus of research was on different areas to those of today as mentioned in this chapter.

Eichholtz et al. (1995) publish an approach to portfolio allocation with the reflection of decisions how much to allocate to broad asset categories and the optimal strategy within these categories. Furthermore, there is an additional focus on risk diversification within the real estate assets.

The research reflects an in-depth perspective of a stabilisation of real estate assets using an ideal portfolio management. Furthermore, it focuses attention on a risk diversification to establish valuable asset portfolios.

However, their consideration lies on the industrial, office and retail real estate assets. Moreover, the research is monetary based and includes decision-making for single investors. Therefore, an overall macro-economic perspective is absent.

For Quigley (1995) a precise measurement of housing prices is important to recognise the action of housing markets. Therefore, the researcher develops an explicit methodology for combining single and multiple sales activities for the analysis of housing prices and efficient price indices. In addition, a case study is outlined of a 12-year sales period in Los Angeles. Valuation variables in the empirical part of the study are mainly reflected in the real estate size, location, elapsed time, real estate price and number of sales.

The study presents a widespread view of monetary strategies in the real estate business. Additionally, it features a case study over a long period of 12 years, which indicates a reliable stability of the results.

Although the paper has a key focus on sales activities and, therefore, on a price valuation of real estate assets, subjects such as economic conditions or price developments are not related. Further areas, e.g., space characteristics also do not play a significant role. As the case study contains sales periods in Los Angeles, also the region is limited, which hinders additional conclusions for other market areas. The study is established in the past and present time period and does not offer further future information, which also bound the findings of the study.

Gencay and Yang (1996) establish a forecast comparison of housing prices in the residential trade and industry by an utilisation of a hedonic price model for prediction and assessment of the monetary sector.

The study embraces a measurable quantitative issue of housing prices with a possibility of using it as a foundation for further research.

Nonetheless, as the study has a strong focus on financial characteristics, key variables of the empirical part of this work are recognised in the area of housing components. Further variables with demographic and economic frameworks are missing.

Evaluating real estate assets is also a topic addressed by Shiller and Weiss (1999). Their study’s framework offers a comparison of real estate valuation systems. Furthermore, a discussion of related measures is outlined with topics such as distribution of errors and correlation of valuation faults.

The study embraces different systems to evaluate real estate assets to realise a professional handling within the residential trade and industry business. The aim is to correct these deficiencies, but according to the authors the methodology is somewhat challenging to implement. Moreover, the view of the research is strongly monetary based with an absence of additional real estate fields that impedes its usage.

For Case et al. (2000) the real estate cycles of global markets are of significant importance. The study focuses mainly on industrial and commercial markets and reflects the substantial amount of the correlation across the world property markets to the effects of global changes.

With the two perceptions of a strong correlation between the markets and the gross domestic product and the investments in globalised real estate portfolios significant for overall trends in global productions, the article shows a strong macro-economic perspective with a negligence of micro-economic characteristics.

Nevertheless, the paper highlights the interaction between general economic markets and real estate markets. Furthermore, it reflects the economic challenges in a globalised and international world, which is important for real estate portfolios and the stabilisation of the assets. Although the study embraces industrial and commercial markets, it is a useful foundation of further markets such as the residential trade and industry.

Kettani (2001) outlines PariTOP, a mathematical decision-support system for determining the market values of real estate properties. In the individual appraisal process, the profile of the subject, profile and exchange value of a comparable, eligibility conditions value of a sale and the resemblance index play key roles. Furthermore, a pilot project is outlined in the Communauté urbaine de Québec that performs a huge quantity of activities for its 12 member cities with the goal to illustrate how goal programming can be established for large-scale property valuation.

The research establishes an in-depth valuation methodology for realising a mass evaluation in real estate markets. Furthermore, it offers widespread analyses as the empirical part of the research embraces different member states.

Nonetheless, the author states that the methodology is far removed from an overall solution to the challenge of mass evaluation. For this kind of methodology, high-quality data are necessary. Additionally, it may not be suitable for other real estate assets due to the absence of comparability.

Steinert and Crowe (2001) examine current investor provisions to real estate assets and illustrate asset portfolio diversification benefits available from the enlarged weighting to the segment of securitised properties with the objective of suggesting an ideal commercial and industrial portfolio allocation.

As there are issues such as property investment, real estate trusts and benefits in the focus of the paper, financial rewards are the key factors with a lack of additional circumstances related to all real estate milieus. Furthermore, the main real estate branch is the field of commercial and industrial assets, which limits the perspective of further areas, e.g., residential trade and industry portfolios.

However, the study highlights significant diversification advantages that focus on the necessity for professional portfolio management to secure real estate assets. Although this paper establishes research in special fields of real estate markets, it also demonstrates high relevance for other markets such as the residential trade and industry.

Using the Analytic Hierarchy Process, Laininen and Hämäläinen (2002) present a formula for evaluations of standard deviations of the AHP weights achieved by regression analyses. A regression technique is enlarged to reduce outcomes of outlier and a dissimilarity matrix method is illustrated for the statistical simultaneous relationships of the weights in the AHP hierarchy.

The study highlights the necessity of stable outcomes of real estate valuations.

Nevertheless, it is established in a specialised area of the AHP methodology. Furthermore, it is validated by simulation experiments and has to be established in real decision-making of experts to evaluate this methodology clearly.

Wellner (2002) establishes the transformation of portfolio management for residential trade and industry assets into a scoring methodology with the target of a holistic real estate portfolio system in the context of qualitative and quantitative valuation of asset management.

The study contains the perception of various portfolio tools such as modern portfolio theory, diversification models, capital market theory etc. Furthermore, the research outlines a scoring technique to analyse portfolios in an operational manner with an amalgamation of qualitative and quantitative methods.

Nonetheless, the approaches are mainly illustrated in a descriptive manner with a handling of various different portfolio tools. A detailed focus is not available. Consequently, the study offers a first overview of portfolio management and further stages have to be researched in future studies.

Du Toit and Cloeté (2003) establish an integrated property and asset market model for mainly South African property markets with the foundation of the Fischer-DiPasquale-Wheaton real estate model (Archour-Fischer, 1999; Fischer, 1992). The research focuses on real estate variables, e.g., property and capital market conditions, demand for space, income and vacancy ratios.

Therefore, it outlines diverse real estate fields such as the building sector, economic and financial segments essential for safeguarding residential trade and industry assets.

Nevertheless, although multiple special economy variables of the real estate branch are outlined, the focus is a single region of Africa. Furthermore, the model is a stable model with an absence of the possibility of a reflection of current dynamic markets, which hinders an application of a flexible decision-making.

Aznar and Guijarro (2007) work with the goal programming optimisation technique with the objective to propose comparative valuation methods that allow the combination of precise and imprecise information in the special area of agricultural context. The paper reflects the significant area of imperfect information in the real estate branch and the ideal handling of information.

As this study is established in a special real estate field with a strong perspective on the monetary framework, it has to be modified for additional real estate assets such as residential trade and industry assets.

Nonetheless, it offers a significant foundation for additional research to manage data and to evaluate it in dynamic markets.

For Hoesli and Lizieri (2007) the real estate investment portfolio plays a major role in asset markets. Therefore, their report, prepared for the Investment Strategy Council of the Royal Ministry of Finance, includes investment possibilities for the ministry, risks and returns in real estate markets measurement issues and fund allocations.

This study mainly reflects the importance of the responsibility of political bodies. Furthermore, it includes the relationship between portfolio risks and earning level. Nevertheless, the authors highlight that the analysis of private ownership and investment in commercial real estate is hampered by data deficiencies.

As the focus is on the financial sector and for a particular region, as it was produced especially for the Royal Ministry, a general application is limited.

Khumpaisal and Chen (2007) conduct research in the field of real estate development and risk assessment with the target to support real estate developers in the decision- making process to deal with potential risks in all project development states.

The methodology used is the Analytic Network Process against the criteria social, technological, economic, environmental and political risks. A case study of a residential and commercial mixed-used project in the centre of Liverpool is established to highlight the effectiveness of the research. Subcriteria for the risks assessment criteria are, e.g., community acceptability, cultural compatibility, constructability, environment impacts, interest rate, demand and supply, and commercial tax policy. This model demonstrates widespread analyses of risk assessment, as 33 risks under 5 criteria are implemented.

The paper places high significance on evaluating risks in residential trade and industry markets with a strong reflection to the dynamic of these markets.

Nevertheless, there are limited environmental subcriteria. In addition, also demographic variables are absent. Therefore, the perspective of this model is limited, especially for the residential trade and industry sector.

Borner (2008) outlines real estate portfolio management in Switzerland using different scenarios in risk assessment. The focus of this study is economic and geographical diversification and the development of rental prices and correlation of vacancy ratios.

The study utilises different variables for portfolio management such as risk variables and environmental and asset price valuation that embraces a widespread field of real estate economy.

This study is founded on the Fischer-DiPasquale model, which is static and does not react flexibly to real estate economy markets; therefore, the evidence is limited. Furthermore, the research is focused on Switzerland, which also hinders an in-depth perspective of other European markets, as the market situation is relatively stable and, therefore, comprises other advantages and challenges compared to markets with unstable or more dynamic circumstances.

Montero-Lorenzo and Larraz-Iribas (2008) examine the spatial correlation in housing prices indexes and propose a new linear estimator that specifies the issue of more realistic estimations of housing prices per square meter. In addition, valuations of the official statistics of Madrid for 2005 and 2006 are highlighted.

The advantage of this study is the possibility of a quantitative measurement and evaluation of real estate assets and housing prices. Therefore, this research offers a useful assessment tool of price developments within the residential trade and industry markets over time.

Nevertheless, the results contain great differences between different housing places. The methodology is specialised in regard to particular locations and is not usable for the overall developments of real estate assets. Furthermore, the study is mainly monetary focused with an absence of additional frameworks such as building quality or demographic developments, which hinders a widespread perspective of the real estate branch.

Bönner (2009) of the University of St. Gallen studies office markets in Germany and, therefore, is limited in further real estate markets.

Moreover, in this context variables such as annualised rents and prices are in the focus of the empirical part with a strong monetary perspective, which limits the perspectives of residential trade and industry assets.

However, as the study embraces a financial view of real estate markets, it develops a significant area of the asset-management.

Gómez-Navarro et al. (2009) present an approach to prioritising urban planning projects. The research is based on the environmental pressure index to rank the complexity of urban development proposals. The technique used in this study comprises the environmental pressure indicators and the Analytic Network Process. Furthermore, a case study of La Carlota Airport in Venezuela is outlined in order to highlight the challenges of pressures. For the ANP methodology, based on the results of five experts, the authors choose criteria in the fields of physical aspects and resources consumption, especially land area, population density, energy consumption, waste generation and water consumption with different club and park alternatives.

The study embraces a new methodology with an amalgamation of different techniques to develop environmental issues in the specific context of Venezuela. Additionally, it establishes an environmental pressure index that realises a quantitative measurement of environmental indicators and variables.

Nevertheless, it is a specialised study; therefore, it is difficult to develop the context to overall objectives. Furthermore, the criteria are limited to the environmental segment and, therefore, further real estate fields are not outlined with a strong limitation to different real estate markets. As the case study is located in Venezuela, which has a different environment to other regions like the European Union, the research findings are limited in this field. Additionally, as the interviews are also realised with experts from Venezuela, the results are established in a special culture.

Lin et al. (2009) use ANP methodology in the area of business intelligence systems to create a performance assessment model. In the focus of the study is the Analytic Network Process to assess the effectiveness of systems to realise decision-making. The empirical analysis of the study embraces expert questionnaires with 12 respondees, which realises the pairwise comparisons of criteria such as services abilities, customer requirements etc.

The research highlights in a clear manner the necessity of efficient and effective environmental assets to obtain a competitive advantage in the business context. Furthermore, it establishes additional product dimensions such as the service environment and the requirement to relate to the demands of market participants.

Although business intelligence is a specialised area, various variables could be transferred to the residential trade and industry.

Vogdt (2009) from the Technical University of Berlin examines whether sustainability of real estate assets is based on the dimensions economy, ecology and socio-cultural features. Furthermore, the author illustrates that the lifecycle of buildings plays an important role in this context. He recommends that further strategies of modernization are necessary for the future of a sustainable development of real estate assets.

The paper touches on various residential trade and industry areas such as the building quality, social, economic and environmental context to stabilise real estate assets in housing markets.

Nevertheless, as there is an absence of future strategies, the article is more descriptive and requires additional research.

Montero-Lorenzo and Larraz-Iribas (2010) examine spatial correlation and house prices. The target of the study is the comparison of cokriged estimations of prices in different temporal moments of Spain. After the decision of a combination of theoretical variograms that captures the structure of the spatial dependence of the researched Spanish regions, quarterly prices are evaluated using cokriging methodology.

The study demonstrates the significance of reflecting a configuration of the spatial dependency among the prices of properties when assessing them.

However, the methodology is a mathematical statistical one that compares mainly this method with others. The focus on this comparison hinders in parts the attention on the special residential trade and industry characteristics and the decision-making of branch experts. Furthermore, it relates to particular time periods and regions of Spain that also creates a limited view of real estate markets. Nonetheless, it develops an evaluation of methodologies to calculate special real estate assets in European markets.

Narula et al. (2010) use a standardised methodology to reduce the number of models for property valuations. The methodology is an interface between data analysis and operations exploration. The target of the study is to present a model for the valuation of single-family residential assets by the utilisation of a hedonic model that embraces variables such as age distribution, lot size and number of rooms. A linear regression approach of quantile regression is used.

The study focuses mainly on the real estate field of technical components that have to be evaluated, which implies one of the important segments of residential trade and industry in the European Union.

Nevertheless, because the single-family segment is a specialised part of the residential trade and industry, an utilisation is not possible for the whole branch. Furthermore, the authors only look mainly at building components, which restrict further valuations in the dynamic market fields of, e.g., economic and demographic characteristics.

Aznar Bellver et al. (2011a) propose a study that combines the AHP methodology and the valuation ratio of the International Valuation Standards to realise an asset and market valuation.

The study outlines a way to evaluate the value of market assets and detect shrinkages of assets over time.

Nonetheless, the study is cost-oriented and has to be developed for the additional variables of the residential trade and industry to stabilise assets also in future decades.

Another research of Aznar Bellver et al. (2011b) outlines an environmental asset valuation method for the assessment of the Ebro River Delta Natural Park. The methodology is a combination of the Analytic Hierarchy Process and the Discounted Cash Flow Analysis with the variables direct, indirect use and non-use values.

This research is strongly monetary-value based and embraces a specialist project in a single region. Therefore, this study is of limited use for additional real estate research. Nonetheless, it establishes an amalgamation of different valuation methodologies that could be advanced and established for further areas of real estate markets.

Cervelló et al. (2011) describe the application of Ballestero's multi-criteria single-price model to establish alternative residential rankings. Furthermore, a case study for a practical application by a major Spanish valuation company is highlighted.

The utilisation comprises variables such as price, usable area, construction quality and urban environment quality. Therefore, a strong reflection is outlined for building components and housing and environmental factors.

Nevertheless, the demographic features are excluded with a necessity for additional characteristics in further research.

David (2011) from the Francis Marion University develops the key issue of strategic management. The author clearly illustrates the strategy formulation, implementations and evaluation. Furthermore, the author deals with strategies in action, where practical examples are highlighted.

In these practical examples the market segmentation, procedures for determining the market values, financial analyses and evaluation of the attractiveness of stock as a source of capital are all explained.

However, the research uses various universal strategy tools such as the Balanced Scorecard and the Boston Consulting Group Matrix and highlights different strategies of single companies without a focus on a specialised strategy for branches or economies. Furthermore, there is an absence of additional innovative methodologies to evaluate decision-making. The AHP model comprises the dimensions costs, profits and risks and includes a clear market approach. Nevertheless, to evaluate residential trade and industry assets, additional social components are required.

Hadjimichalis (2011) discusses the regional development theory in relationship with conditions of unequal geographical developments in the field of the financial crisis after 2009 within the European Union.

The research focuses on a less macro-economic context, but a more spatial area. It embraces topics such as uneven geographical development since the introduction of the Euro, urban and regional discourses and the concern of political responsibilities. The study looks at spatial development and also the interrelationship between economic tendencies that implicates to important real estate fields.

Nonetheless, additional significant real estate areas to evaluate the overall asset market are not analysed. Furthermore, the research has a strong focus on the markets of Portugal, Italy, Ireland, Greece and Spain, which limits the usability of this research in the regional part of issue.

Abastante and Lami (2012) present a methodological framework with the establishment of two different techniques, quality function deployment and the Analytic Network Process for a cohousing project in Italy with the overall goal of the stakeholder's requests.

The network model of the Analytic Network Process embraces the variables environmental, social, and economic and urban planning aspects. It highlights important fields of residential trade and industry markets. Furthermore, the combination of different methodologies enables the utilisation of different market variables.

Nevertheless, cohousing in the real estate segment is a minor specialised field in this branch. Furthermore, the model demonstrates limited perspectives as, e.g., the demographic, financial and building quality components are missing.

For Baixauli et al. (2012) a risk management for real estate companies is outlined by combining structural models and accounting-based mathematical models for an evaluation of real estate credit risks. The researchers calculate scoring models in the time period from 2003 until 2007. Furthermore, they focus attention on an evaluation of credit risks to establish a risk management for an advancement of real estate assets.

As the paper takes a financial view and includes the past time period from 2003 to 2007, the research can be used in a limited manner. Also the short time period of five years hinders a widespread evaluation and future possibilities in these markets.

Bischoff (2012) explains regional variations in equilibrium asset prices and income in German countries and cities before 2005 with the outcome of positive collaboration results of income and real estate prices. The author´s methodology is a combination of Potepan's real estate model that explains why housing prices, rents and urban land prices vary between different real estate markets and the spatial equilibrium approach to verify the interdependency between the variables housing prices, rental prices, building land prices and income levels.

The research looks at the monetary levels of supply and demand segments and illustrates different perspectives of market participants.

Nonetheless, as Potepan's model is created for the American market and especially for the metropolitan housing market, the validity of its utilisation for German markets is questionable. Furthermore, the additional economic model of spatial equilibrium approach is a stable systematic, which hinders its usage in dynamic residential trade and industry markets.

Bouchouicha and Ftiti (2012) examine real estate markets and the macro economy. They analyse the interactions between commercial securitised and residential real estate markets and the macro-economic environment in US and UK markets. Key contents of the study are housing expenditure channels, real estate crises, market downturns and institutional shocks that highlight strong preferences for the monetary and economic field of real estate assets.

The paper analyses in an in-depth manner extreme situations and strong economic market situations to establish a risk assessment in this branch. Furthermore, it focuses on strategy management to safeguard housing assets also in extraordinary market dynamics.

Because other aspects such as environmental or social features are mainly neglected, the paper has a narrow focus; also the fact that the real estate markets are located in the UK and the US hinders a widespread general perspective of additional market situations in the European Union.

Cervelló et al. (2012) provide an analysis and an optimisation model of the spatial influence for externalities resulting from urban renewal and restoration of historic regions. Additionally, a case study is included of areas in Valencia that demonstrates the urban regeneration model used for the research.

The aim is to compare various situations in the historical environmental field of real estate assets. Furthermore, it focuses on urban development and, therefore, comprises a specialist area of real estate development. Therefore, its utilisation in general has to be expanded for residential trade and industry assets within the European Union.

Narula et al. (2012) highlight the evaluation of real estate using parametric programming to assist analysts in finding an ideal prediction model. The approach offers an interface between the database analysis and an operational research and, therefore, combines mathematical strategy with operational management.

The paper reveals a strong necessity for management of strategies in the real estate sector to evaluate, on the one hand, asset values, but on the other, to implement strategies that could safeguard housing assets in the long term.

Nonetheless, the research is advantageous as a first step of decision-making, but outlines no additional fulfilments to validate residential assets.

Pomogajko and Voigtländer (2012) develop a study that specifies that the result of globalisation and monetary integration is equal macro-economic conditions in industrial states. By using a factor analysis, they measure the degree of co-movements of house price cycles in the residential trade and industry markets with the outcome that monetary integration plays a minor role and that the risk reduction in international housing markets has strong effects.

The analysis reflects house prices in OECD countries in the period 1990 to 2010. It places a strong emphasis on international markets and the minimisation of potential risks in the markets to stabilise assets of the residential trade and industry.

Nevertheless, the paper has a strong focus on globalisation and housing prices with an absence of additional real estate fields, which consequently hinders a widespread view of real estate assets. Furthermore, the reflection of asset markets is limited through the time periods established in the past and present decades and do not reach future periods, which also limits the approaches of that research. As the examined housing prices are for OECD countries, it represents an additional limitation of the research findings.

Safian and Nawawi (2012) combine within their research the Analytic Hierarchy Process and the Geographic Information System to evaluate the quality of locational characteristics of commercial buildings to realise investment decisions. The research scopes are five samples of the Kuala Lumpur Golden Triangle area.

The research places a strong emphasis on environmental features in the real estate markets.

However, the real estate area is limited as the study covers commercial buildings in Kuala Lumpur. Moreover, the AHP hierarchy is limited as it embraces only the locational characteristics of commercial features, availability of transport options, transportation and parking distance, vehicle flow and efficiency of property market. Areas such as demographic, economic and build-quality features are lacking with the result of a minor usability of this model.

Schnabel (2012) proposes a paper for a rationale home-country bias for asset portfolios with the intention to evaluate the desire of investors to hedge a bundle of assets by using an asset-pricing model. The intention is to develop an international model of the capital market equilibrium. The objective is a latter portfolio that maximises the expected rate of return minus a risk tolerance weighted by variances of tracking errors.

The finding is a revised security market line that differs from traditional systems that is interpreted as a multi-country generalisation of the Capital Asset Pricing Model under uncertain inflation.

As the research highlights a strong macro-economic focus by developing equilibrium, the model requests stable market conditions, which is a special quantity of market information. This context hinders the management of dynamic international markets.

Warren-Myers (2012) analyses the value of sustainability in real estate markets from a valuation perspective. The aim is to establish a relationship between the sustainability of real estate assets and market values. According to the author, sustainability is a relatively new trend in the real estate branch. Therefore, the author examines a lack of historical proof, databases and information on the quantifiable market value effects.

Nevertheless, as the research combines the more qualitative area of sustainability with a quantitative valuation methodology to evaluate the asset orientation in this field, this is a useful strategy to count the market sector of sustainability.

Amédée-Manesme et al. (2013) highlight the risk management of real estate portfolios by combining Monte Carlo simulations. The objective of the study is to illustrate that the correctness of the valuations of real estate portfolios and asset risk management can be increased by the simultaneous utilisation of Monte Carlo simulations and the options theory.

The key variables of the research are market prices and rental values. Furthermore, an optional model analyses the rational behaviour of real estate tenants and the effect of the owner's income. The research paper examines in-depth the components of market risks, prices and market rental values.

The model used to analyse the rational tenant's behaviour is also in the authors' opinion a research limitation as a rational individual performance is difficult, respectively impossible to establish. Moreover, the researchers also communicate a lack of data in many markets, which limits the validity of the study. Nevertheless, this research also shows the importance of a valuation of property assets with a focus on risk management, income levels and market values. Therefore, the study is a basis for further advanced studies in the area of housing markets also in the European Union.

Devkar and Kalidindi (2013) highlight the competencies in urban local bodies for a development of public-private partnerships to manage urban projects. The AHP methodology is used to formulate approaches to overcome gaps in competencies and stabilise urban infrastructures and urban areas.

According to the authors, the study demonstrates the high responsibilities of political bodies to stabilise real estate markets. Furthermore, a significant field of infrastructure is outlined.

As this research is mainly based on the individual's competencies and not on real estate requirements, the focus has a strong limitation and could just be the first step to another development of real estate portfolio management. Furthermore, the study covers a specific region, namely India and takes an urban perspective that limits further implementations in the residential trade and industry, because Indian urban structures are not similar to market structures of European Union housing markets.

A special focus is outlined in the study of England et al. (2013), where the impacts of property taxation in the area of residential real estate development are evaluated. The analysis suggests that also the property tax rate could affect lot sizes and sizes of new-constructed real estate assets.

The result demonstrates that an increase in property taxes is associated with both smaller lots and additionally smaller housings. The research evaluates the different influences of housing taxes and the challenges for the real estate branch. Because the research area indicates one of several influencing variables, it reflects only a side aspect. Also the research is based on houses built in a particular region, New Hampshire. The timeframe extends from 1985 to 2006 and, therefore, covers only a past decade.

Nevertheless, as market dynamics are developing in real estate markets, this research design hinders an utilisation in other markets for future time periods.

Erdem and Ozorhon (2013) propose a comprehensive success model for real estate projects with a consideration of short- and long-term performance. The methodologies used are the Balanced Scorecard and Analytic Network Process to evaluate the significance of the attractiveness of location, business value and cost estimation.

The paper outlines in parts environmental factors in correlation with cost variables. Nevertheless, the Balanced Scorecard reduces a detailed external environment.

As the Balanced Scorecard is integrated into the Analytic Network Process, the flexibility of variables and, therefore, establishing variables for the real estate branch is limited.

Ghysels et al. (2013) investigate the forecasting of real estate prices with an emphasis on residential and commercial real estate markets in the US market. Variables, e.g., short-run persistence, long-run reversals, real estate prices and construction indices play an important role.

The paper shows that forecasting real estate prices has significance in different real estate areas, especially the residential and commercial real estate area. Additionally, a widespread analysis is outlined in the context of securitised assets and REITs with the issue of a discussion of leverage effects and monetary policies. The advantage of the study is that the authors investigate in both a short- and long-term context, which indicates a widespread timeframe for housing markets.

Nonetheless, the paper forecasts real estate returns and takes a significant perspective of the monetary milieu of real estate assets and real estate portfolios. Besides this aspect, the US real estate market is highlighted with an absence of generality for other real estate asset developments.

Haran et al. (2013) examine the importance of securitised real estate assets within the boundaries of multi-asset investment portfolios with the aim to identify whether real estate investors can afford the required investment benefits of direct property investments at the same time as modifying barriers and risks in dynamic real estate markets.

The findings of this research demonstrate the unresponsiveness of direct real estate markets to listed real estate markets.

Nevertheless, although the study reveals the necessity of an ideal portfolio management to safeguard real estate assets in dynamic markets, the financial components prevail in the research with an absence of a perspective of real estate users and the basic needs of real estate occupants.

Lee et al. (2013) apply the Analytic Network Process to rank critical success factors in the area of redevelopment.

Although the research field is established in the waterfront context, important criteria such as economic and community function and city branding are highlighted. Furthermore, the special criterion port function could be established as the building quality function for real estate assets and, therefore, the focus is on significant variables that could also be established in the real estate branch of the European Union.

Nguyen et al. (2013) examine the profile of the social component poverty in certain areas of Vietnam. In this context, a focus on income and expenditure variables is highlighted. Furthermore, the research embraces databases of the Urban Poverty Survey with a comparison of variables such as household demography, household assets and living areas. In addition, a deep analysis of the social variables, e.g., income and poverty line is outlined to compare different regions of Vietnam.

The research shows a strong emphasis on demographic, building features and environmental characteristics. Furthermore, it reveals the necessity to establish strategies to meet the demands of individuals, also against the background of monetary aspects such as poverty.

Although this research includes various perspectives and variables, it is limited as a result of a focus on special regions of Vietnam, mostly rural environments and populations on the poverty line. Therefore, its utilisation for further demographic, space and environmental social perspectives for the residential trade and industry assets in the European Union is hindered.

Osland (2013) demonstrates that outcomes from pooled time series and cross-section models could be influenced for basic implicit price analyses. The paper offers the hedonic methodology by using regression analysis and estimates basic and parsimonious models with the utilisation of pooled time series and cross-section data, respectively panel data that are compared. According to the author, there is a strong significance to research in different manners whether the traditional approaches provide unbiased outcomes.

In this research different models are analysed that use panel data versus models that use traditional time series and cross-section data.

Nevertheless, the focus of this study is the hedonic house price models and the research question is whether traditional or innovative models are able to realise a more concrete result of housing prices in real estate markets. Therefore, additional models for dynamic real estate markets are not offered. Furthermore, according to the author, another research limitation is that potential bias using a general fixed conclusions methodology could not be tested; the outlined time-varying variables are not reliable and only embrace a small range with the consequence of an absence of generality.

Spencer and Huston (2013) evaluate the housing market from a perspective of monetary policy effectiveness. The model comprises a housing equation and a mechanism to link real estate relationships. Empirical results link the monetary policy to current housing crises. Furthermore, the outcomes illustrate a long-term prior crisis and channels of influence that run from economic influences to mortgage interest rates to housing prices.

As the monetary policy and the period 2002-2005 is in the focus of the paper, further real estate developments and future changes are not highlighted. Additionally, the short time period of four years minimises the validity of the research that also limits the study’s findings.

Wen and Li (2013) examine the characteristics of real estate investment risk and general rules using the Analytic Hierarchy Process and the Fuzzy Comprehensive Evaluation methodology.

The study combines risk factors by utilising an expert scoring method to quantify the risk factors. The real estate investment risk factors and index system embrace micro- and macro-environmental variables such as tax and land policy, bank rates, investment- and financial risks and economic growth rate. The paper has a strong monetary and related economic point of view.

Nonetheless, the variables illustrate mainly the financial perspective with an absence of further real estate variables. Additionally, the article contains a company-specific analysis of risk investments in real estate projects. Therefore, it does not comprise a model for overall use in the real estate branch.

Wyman et al. (2013) outline the lack of the reliability of classic economic real estate models and focus on the complexity and non-linearity of housing markets. The study shows that political bodies need to create non-linearity representative financial models for the dynamics of residential trade and industry markets, which also embrace risk management for possible economic gaps and instabilities.

The research highlights the strong necessity of dynamic real estate models to respond to the special features of these markets and, therefore, to the special basic needs of real estate users.

However, the study includes the importance of additional models but does not create such models. The research also places the responsibility on the political area and includes a minor share of managerial handling of real estate assets, which hinders the findings of this study.

Aizenman and Jinjarak (2014) reflect on the real estate valuation in the milieu of account and credit growth patterns in the timeframe before and after the worldwide economic and financial crisis 2008-2009. The authors investigate the stability of accounting variables for a valuation in the real estate markets. In the focus of the study are 36 countries with the purpose of the evaluation of the robustness between real estate valuation and account patterns. Significant variables of the study are, for example, the lagged equity market valuation appreciation, standard deviations and economic growth.

The research deals with the correlation of real estate valuation and accounting. Furthermore, it focuses on the micro- and macro-economic development in the context of real estate markets. The approach offers a widespread perspective of real estate valuation as the empirical study involves 36 different countries with a result of a generality of outcome in this area.

The paper places a strong focus on the equity markets and monetary valuations of real estate assets and portfolios with the result of a limited real estate area. Furthermore, the research illustrates the present periods with an absence of future developments, which hinders in-depth analyses of trends over different time periods.

Bai et al. (2014) focus on the financial portfolio management in the context of REIT – Real Estate Investment Trust and the growing and decreasing of the asset leverage and the managerial practice of handling the trusts. The study clarifies the reasons for leverage structures and capital structures.

The paper outlines a strong necessity for real estate asset valuations and strategies to manage the asset portfolio management successfully. Furthermore, it develops the context of risk minimisation through a responsibility of market actors in this field of housing markets.

As the capital structure and the investment decisions of individual real estate investors are in the focus of the research, general deduction for overall real estate assets is not possible. Moreover, additional perspectives such as demographic or environmental viewpoints are not presented.

Bao et al. (2014) evaluate the land value determination with a hedonic price model. The target is to assess the pricing behaviour for land areas in a region of China, Beijing. The key findings are that traditional variables such as size, planning utilisation, location and environmental characteristics play a basic role for the pricing behaviour of real estate investments.

The approach develops monetary behaviour within the context of real estate asset and environmental features and establishes significant variables in these fields.

Although the study includes build quality and environmental milieus, variables such as demographic development are not highlighted. Additionally, the research is based on a particular region of China and, therefore, is not usable for general evaluations of real estate assets. Furthermore, it establishes valuation analyses for land real estate assets and, therefore, focuses on a special type of assets markets, which hinders a holistic utilisation for residential trade and industry assets.

Borgersen (2014a) compares the structure of risks and pricing systems in heterogeneous housing markets where the collaboration between sectors is interpreted with the target to reflect the scope to which homogeneous market frameworks undervalue the variables of pricing and risk in residential trade and industry.

The researcher compares homogeneous verses heterogeneous markets and also analyses the response of prices and risks in the context of economic shocks. The study offers a deep comparison of homogeneous and heterogeneous asset markets and also reflects the role of risk management in extraordinary macro-economic circumstances such as market shocks.

Although the analysis is an in-depth study that shows the dynamic and complexity of the real estate branch, the focus is on the macro-economic milieu with financial and economic components and a minor illustration of additional fields such as housing and demographic structures that limits a widespread utilisation of the research.

Another study by Borgersen (2014b) highlights a macro-economic perspective of housing market structures. Within the paper a linear housing market model is illustrated that embraces three different segments where the concentration of equity-induced up trading in various real estate market fields is illustrated.

This research reflects the residential trade and industry markets from the financial perspective and outlines an economic and monetary view of housing markets. The approach illustrates a strong relationship between the financial and economic components of housing markets.

Nevertheless, although this is one of the important indicators of housing market structures, in addition variables such as demographic development and particular housing characteristics also play a role within these structures that are not illustrated in this study. Its utilisation is limited for a residential trade and industry valuation of assets in the European Union.

Also Chu (2014) highlights a strong economic and monetary focus that includes credit constraints, housing booms and inelastic supply in the housing market. The research develops a dynamic general equilibrium model for the purpose of the sensitivity of house price developments with respect to credit constraints. The study focuses on the housing boom during the period 1995 to 2005.

The approach offers a widespread perspective of economic situations in dynamic housing markets with a strong focus on supply and demand. Furthermore, it contains an example of an extreme market situation within the housing booming phase and outlines asset development in such economic special circumstances.

As this field is a special asset management segment and a particular economic condition and analyses past periods, the findings of the study are limited to present and future housing market circumstances.

Cupal (2014) realises a comparative approach theory for the valuation in real estate markets. The paper introduces an advanced methodology against classical systematics to improve the procedure of selecting the basic sample data into sample sets.

This kind of methodology helps to manage the collection of extensive databases. It assists researchers in establishing procedures for their empirical work to collect and establish a high quantity of databases.

Nevertheless, while this is a first stage in empirical working, additional steps to improve variables and tendencies in the residential trade and industry markets have to be fulfilled. Furthermore, the study does not contain methodologies for real estate evaluations, which limits the findings of this study.

Devaney (2014) examines in the field of European property investment performance and the establishment of price indexes for commercial real estate markets. Additionally, databases of the USA and UK are used to discuss the benefit of transaction-based price indicators in commercial markets that are volatile.

The approach highlights the volatility of real estate markets in different regions. The formation of price indexes embraces a standardised foundation for the valuation of different real estate assets. The study strongly reflects the financial performance of different property approaches.

As the USA and UK are the researched regions, these especially markets limit a generalisation of real estate markets. Furthermore, the commercial area of asset markets is reflected with an absence of a transformation to residential trade and industry markets. In the view of the author another limitation is that only country-level indicators can be constructed in various cases with the consequence of low research volumes.

Dorofeenko et al. (2014) analyse the role of stochastic uncertainty within a housing model with financial frictions. Additionally, the authors also include research of economic risk shocks with a focus on housing supply. Variables such as price movements, volatility, bankruptcy costs and housing prices are the key factors within the study and offer a widespread financial and economic perspective of real estate markets.

The research mainly reflects in an in-depth manner the dynamic market situations and macro- and micro-economic challenges for real estate assets and their value stability.

As the investigation focus lies mainly on these two areas, other market fields, e.g., demographic or housing features are generally neglected. Moreover, as uncertainty and economic shocks play an important role, special market situations are outlined with an absence of a general usage in standard market situations. Furthermore, as the analysis is established in a quantitative manner, qualitative variables are not available.

An urban approach of housing dynamic is realised by Glaeser et al. (2014). The study uses a dynamic linear rational equilibrium model for analysing housing markets with their dynamics and economic conditions.

The research illustrates the dynamic of local markets, volatility, local income processes and construction circumstances. The study reflects the dynamics in volatile and dynamic real estate markets and illustrates the interrelation between the main economic components of supply and demand and their challenges and risks. Furthermore, it includes the projection of a stability of market assets and economic situations.

As the model is a stable economic model, the dynamics of volatile market situations could not be outlined. Furthermore, the focus is on urban environment that illustrates one share of economic housing markets by not highlighting a widespread perspective.

Higgins (2014) outlines the financial meltdowns and black swan events in property asset management. The target of the research is to highlight and reflect black swan management tools to realise a decision-making process for property asset managers in extreme time periods.

The paper discusses the issues of these economic situations and offers practical asset management tools. It analyses in an in-depth manner the risks and challenges of real estate markets and their dynamics. Additionally, the research mirrors extreme situations in dynamic markets and offers tools to handle extreme macro-economic circumstances within portfolio management.

Nevertheless, the study concentrates on special risky market situations that occur in market distances. Consequently, this financial and risk focus is a particular economic area in the real estate branch and, therefore, is not usable for regular market performances.

Hui-Ching (2014) investigates in the context of the relationships between stock returns, trading volume and volatility and outlines also an empirical study from listed real estate companies in Asia.

The author focuses on causal relations between financial variables of asset stocks to help investors understand the characteristics of real estate companies for an ideal decision-making of portfolio returns.

The research mainly outlines the volatility of markets and potential of stable real estate portfolio management to realise ideal outcomes of asset returns. Additionally, it realises a practical assistance for portfolio managers to achieve optimal portfolios and returns in dynamic real estate markets. Because the variables are very limited – they include mainly the financial milieus – other key variables of the real estate branch are missing with a limited usage of this study. Furthermore, basically returns are outlined in the research with an absence of build, environmental and demographic components. In addition, the empirical study focuses on the Asian context and hinders an utilisation of other regions.

Määttänen and Terviö (2014) focus on the relationship between income distribution of the households and housing prices. An empirical evaluation of these connections is realised with databases between 1998 and 2007 and reflects the impacts on average house prices in different US metropolis.

The paper reveals the correlation between the variables household and prices and, therefore, supply and demand in dynamic real estate markets.

As the time periods and the regions are specialised, the research has limited findings. Moreover, the research includes past 10-year periods, which hinders the view to present and future real estate market situations. As the study embraces databases and information on the US region and urban living, the findings are also reduced in the regional area of real estate markets. Additionally, the focus has a monetary perspective that again limits a widespread perception of real estate markets.

Mroua and Abid (2014) introduce a concept of portfolio resampling by utilisation of the Monte Carlo methodology to investigate a performance for local and international real estate portfolios. The target is to introduce a concept for dynamic portfolio management under consideration of transaction costs.

The advantage of this approach is a widespread view of national and international real estate markets. Furthermore, it investigates a dynamic asset portfolio management that meets the different characteristics of changing market circumstances, possibilities and risks of asset markets.

As return performance and transaction costs are the focus of the study, additional perspectives such as demographic, environmental and build quality play a minor role in the research and limit the utilisation for this research for an overall view in the residential trade and industry. Furthermore, a main focus is established in the emerging market diversification that also limits the region of real estate markets.

Olesen (2014) highlights a neoliberalisation of strategic spatial planning within northwestern European countries. The paper contains an analysis of complex relationship between neoliberalism and the strategic spatial planning. Additionally, it reveals a strong necessity to realise spatial planning strategies to stabilise real estate markets in Europe.

The analysis places an important emphasis on the area of spatial planning and the necessity of governance reforms to achieve stability within European real estate markets.

Nonetheless, it focuses strongly on only spatial decision-making and strategy and neglects additional real estate segments such as economic or demographical aspects, which hinders a widespread picture of dynamic asset markets.

Rodríguez and Romero (2014) investigate the purpose of risk-adjusted implementations of US-based international real estate mutual funds (GREMFs) that focus on the possibility to manage national and international real estate portfolios. The study is financially driven and empirically embraces the ability to handle political, economic and exchange rate conditions. The included methodology is an econometric measurement of portfolio implementation and also includes a method named Attribution Returns to amount the projecting capability.

The study deals with different perspectives of real estate portfolios. It outlines national and international portfolio management. Furthermore, it includes the political and the economic area of management.

Although a future perspective and the management of real estate assets and portfolios are contained in the study, the focus is a financial one and, therefore, additional variables for an evaluation of general real estate assets are missing. Additionally, the key focus is the implementation of US-based real estate assets, which limits its usability for further region such as the European Union.

Rossini and Kupke (2014) address a basic issue in the procedure of land and housing markets and the correlation between land and house prices. A key outcome of the research is the establishment of a comparison of the Site-Adjusted Land Price Index and the Quality-Adjusted House Price Index with the result of a lagged result of land values on house prices.

The study highlights the correlation of land and housing real estate assets. Furthermore, it establishes an evaluation within different price indexes that realises a quantitative evaluation of real estate assets.

Nevertheless, also in this study a main focus is the financial value context with an absence of further perceptions. Furthermore, the study focuses on a specific area of Australia, in Adelaide, and is thus not usable for additional regions and real estate portfolios.

Yao and Pretorius (2014) reflect the demand uncertainty and the development of timing and leasehold land valuation. Furthermore, they outline an empirical testing of real option in the residential real estate movement. The authors test and evaluate option values in different Hong Kong cases with the inclusion of purchase, holding, adapting and increasing land.

The paper reflects the interrelation between real estate valuation and the volatility of economic success within supply and demand. The leasehold land valuation is a special issue; furthermore, also the Hong Kong region is a specialised real estate market.

As the analysed cases mainly reflect Asian circumstances and may differ from other markets such as those in the European Union, a generalisation of this study is not possible.

Also various other studies illustrate a strong regional orientation of residential trade and industry markets (e.g., Costello, 2014; Filippova and Rehm, 2014; Larsen and Coleman, 2014; Lee, 2014; Lin et al., 2014; Moriizumi et al., 2014). They focus on markets such as the USA, New Zealand, Australia, Malaysia or Japan. The authors establish in-depth research of specialised real estate situations in different parts of residential trade and industry markets.

As the focus reflects market situations in specialised market segments with different dynamics, risks and environmental and economic circumstances, a generalisation for other markets is restricted. Additionally, within these limited regions, also the real estate markets are particular as the research embraces areas, e.g., effect on socioeconomic factors, urban environments, inflation-hedging characteristics, consumption fluctuations etc.

These milieus reflect significant parts of real estate asset markets – for example economic, environmental or financial variables – but do not illustrate a widespread perspective of all the dimensions of the markets. Therefore, the findings are limited to a usage of residential trade and industry assets, wherein studies have to be developed to realise an overall perspective of market situations for a general area such as the European Union region.

Additionally, also other authors are published in the field of portfolio management and financial benefits (e.g., Firstenberg et al., 1988; Friggit, 2001; Hoesli and Lekander, 2007; Hoesli and MacGregor, 2013; Kirchhoff and Piwinger, 2001; Scholz et al., 2014; Schulte, 2014; Smietana, 2014; Stein, 2014; Taltavull de la Paz, 2014). These researchers mainly reflect behavioural economics, credit crunches housing supply and demand, asset pricing, real estate funds, volatility and transaction indices.

A strong emphasis in all these studies is the establishment of real estate assets that offer stable returns over time periods and to minimise asset risks to stabilise the monetary perspective of real estate assets.

The approaches highlight mainly the interaction between monetary and economic effects. Furthermore they often establish quantitative foundations for realising valuations of real estate portfolios in dynamic markets to stabilise assets and profits. Nonetheless, although the economic and financial views are huge areas of asset management, also perceptions of demographic and build specific characterisations are parts of these dynamic markets that are often missing in research.

Chiu et al. (2015) examine transaction volumes in the Hong Kong housing market in the field of market response of public land auctions. The study reveals that the influence applied by the adverse auction results on transaction dimensions in housing markets is stronger than the positive outcomes.

The focus of this paper is the specialised real estate market of public land auctions and their advantages, respectively transaction disadvantages within an Asian metropolis housing market. For the authors, there are research limitations: Their findings are contrary to other financial literatures of stock transactions and unexpected outcomes, which they argue with the imperfect market structures. Furthermore, Hong Kong is also a limited financial real estate market and reflects a market structure in the Asian market that could not be transferred to other markets, thus hindering its usage for the European residential trade and industry market.

Ciarlone (2015) investigates the characteristics of various house price dynamics within the examples of 16 emerging markets, located in Asia and Central and Eastern Europe from the past decade 1995 until the current year 2011. The focus is on determinants such as supply and demand, asset prices, price dynamics and housing valuations.

The paper comprises a widespread investigation of housing markets as the researcher establishes an empirical part with diverse real estate markets in different Asian and European markets.

The study has a strong focus on the economic and financial aspects of research in emerging markets. Therefore, the areas are specialised and hinder a general perspective of real estate assets.

Fuerst et al. (2015) investigate the effect of the crisis on the pricing of real estate asset qualities. In their paper, sales transaction databases are outlined to evaluate the risks in the US office market in the financial crisis from 2007 until 2009. To test their purposes, hedonic regression models are highlighted to evaluate a growth of price spreads with a relationship between the returns during market stress phases.

This research is an in-depth investigation into dynamic macro-economic market situations with extreme circumstances. Furthermore, the paper offers an overview of challenges within risky phases of market situations and analyses the differences in price developments within real estate markets.

Nevertheless, as the research contains special market situations such as crises or stresses, a conversion to other economic markets is not possible. Moreover, the study focuses on a special real estate field, namely the office market, and also on a limited region, namely the US market. Therefore, the purpose hinders a movement to conventional market conditions. In addition, no future perception is included with an indicator of a single special economy case.

For the researchers Lang and Scholz (2015) the character of systematic risk factors plays an important role. The purpose of their study is to evaluate in the context of an asset-pricing background whether risk factors play a different important role for listed real estate companies in relation to common equities according to the financial real estate area of returns. The methodology of the research is a difference test of the Fama-French three-factor and the liquidity-augmented asset-pricing model with a time period basis from 1992 to 2012.

The research findings indicate that the real estate equity returns of European assets include differences in terms of size value and liquidity factor while the stimulus of market features seems to be comparable to other asset markets. The study has a deep focus on European real estate markets, risk factors and the asset area of stock markets. Moreover, it reflects the high correlation between market challenges and stimulus of market participants with a significant influence of housing returns.

Nonetheless, the research is mainly monetary driven. Furthermore, the liquidity of time series from 1992 until 2012 is analysed, which indicates tests on past and present basis years with an absence of future periods.

In the real estate asset area of financial integration Loutskina and Strahan (2015) investigate the economic volatility in housing markets. Their aim is to demonstrate a positive effect of housing prices during economic shocks within a financial integration that is advanced by a securitisation and national branching. The researched time period is limited from 1994 to 2006 with the result that price shocks in housing economics spur economic development.

The paper includes a deep analysis of the volatility in economic circumstances and reflects monetary integration in housing markets. Additionally, it highlights extreme economic situations such as economic shocks and also analyses real estate valuation in special market situations.

As this field of the securitisation and national branching is a specialist segment in real estate asset management, other fields of real estate markets are not prioritised, which represents a limitation of this study. Furthermore, the time period reaches from 1994 to 2006 and, therefore, illustrates past situations with an absence of present and future developments that also represent another limitation.

Within the spatial sector, Luukkonen (2015) studies that spatial planning procedures demonstrate a key component of real estate asset markets. The paper focuses on territorial politics, territory and territoriality within a special planning. The paper examines spatial planning within a political geography and proposes that spatial planning within the European Union has to be conceptualised as a political skill of territory.

The research outlines a strong focus on special planning within Europe and a high responsibility for political bodies to manage the spatial issue in order to stabilise real estate assets.

However, the article mainly focuses on the spatial development and neglects additional areas of residential trade and industry segments, which hinders a widespread view on different European real estate branches.

Nuuter et al. (2015) compare the housing sustainability of the Estonian housing market in relation to other European real estate markets with a reflection of different socio-economic indicators using the methodology of Multiple Criteria Complex Proportional Evaluation. Furthermore, the Decision Support System for Housing Sustainability Assessment is outlined to realise the development of sustainability in housing markets.

The authors use different criteria groups such as economic, housing stock, housing affordability, population, social conditions, housing and environmental quality. The study illustrates a widespread area of the residential trade and industry market with variables in the demographic field, build features and environmental social segment. Furthermore, it also reflects the value and sustainability of housing markets within these variables.

Nevertheless, the study outlines recommendations for the Estonian market and places an emphasis on the special area of sustainability, which limits the research for the overall housing segment also in other countries. Nonetheless, the variables act as a foundation for further research in the residential trade and industry context for the European market.

The authors Wurstbauer and Schäfers (2015) focus their attention on the inflation hedging and protection features associated with the infrastructure and real estate assets. The purpose of the study is to analyse short-and long-term inflation-hedging types and additionally inflation protection. The databases that are the foundation of the study are based on assets in the USA in the time period 1991-2013 with the outcome that the tests indicate that all series of databases have long-run co-movements within the economic context of inflation, involving a long-term hedge.

Also this study offers substantial information of economic and financial perspectives of the real estate branch. Furthermore, alongside the asset component the research also integrates the environmental aspects that reflect a widespread view of real estate markets. Because the tests involve databases of the special region USA and include past and present basis years, the results realise a limited explanatory power for other regions such as the European Union and future market situations.

As the literature analysed above demonstrates, in the environmental social context a strong emphasis is placed on economic and financial issues. The research outlines a key issue of the correlation of micro- and macro-economic as well as monetary interactions with findings of real estate valuations within dynamic asset markets. Nonetheless, the literature basically focuses on these two dimensions with an absence of other residential trade and industry fields such as demographic, space, environmental topics that include a widespread and in-depth perspective of these real estate markets.

However, there is also literature that contains different perspectives of residential trade and industry markets. Here, there is a focus on expert decision-making in the areas of **demographic, space and environmental social context**, which indicates a widespread view of real estate markets. This literature is outlined next.

Saaty and Vargas (2001) establish the AHP and the ANP methodology and create various models in different branches to realise decision-making. Therefore, also the researchers focus on the residential trade and industry. For choosing the best house, the study contains an AHP model with the target of the satisfaction with the house, criteria such as size of house, transportation, neighbourhood, age of house, yard space, modern facilities, general condition and financing. For the alternatives they choose three housing options.

The study establishes criteria that could be important for those demanding housing. Nevertheless, the criteria are located in the space and environmental social context with an absence of demographic developments.

Nevertheless, the model represents a substantial foundation for the creation of further variables in the residential trade and industry in the European Union to evaluate real estate assets.

Aragonés-Beltrán et al. (2009) focus on asset appraisal as an important issue in any country by using the methodology of the Analytic Network Process based on multiple criteria decision analysis. The criteria include the retail space and environment social characteristics with subcriteria such as build quality, balcony area, shopping environment and income level.

The results of this research demonstrate the differences between the calculated value and the current market price with a strong focus on the monetary investment perspective in the real estate branch. Moreover, it establishes significant variables in the area of building quality, environmental and economic features.

As it outlines a specialised field of the real estate branch, for additional areas such as the residential trade and industry, further variables have to be available.

Aznar et al. (2009) present a comparative methodology for the valuation of urban properties with the foundation of the Analytic Network Process. For an illustration of the researched proposal, a real case study is covered with four different models with the target to analyse the accuracy of each model. Within the AHP/ANP hierarchy, the criteria property, building and environment characteristics are illustrated with subcriteria such as floor space, floor number, build quality, age, and shopping environment or population density.

The study comprises a widespread view of real estate asset markets with an emphasis on different perspectives for an in-depth valuation of real estate assets. The alternatives comprise assets to be valued and, therefore, are specialised individual real estate assets. Furthermore, the research illustrates urban assets and, therefore, includes a special real estate field. Additionally, the demographic development is not outlined in this study, which hinders an overall view on residential trade and industry assets.

For Haase (2009) demographic development has become a central topic for Central, Eastern and Western European cities and urban regions. Her paper written for the 45th Congress of the European Regional Science Association focuses on predictor variables, which explains urban shrinkage and the residential degeneration in the form of asset vacancies. The main issues of this research are the extraction of predictor variables of urban socio-economic and environmental indicators, the analysis of spatial shape and a conceptual rule-based model for spatial shape. The model includes variables such as total population, migration, housing attractiveness and urban structure. For the author the key variables are such as out-migration, age group proportions and urban structure types; the economic variables are not included in the concept model.

The research highlights the correlation between demographic, social and environmental influences within the residential trade and industry and, therefore, offers a widespread view of diverse areas of real estate management.

Nevertheless, this research is superficial, which is also stated by the author, since the study underlines that there is a need for additional detailed research. Important real estate variables, e.g., economic or housing structures, are not utilised in the overall model, which hinders an overall practice in the residential trade and industry. Furthermore, the study outlines in particular urban regions and special European cluster, especially Central, Eastern and Western areas that are a field of the real estate branch. Additionally, the research only demonstrates real estate challenges with a lack of conclusions to eliminate these challenges in future periods.

Lami and Vitti (2011) highlight a methodology to integrate the requirements of stakeholders and various aspects of urban redevelopment projects using the Quality Function Deployment and the Analytic Network Process. Furthermore, a case study of the transformation of the "Belle de Mai – La Friche" in Marseille is summarised. The authors create an in-depth ANP network with variables such as project sustainability, area impacts, metropolitan impacts, and environmental, architectural, urban and economical aspects. Furthermore, various subcriteria, e.g., energy content, cultural facilities and cycle paths are established.

The research offers an in-depth perspective of the real estate market with various different criteria and subcriteria.

However, the absence of the demographic component limits this model. Furthermore, the research is based on an urban content and does not focus on the real estate branch in total with the consequence of again a partial real estate region. As the case study demonstrates real estate transformation in Marseille, its utilisation for further areas is again limited.

Khumpaisal et al. (2012) publish a paper reviewing the decision-making of practitioner's procedures in evaluating potential risks in urban renewal projects using the Analytic Network Process. The research clusters five different risk areas such as social, environmental, political, economic and technological risks. Due to time constraints and the nature of the methodology, the authors limited the number of interviewees to 3. To demonstrate the ANP methodology in assessing risks in urban projects, a case study of a residential and commercial mixed-used project in Liverpool city centre is highlighted.

The paper demonstrates a widespread overview of diverse real estate issues and contents. Therefore, it reflects different areas of residential trade and industry markets within the context of risk management. This study contains the urban regeneration perspective of real estate development and is a subarea of the residential trade and industry. Furthermore, it demonstrates that risk assessment is also a special part of decision-making. Also for the authors, further research is required because an important amount of information in this segment is required to modify and improve the risk assessment criteria.

As a consequence of an absence of information, they outline various criteria and subcriteria, but the variables that offer a wide choice of issues do not comprise in-depth contents.

Kuijstermans (2012) reflects on the sustainability perspective with key issues, e.g., multi-criteria analysis and the decision-making in the real estate sector in the commercial office market. Using AHP methodology, the researcher establishes economic and object factors with subcriteria such as revenues, costs, and technical and sustainable aspects. Consequently, the main focus lies on the financial and technological variables with an absence of additional perspectives, e.g., environmental, demographic and macro-economic features.

Nevertheless, he establishes a relatively new trend in the real estate branch, especially the sustainable perspective that develops the valuation of residential trade and industry assets in this market.

For Sirijanusorm (2012), a study with a key focus on the impact of risk factors on the special real estate field of urban development is significant. Therefore, the paper focuses attention on risks essential to heed when planners realise a project feasibility analysis. The methodology of this study uses the Analytic Network Process. The criteria are established in the social, technological, environmental, economic and political segment with various subcriteria such as degree of benefits for local communities, total duration of design and construction, degree of pollution affect, number of jobs and degree of protest by the urban communities.

The study highlights various real estate milieus, again with a strong focus on the risk management of this market.

Nonetheless, also the establishment of various criteria and subcriteria do not reflect the real estate economy, as different issues are not available such as demographic developments, additional environmental or economic conditions. Although the research outlines urban regeneration projects, a widespread overview of the real estate branch in total is hindered.

In the area of demographic development Ma and Liu (2013) analyse the ripple effects of housing prices within the geography context. Their study focuses on capital cities of Australia and outlines the interconnections between the development of housing prices across different regions over space and time. As methodology the authors integrate the Spatial Vector Auto Regression models to investigate the spatial heterogeneity of real estate markets and auto correlations of prices in the residential trade and industry within the variables of demographic and geographic milieus.

The paper contains information of the dynamic of real estate assets and two different essential areas of real estate markets.

The research limitation is that the study deals with particular regions within Australia and urban locations within the country, which hinders a generality of real estate markets. Further variables such as housing specifics also play a minor role that minimises a widespread reflection of residential trade and industry markets.

Worthington and Higgs (2013) model macro drivers of the Australian housing affordability using databases from 1985 to 2010 and an Autoregressive Distributed Lag (ARDL) approach. Six sets of variables are used, e.g., economic, demographic, financial and social characteristics.

The outcome embraces the key drivers of affordability, especially economic growth, changing populations, housing finance, government policy and tax environment that offer a widespread perspective of the real estate market.

Nonetheless, the research outlines results for the past and present decades for a special real estate region, especially for the Australian market that could differ from other markets such as the European Union. Future time periods and general asset markets are not outlined.

Hamdam et al. (2014) highlight the social capital and quality of life in urban environments with high-density patterns. Also this study reflects household situations, especially in Klang Valley, Malaysia. Additionally, a questionnaire survey demonstrates the significance of social capital and the influence on neighbourhoods. The research has a key focus on the social and environmental aspects in the residential trade and industry.

It highlights the correlation between the component of social capital and the environment of living space.

Nevertheless, additional market segments such as economic aspects play a minor role. Furthermore, the investigation covers only a particular region of Malaysia, which hinders a further development of the results to additional countries or regions. As the questionnaire survey reflects the view of Asian participants, a cultural aspect could play a role that might differ from perspectives of additional cultures such as cultures in the European Union.

Mawejje and Holden (2014) examine the determinants of livestock investments in a social context in a method of community group participation. Furthermore, an empirical analysis highlights the importance of social capital in a rural milieu after a shock period to establish a positive livestock investment.

This research concentrates on a widespread context such as social, environmental and demographic components, for example, household characteristics, e.g., age, dependence ratio or village population densities. These areas focus on a widespread perspective of residential trade and industry markets. Furthermore, the study places a strong attention on the social aspect of real estate valuation.

However, this paper focuses on social capital. Additionally, the study covers the rural environment and a single region, Uganda. Therefore, a general establishment of asset management is not available.

In the field of urban growth and property development Mesthrige (2014) introduces a new parameter developed as the office-space-usage pattern. The aim is to test whether investors respond to intangible measures when investing in new developments. According to the author, the study raises concerns about the importance of non-price measurements with a reflection on the supply side of the office market.

For him the scope is to address the research questions using better data sets. Furthermore, in Mesthrige's opinion there is the possibility to model the supply modification procedure more dynamically. In addition, the field of study is limited as the research covers the urban environment and commercial segment of the real estate branch and, therefore, is of limited use for the residential trade and industry. Moreover, it reflects the Hong Kong Asia market and is specialised in a single field. Nevertheless, the paper deals with the intangible measurement, which is an advantage for research in the real estate segment.

Mosadeghi et al. (2015) use the Analytic Hierarchy Process to evaluate the urban land-use planning procedure. The study illustrates how spatial decision-making can be managed to rank the priority of variables and realises scenario analysis in the special field of the spatial development.

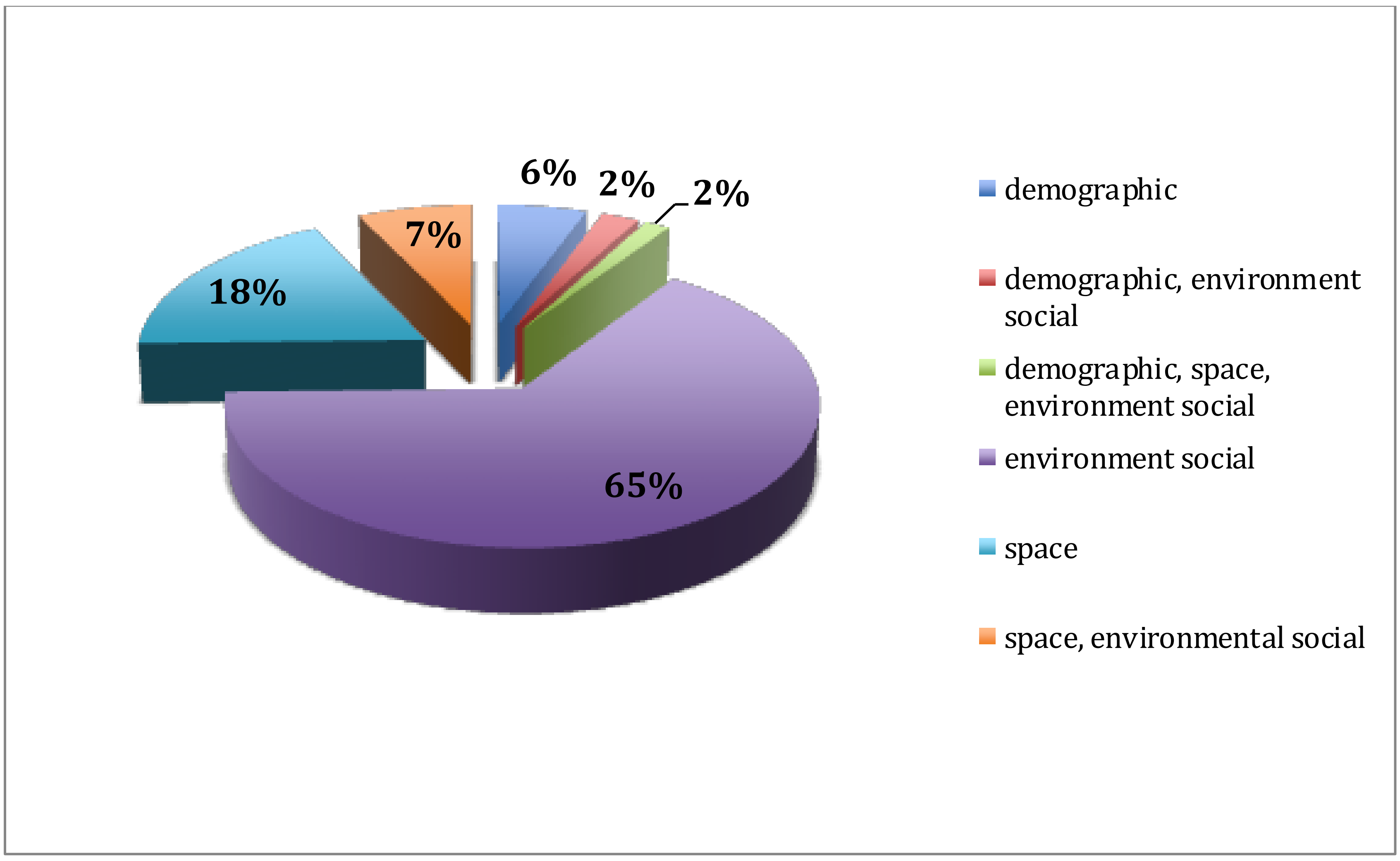
The study has a strong focus on political transitions and urban planning policies. The research evaluates different results through the methods of AHP and fuzzy AHP within the defining of the extent of land-use areas in urban planning scenarios. The in-depth research offers a widespread area of residential trade and industry markets by assessing the environmental aspect for real estate assets.

Nonetheless, additional parts such as economical, demographic and build characteristics play a minor role, respectively are excluded. Furthermore, the study reflects urban markets and is limited for rural real estate areas.

The aforementioned literature demonstrate a basically widespread perspective of the real estate markets with a reflection of different areas and variables in the field of demographic, space and environmental social characteristics. These different perspectives assist in an evaluation of real estate assets in different markets. Nevertheless, also this type of literature contains gaps as the studies reflect mainly special areas, respectively specialised issues and place emphasis on real estate evaluation such as financial, spatial, social or sustainability approaches, which hinders an overall view of residential trade and industry markets.

The specialised real estate economics literature analysed before demonstrate again – similar to the databases literature – a high fragmentation of different characteristics, real estate market areas, time periods and research topics. Consequently, an in-depth and widespread analysis of residential trade and industry markets is not available. In the following figure the fragmentation of demographic, space and environmental social fields is outlined. This figure demonstrates a key focus on the field of environmental social development of real estate assets, especially in a general area of financial and economic valuation. This literature represents 65% of real estate economics literature. The second highest share is within space characteristics with 18%. In contrast to the database research, the demographic development includes a minimal ratio of 6%. Research that focuses on different market characteristics count for 11%. This demonstrates a high necessity for a widespread perspective of various real estate asset market segments. This is illustrated in the figure below:

Figure 2.6 Fragmentation of specialist research: Shares of characteristics

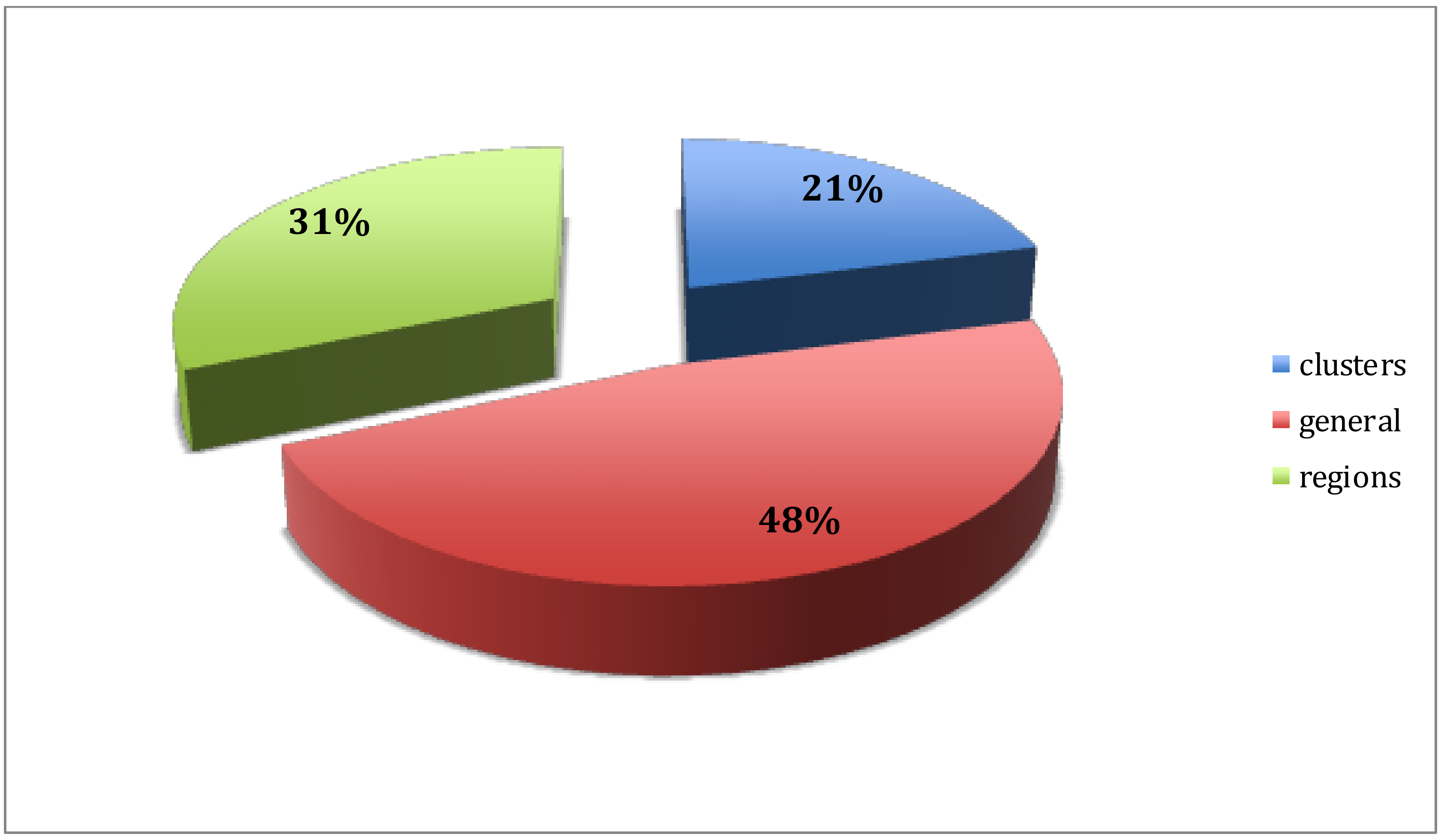


Source: Own analyses

Furthermore, also the areas of literature attention are fragmented – analogous to the database research.

Within this context, the literature does not evaluate special regions with an absence of conformability of area attention. This is a main share with a percentage of 48%. Furthermore, additional literature develops real estate contexts in regions – e.g., cities, special environments – or clusters – geographical environments – which again hinders a specialist view on the overall focus on the European Union in detail with a share of 52%. The following figure illustrates these imbalances.

Figure 2.7 Fragmentation of specialist research: Shares of areas

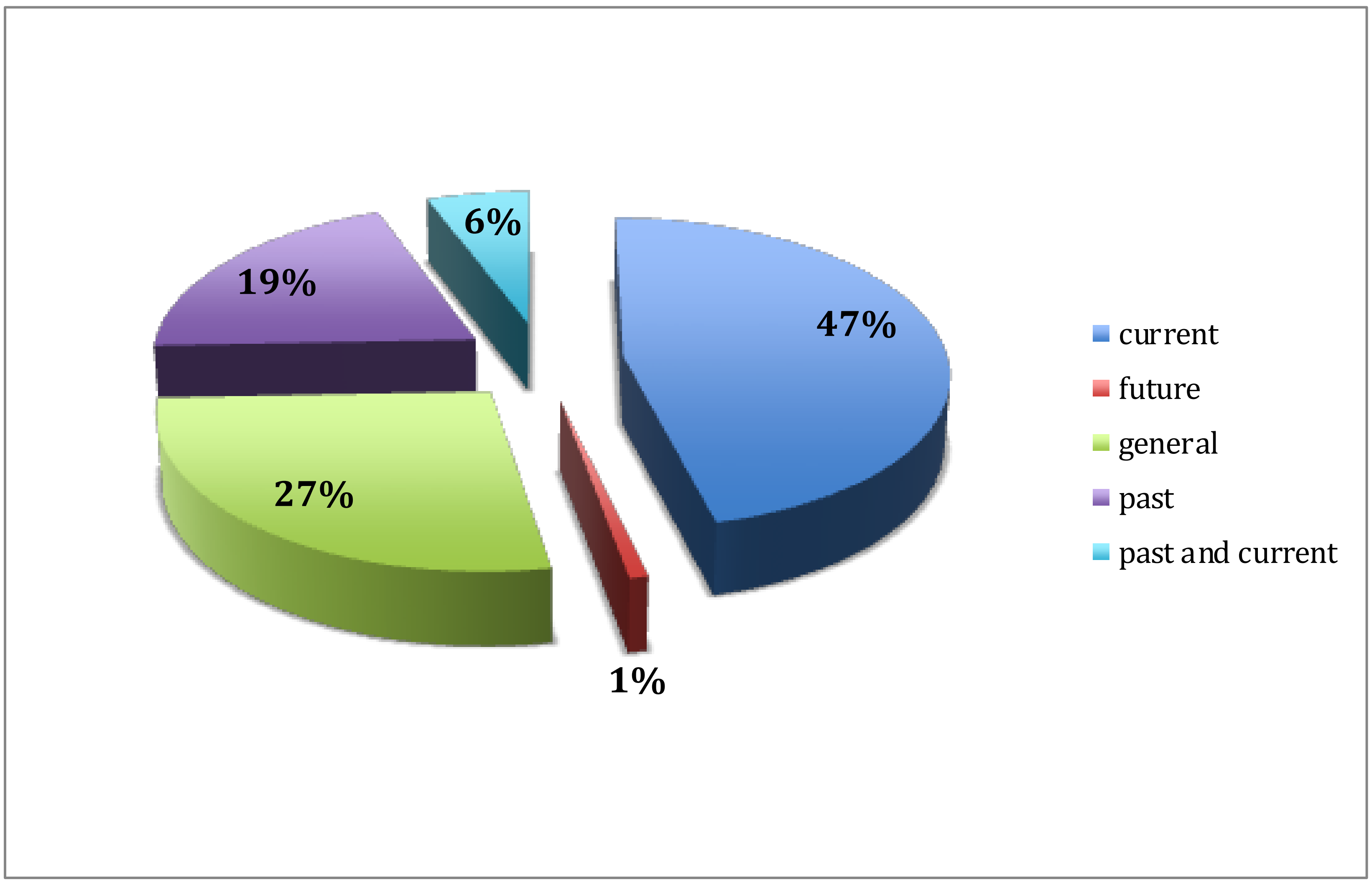


Source: Own analyses

Also the time periods – similar to the database research – are again fragmented with a 47% share of investigations in current time periods. Additionally, 27% of the literature does not deal with a special timeframe. The past period is covered in 19% and past and present 6%. Studies that contain past, present and future tendencies are rare.

The shares of time periods are highlighted in the following figure:

Figure 2.8 Fragmentation of specialist research: Shares of time periods

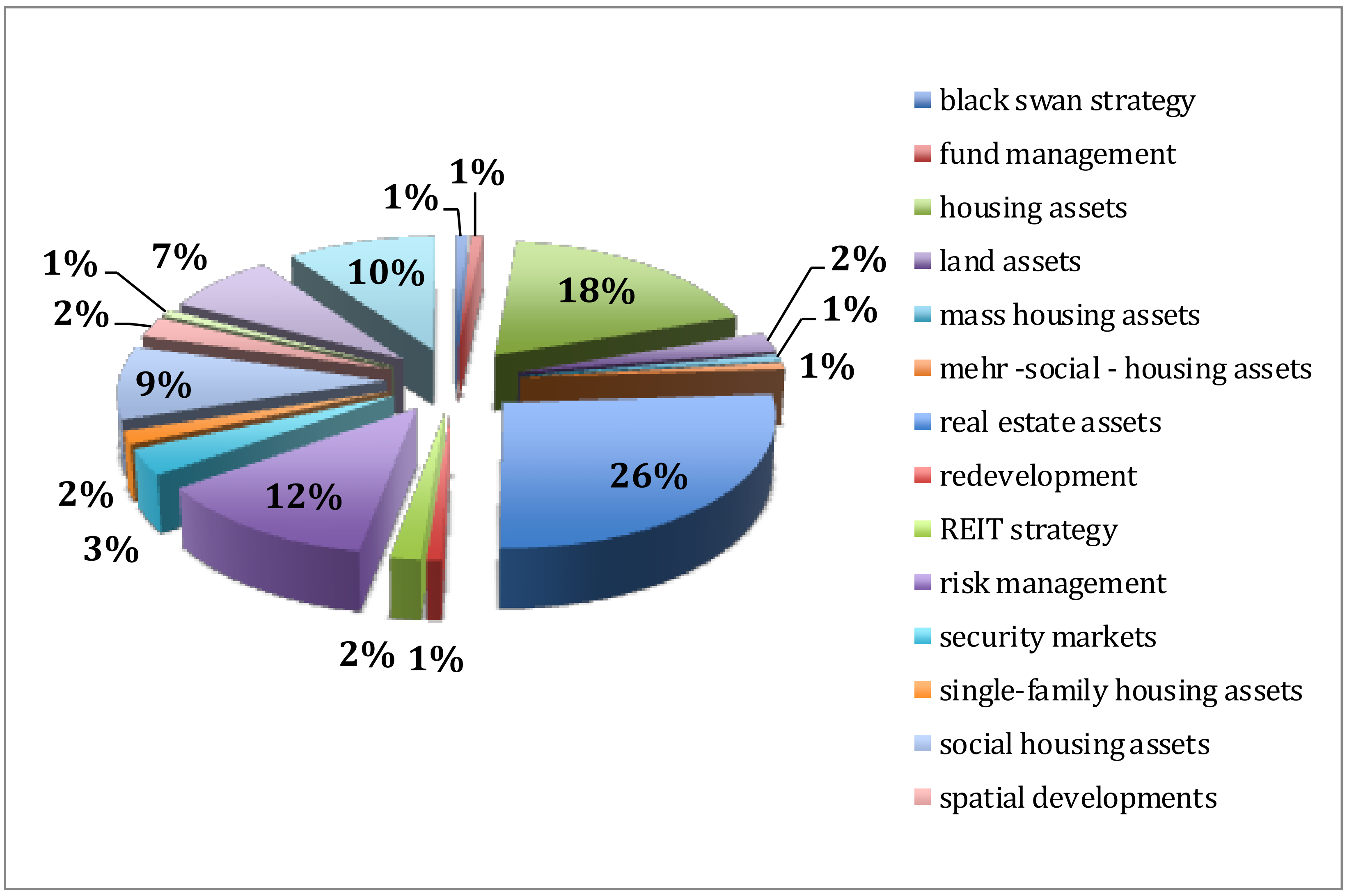


Source: Own analyses

The most challenging context of specialist literature is the fragmentation of real estate segments as the real estate branch includes diverse single and special asset segments. Most of the studies, 29%, reflect the overall real estate market, which realise research in a fuzzy manner. Additionally, 18% of the aforementioned literature analyses the special housing market, 12% land assets and 10% security markets. Further real estate markets such as REIT, single-family housing, social housing assets etc. are found only in a small share of literature.

As literature is very specialist it is difficult to establish further analyses with a foundation of existent literature.

Figure 2.9 Fragmentation of specialist research: Shares of subjects



Source: Own analyses

As this research demonstrates, the literature in the databases and information area and the specialist real estate economic context is very fragmented and mainly contains single or special fields of economy, time periods and areas, which hinders the establishment of further research within established studies. Furthermore, this also makes it difficult to realise further real estate research in the residential trade and industry of Europe. Nevertheless, it also enables the possibility for a new foundation and a widespread perspective of general fields of real estate valuation that will be outlined within this study. Thus, in the first step the next chapter reflects a theoretical framework of determining factors that influence the residential trade and industry in a significant manner.

3 Theoretical framework of determining factors in real estate markets

For Czischke (2007) the existing amalgamation of welfare alteration and demographic development needs to concentrate on the responsibility of the housing establishment to handle the influences of shifting demands in the milieu of fluctuating family configurations as well as failing markets. The established post-war prosperity was prototypically organised as a mixture of responsibilities combined by the state, the families and the market. Currently, fundamental transformations in both family structures, e.g., with rising divorces, single parents and older people, as well as in the economy, e.g., globalisation, flexibility and job uncertainties, have raised the need for a redefinition of this model. A redefinition must also reflect the housing markets of the countries in the European Union, because the economic welfare transformation strongly relates to housing markets. Residential trade and industry economies play a vital role in people's lives and for the diverse household typologies with usually the largest single costs being for households. The housing economy is one of the pillars of the welfare state in countries where the state plays a key role in construction and financing large-scale real estate projects to counter building shortages. However, there is an additional trend in housing markets towards an important involvement of non-state actors (Czischke, 2007).

In order to identify the determining factors of these important economic drivers, a theoretical framework is drawn up that reflects the correlations of the basic elements in the residential trade and industry.

3.1 Real estate assets

Real estate assets show strong performance in asset markets and interact in a vital correlation to the countries´ economies. Nevertheless, they have special characteristics and interact differently to general asset instruments in financial markets. To focus on these exceptional determinates, the characteristics as well as economic features are underlined in the following sub-chapters.

3.1.1 Characteristics of real estate assets

For researchers such as Hoesli and MacGregor (2013), Schellenbauer (2003), the real estate market comprises various market sectors differentiated according to type of real estates, such as the landed property market, industrial market as well as residential trade and industry market. In the opinion of Zieting (2012) an additional partition in each market sector is achievable that concentrates on the configuration of buildings. For the residential trade and industry market there are diverse partitions, specifically the age distribution of the housing stock with its construction levels, e.g., the old construction quantities such as not-reconditioned or rather extrapolated as well as reconstructed, modernized buildings with customised adaptions as well as new developments. Furthermore, dwelling features and the quality of the units, for instance build quality, e.g., fixed bath or shower inside the dwelling, electric lighting and balcony and additionally the size of the unit with its number of rooms and amount of square metres distinguish residential trade and industry assets from each other (Zieting, 2012).

Zieting (2012) illustrates, that the residential trade and industry assets embrace significant typifications: One important aspect is their characterisation as social properties. Habitation is a basic physiological human requirement in every society and plays an important role for individuals. Czischke (2008) explains, that housing costs are the largest single costs for most households. Therefore, for Cecodhas (2012) there is a public attentiveness to the involvement individuals make to society. Hence political decision-makers as well as stakeholders in the public and business sectors have to realise the circumstances that meet these basic necessities for inhabitation, e.g., affordable as well as customised residences (Cecodhas, 2012). According to Case et al. (2000), another typification is the habitation location, which is significant for the household compositions. Habitation locations have different levels of quality. Zieting (2012) differentiates between micro- and macro-location. The micro-locations highlight the direct environment such as land area, infrastructure, offer of services, social milieu, and image as well as development perspectives. Macro-locations focus on the region and involve economic relevance, demographic developments, support programs, investment climate as well as economic development schemes. Habitation locations are key factors that determine the popularity of real estates and, therefore, the value of habitations (Zieting, 2012). For Czischke (2008) real estate assets are significant economic drivers. Trends of the residential trade and industry markets, e.g., habitation configurations and locations, change over time as a result of movements in societies. Consequently there has to be a focus on the need for customer orientation and user involvement with the target of an increase in the efficiency and financial sustainability of housing markets. As a result of these concerns, there is a correlation between the housing sector and economic welfare of a community or country (Czischke, 2008).

Furthermore, Zieting (2012) mentions that residential trade and industry assets are also crucial factors in financial markets. They represent factors of properties, because the property has its own value that depends on the location with a focus to the micro- and macro-location, as analysed earlier (Zieting, 2012). In the opinion of researchers such as Ambrose and Lusht (2008), residential trade and industry assets are competitors to the factor of capital, but also require a strong dependence on the factor of capital. Habitations of the residential trade and industry are an asset class with exceptional characteristics that differentiate them from other asset classes and that separate the real estate industry from other financial segments. Residential trade and industry assets comprise tangible assets, which have a value as a result of their properties and building qualities. Therefore, residential trade and industry assets compete in the broader capital markets. As a consequence of their physical characteristics such as immobility and heterogeneity, they influence the economics of the asset market, e.g., these characteristics lead to a product-market segmentation resulting from dissimilarities based on the demand of the investors and comparatively high debt-equity ratios that are used to finance residential trade and industry investments. Unlike other assets such as equipment, real estate investments have for investors the prospect of substantial residual property. Nevertheless, additionally, real estate varies from other asset classes by embracing high transaction costs and other barriers to entry, long-lasting improvements, and have a slower response of supply to fluctuations in demand as analysed in more detail later. These characteristics have effects on the general efficiency of the market (Ambrose and Lusht, 2008). Regarding Zieting

(2012), the decision regarding distribution of the residential trade and industry assets depends on the following criteria: The income for financing these real estate assets, the risk of the stability of the value of this asset as a consequence of changing demands and shifting returns, transfer costs such as official charges and relocation costs in the purchase and management phase as well as the fungibility, respectively liquidity connected with the investment of assets (Zieting, 2012).

For Zieting (2012) the economic targets of the utilisation of these assets follow different directions. Ambrose and Lusht (2008) researched that a vital course is the owner occupation. The decision for this focus essentially depends on the cost-value ratio. As stated before, on the one hand there is a rather high debt-equity ratio that is used to finance the investment of the habitation. On the other hand, residential trade and industry assets comprise substantial tangible assets. Therefore, an appreciation of the value of an ownership, respectively tenancy is essential for each individual (Ambrose and Lusht, 2008). Aimed to Czischke (2008), an additional motivation for owner occupation is safeguarding the location's competitiveness. As analysed earlier, the location with the micro- as well as macro-economic plays an important role in the assessment of value in the residential trade and industry. If the competitiveness of a region increases over the time, so does the value of the real estate asset and vice versa. Hence this is a vital economic target of the utilisation of the habitation asset (Czischke, 2008). For Zieting (2012) another stimulus is the safety for additional funding. As a relatively high debt-equity ratio is necessary for financing the purchase and running costs of the real estate asset, long-term planning of the financial conditions especially interest rates is essential in order to ensure the advantages over the cost-value ratio of the habitation (Zieting, 2012).

In his opinion besides owner occupation also both the short- as well as long-term utilisation play significant roles in the asset operation. Short-term utilisation focuses on the maximization of profits. As a result of high economic targets in the area of short-term consumption, enlargement of earnings is highlighted in the managerial decision-making. Thus the proportionality of sales revenues as well as expenditures for management and sales and marketing has to be kept in focus. The purpose of long-term utilisation is also mainly the maximisation of the profit ratio. Similarly in long-term utilisation, economic targets are crucial. Hence increasing the profit ratio with a focus on continuous profits as well as appreciation values as a consequence of, e.g., advantageous financial conditions, profitable locations, solid build quality as well as a stable or growing real estate demand is vital (Zieting, 2012).

Nevertheless, for Perry (2014) security is also a crucial driver. In long-term utilisation owning real estates can provide an important stock of value and a hedge against inflation. Furthermore, rental properties can provide stable cash flows for the investor's income stream (Perry, 2014). Researchers such as Friggit (2001), Hoesli and MacGregor (2013) analysed that in a different way to other assets in the financial markets, fungibility is a fundamental aspect in the decision of long-term utilisation. The fungibility of real estate assets is unincisive in contrast to other assets such as securities, stocks and bonds, because as a result of their characteristics residential trade and industry assets are difficult to change and thus less liquid (Friggit, 2001; Hoesli and MacGregor, 2013).

Consequently, for various real estate researchers the differences between residential trade and industry assets in contrast to other assets are mainly the following (e.g. Hoesli and MacGregor, 2013; Zieting, 2012):

- *Immobility*

  In contrast to other assets real estate assets are immobile because they are permanently fixed with the landed property (Hoesli and MacGregor, 2013; Zieting, 2012).

- *Uniqueness*

  Habitations are inimitable, because each residential trade and industry asset is one of a kind and not completely equal to any other as a result of different locations, build qualities, sizes, construction years, tenancies etc. (Zieting, 2012).

- *Heterogeneity*

  Because real estates are unique they are heterogeneous (Quan and Quigley, 1991). These assets are not similar; nevertheless, they compete against each other (Zieting, 2012).

- *Long-term production*

  The production time of real estates embraces mainly a long-term period. A long-term upstream approval process from approximately two to five years or longer, the construction phase as well as the tenancy, respectively the sale phase implies high uncertainty for investors. Therefore, in the residential trade and industry the phenomenon of cyclical variations of supply and demand is important. If demand is increasing, the production of real estate as the supply side has to stimulate it. Nevertheless, as a consequence of long-term production and the resulting time delay there is a high level of insecurity in the demand situation after concluding the long-term construction (Zieting, 2012).

- *High capital commitment*

  Because real estates embrace an essential capital value, capital commitment is high. However, capital commitment depends on the type and constancy of the investment. For example, a developer will invest mainly in the time period of the production phase until the selling process with the result of a mid-term investment, while an end investor will be responsive to real estates with a long-term utilisation and therefore will realise a long-term investment (Zieting, 2012).

- *Constancy*

  Real estate assets are long-lasting assets and often purchased, respectively sold within the lifecycle (Zieting, 2012).

- *High transfer costs*

  In the purchase phases there are diverse transfer costs that also have to be paid, e.g., official charges or relocation costs (Zieting, 2012).

Real estate assets with their special characterisations in contrast to other assets in financial markets have a strong influence on a country's economy as a result of high significances as analysed earlier. Therefore, being a special field, the real estate economy is outlined in the next section.

3.1.2 The real estate economy

As analysed before, real estate markets are different in a number of aspects in comparison to other financial assets. Nevertheless, basic economic principles are also embraced in the residential trade and industry market.

For Steinert and Crowe (2001), the demand for real estate is significant for the real estate economy. Schellenbauer (2003) defines real estate demand as the perception of the effective market demand, which embraces that the demand is pushed by the purchasing power of market participants. In some analyses a focus on the 'desired or ex-ante demand' is also highlighted. This abstract concept refers to the 'aggregate desired' quantity of a product before purchasers interrelate with the market. After interrelating with the market is realised or 'ex-post demand' could be dissimilar to the 'ex-ante demand' for several reasons, e.g., supply limitations. The not-yet-realised demand is often illustrated as a 'pent-up demand'. A central attribute of the demand curve is the sensitivity of the quantity of products, demanded to price fluctuations. This kind of sensitivity is included in the perception of the price elasticity of demand. This perception is calculated as the ratio of the change (in percentage) in quantity demanded over the percentage of the change in prices. The price elasticity shows how much the percentage of the quantity demanded will decline in reaction to a 1% rise in the price level. The real estate demand is in the main more inelastic price. When price elasticity is equivalent to value elasticity, then the demand is reflected to be unit elastic, and indicates the circumstance that a percentage rise in price induces precisely the same percentage decrease in the quantity demanded. Conclusively, demand is reflected to be elastic if the price elasticity is bigger than value elasticity. An elastic demand indicates that small increases in price influence leads to large reductions in the quantity of space, respectively amount of units demanded. The price elasticity of demand depends on the obtainability of substitutes. For example, if a product has few substitutes, such as custom-made housing, then it should have a less elastic demand than a product with several substitutes, such as multifunctional housing (Schellenbauer, 2003). For Cieleback (2008) at the macro level price elasticity can realise the measurement of influence of transformations in market prices, respectively rents on demand and more precisely, on the quantity of space and/ or amount of units demanded. Following Sivitanidou (2003), from the micro-level view, it can help investors as well as developers evaluate the effect of price growths on revenues.

Sivitanidou (2003) mentions that the exogenous determinants of real estate demand can be divided into the following classifications:

- *Market size*

  This variable, which drives the demand for real estates, includes in the case of housing the relevant exogenous determinant of the number of households.

- *Income/ Wealth*

  Income as well as wealth directly influences the demand for residential real estate. If prices constantly rise, but the household income increases, than more households can afford to buy a house or pay higher rent.

- *Prices of substitutes*

  The price of substitutes could also generate changes in the demand for real estate assets. For example, if owner-occupied single-family housing prices constantly rise, but apartment rents increase and become expensive, then renters of apartments could find home ownership more attractive.

- *Expectations*

  For Granovetter (1985), consumer expectations can also generate fluctuations in demand. For example, prospects of higher prices, respectively rents in the future could affect in the present the increases in the number of habitations demanded.

Additionally, Sivitanidou (2003) states that also the supply of real estates is a fundamental key driver of the real estate economy. The real estate supply defines in general the quantity of housing units supplied at several prices. The long-term aggregate supply represents the connection between long-term prices or rents as well as the total number of units or square metres supplied over the long term. The short-term aggregate supply indicates the total stock of a market at a given time. New construction is the most significant supply perception and the central law of supply when analysing real estate markets as a result of the long life of real estate assets (Sivitanidou, 2003).

The key motivation for the improvement of every speculative real estate project, respectively housing increase is profit (Sivitanidou, 2003).

Therefore, for Sivitanidou (2003) the main exogenous determinants of the new construction sector of a market are the influences that regulate project profitability as well as the related uncertainty. These determinants include for this researcher the following:

- Availability as well as costs of the factors of production
- Expectations concerning the future real estate demand and prices,
- Noticed market risks

For Sivitanidou (2003), the factors of production essential to realising the real estate advance are as follows:

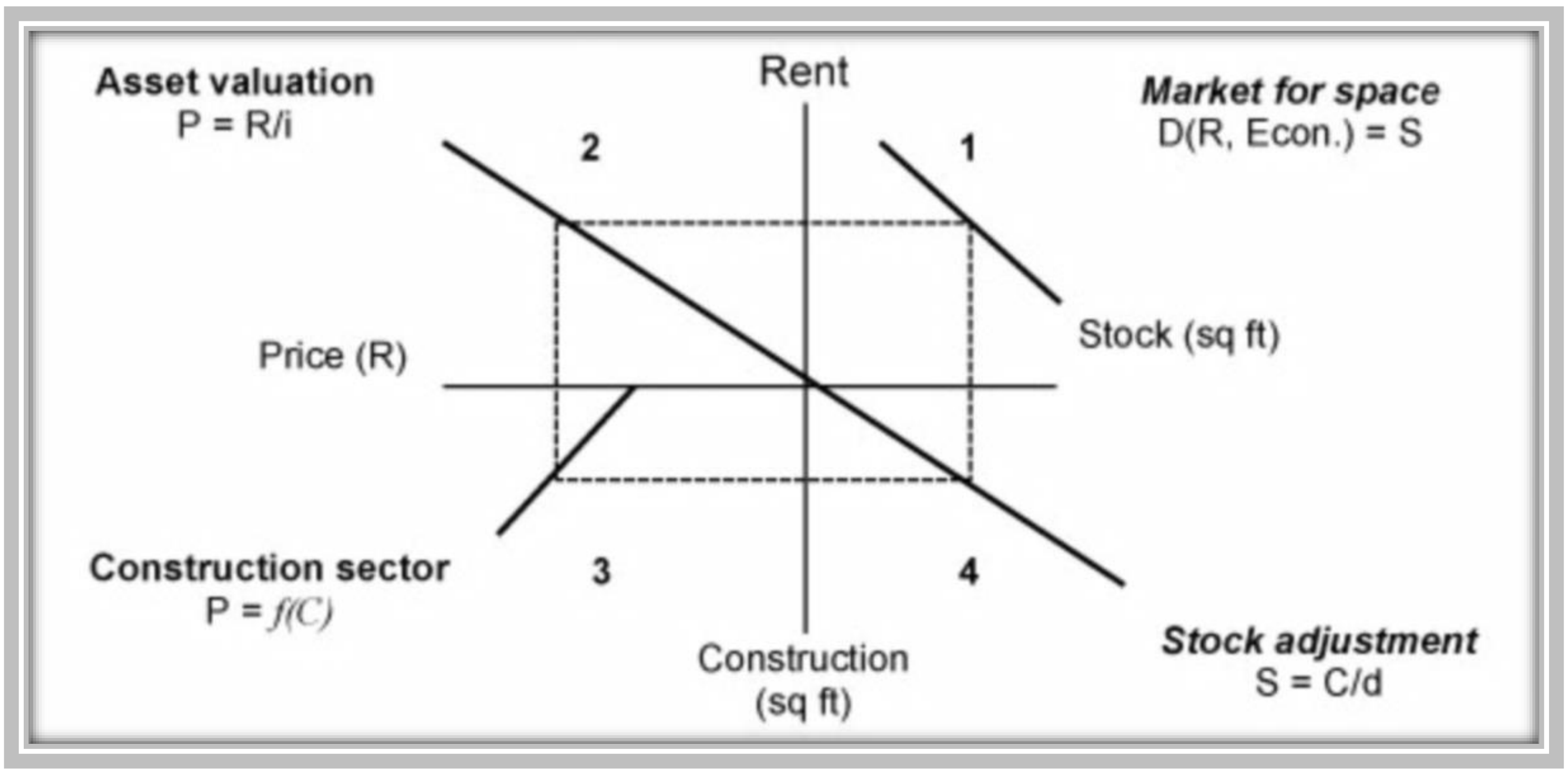
- Capital
- Labour
- Land
- Building materials

The research of Quan and Quigley (1991) proofs, that real estate price changes and rents as well as prices are central to the real estate economy as they are in any other market. Moreover, rents and prices are one of the most or the most significant inputs for the valuation of the financial possibility and capability of a real estate project. Therefore, it is vital to realise the determination and mechanism of market rents and prices and the drivers of their movements (Quan and Quigley, 1991). As in the case of any other market, for Sivitanidou (2003) also real estate rents and prices are influenced by the interaction of supply and demand, respectively sellers and buyers in the market.

The Fischer-Dipasquale-Wheaton model, analysed by Du Toit and Cloete (2003), highlights the amalgamation of the different basic key drivers in the real estate economy. As mentioned before, there are various exogenous variables, which interrelate with each other in the economic context of the real estate market (Du Toit and Cloete, 2003).

The Fischer-Dipasquale-Wheaton model is a static model that reflects the relationship between the real estate market, the asset variables as well as principles that generate the equilibrium in the demand and supply of this housing market with the outcome of a demand for real estate assets being identical to its supply. The target of this model is to standardise the market equilibrium such as the quantity of living space demanded and supplied at a given level of price or rent. In this equilibrium, the supply of residential space should be equal to the demand at a price or rent as illustrated in quadrant 1. The asset price paid by the investor or the real estate owner is the function of real rent. This real rent is generated in the evaluation of property values in the capital market, when prices are capitalised at a tolerable capitalisation ratio as visualised in quadrant 2. The adjustment between property values and replacement costs per unit produces the supply of new constructions as analysed in quadrant 3. Also there are strictly static circumstances demonstrated, a certain level of construction is required to renew stock at the necessitated equilibrium: a quota of stock is always subject to demolition, for example, as shown in quadrant 4. The adjusted stock, for example, the new construction stock minus the demolition losses, is altered into a long-term stock of residential space and insofar illustrated as back to quadrant 1 (Fischer, 1992). The resulting figure of Archour-Fischer (1999) demonstrates these relationships as follows:

Figure 3.1 Fischer-Dipasquale-Wheaton model



Source: Archour-Fischer (1999)

According to quadrant 1 the rent R has to be estimated in a way that the demand is precisely the similar as the stock S, taking the stock as given. Therefore, D is a function of R and the economic conditions, as verified in the equation (Archour-Fischer, 1999):

$$D(R, Economy) = S \tag{3.1}$$

The price for real estate assets P, *illustrated* in quadrant 2, is derived from the ratio of rent level R taken from quadrant 1 and the capitalisation rate i with the ensuing equation (Fischer, 1992):

$$P = R/i \tag{3.2}$$

Quadrant 3 determines the construction of new real estate assets with the two axes of price and construction. This area of the asset market curve *f(C)* validates the replacement cost of the real estates. The quantity of construction is estimated to rise with higher building movement. For that reason, the curve transforms to follow a bottom-left path. It cuts the price axis at a point that determines the smallest value needed for fundamental construction. The price as well as real estate construction costs have to be equal, since both are a function of the construction level *C*. The subsequent equation outlines these conditions (Fischer, 1992):

$$P = f(C) \tag{3.3}$$

Quadrant 4 typifies the real estate space market with the two axes construction and stock. The annual flow of new construction assets is transformed into the long-term real estate space stock. The adjustment in stock embodies the new construction segment in a given phase reduced by the depreciation rate *d* with the next equation (Fischer, 1992):

$$\Delta S = C - dS. \tag{3.4}$$

The ray evolving from the base describes the level of the stock that has to be built up to safeguard the long-term supply of stock. Consequently *S* equals zero (Fischer, 1999):

$$S = C/d. \tag{3.5}$$

The entire construction is in equilibrium when the starting and end values of the stock are analogous. Hence the model explains the correspondence between two submarkets – the property markets illustrated in quadrants 1 and 4 and the asset markets presented in quadrants 2 and 3 – and the effects of the total real estate market mechanisms (Fischer, 1999).

Nevertheless, there is also criticism for the earlier stated economic projections and the Fischer-Dipasquale-Wheaton model. Already early theoretical critics from e.g. Eichner and Kregel (1975) and Veblen (1998) often analyse the economic assumptions as normative economics with static models and an absence of real situations as well as current economies based on empirical studies. Additionally, the market participants are often defined as individuals with a high rationality and overall information of the market variables with an ignorance of bounded rationality, human thinking, behaviour and decision-making (Eichner and Kregel, 1975; Veblen, 1998). Also current economists such as Colander et al. (2009) develop criticism, mostly after the global financial crisis in 2008 with the assumption that "the global financial crisis has revealed the need to rethink fundamentally how financial systems are regulated. It has also made clear a systemic failure of the economics profession. Over the past three decades, economists have largely developed and come to rely on models that disregard key factors – including heterogeneity of decision rules, revisions of forecasting strategies, and changes in the social context – that drive outcomes in asset an other markets". (Colander et al., 2009)

The Fischer-Dipasquale-Wheaton model is also static. Additionally, there is a reproduction of four fields of the real estate branch, specifically market for space, asset valuation, construction sector as well as stock adjustment. Quadrant 1 validates the demand, which is equal to the stock. Nevertheless, if real estates do not meet the demands of occupants, there could be an imbalance between these two variables with the consequence of vacant real estate assets. On the other hand, the quantity of stock depends on the willingness to supply real estate assets with a dependency on, e.g., rents, prices and convenient economic, political and environmental requirements. Therefore, also the level of rent depends on these circumstances: A low quantity of stock could also reduce rents if this stock does not meet the demands of the customers and vice versa.

Quadrant 2 sets the level of ratio of rent from quadrant 1 and the capitalisation rate into correlation. However, just the acquisition costs in the capitalisation rate are insufficient for real estate prices, because there are high consequential costs such as vacancy, renovation and modernization in the real estate branch, which also have to be considered.

Quadrant 3 demonstrates the price and construction axes. Nonetheless, also these variables are not adequate as a result of limitations in, e.g., land areas in urban regions, laws that restrict the construction sector and public urban developments that promote or hinder real estate constructions.

Quadrant 4 justifies the quotation of the space axes that is equal to the construction function minus a depreciation ratio. As described earlier, real estates are heterogeneous, so also the depreciation of these assets is very different as a result of different building qualities, utilisations, lifecycles and renovation or modernization conditions.

In consequence there are various variables, which also have to be focussed on by the real estate branch, e.g., market size, income levels, expectations of the market participants, market risks, land area, economic conditions, social circumstances, demographic environments etc. Therefore, also this economic model has a limited predication.

One crucial issue that touches real estate assets as well as the economy in a significant manner is the demographic development in the residential trade and industry. The factors are multifarious. Therefore, the basic assertions of these economic movements for the European Union 27 are pointed out in the following.

3.2 Key-drivers of the demographic development in the European Union

In the view of Schoenmaeckers and Kotowska (2005), the current demographic developments in the European Union 27 have been evident ever since they began a few decades ago. Nevertheless, neither the European regimes nor the public nor the residential trade and industry noticed this trend for several years. Today this topic is high on the public agenda (Schoenmaeckers and Kotowska, 2005).

Eurostat (2011a) analyses that the demographic changes validate the key ensuing tendencies: significant changes in the age structures of the populations of the European Union. The size of the younger generations is falling, while the number of seniors is increasing. The main demographic trends demonstrate low fertility indicators with lowest–low fertility, i.e. below 1.3 children per woman with an average of 1.6 across the European Union 27. This is still well below the replacement rate of 2.1 children per woman with the result of the young generations shrinking. On the other hand, life expectancy continues to rise, particularly due to improvements at older ages. Since there are large inconsistencies among and within countries, there is the prospect for raising average life spans for the less-advantaged clusters. Populaces, which are presently the oldest, such as Germany's and Italy's, will age quickly for the next twenty years before stabilising. Some populations that are younger at present, typically in Eastern Europe, will undergo rapid ageing and by 2060 will have the oldest inhabitants in Europe (Eurostat, 2011a).

For Eurostat (2015b) the population of the European Union is rising and its inhabitants are getting older. In 2015 the population of the European Union is projected to be 508.2 million, 1.3 million more than the previous year (Eurostat, 2015b). Nevertheless, the European Commission (2012a) as well as Eurostat (2011a) state that although the net migration rate continued to be the core determinant of population development by contributing 63% to the total population growth in the European Union, the population in eight countries was already declining. It is forecasted that the number of inhabitants will continue to fall until 2050 in 9 countries: Bulgaria, Estonia, Germany, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia (European Commission, 2012a; Eurostat, 2011a).

Because fertility rates, life expectancy as well as migration developments are also for various research institutes and researchers such as Mirkin and Weinberger (2000) the key indicators for the demographic developments, they are highlighted in below.

3.2.1 Fertility rate

Major developments are touching the populations of the states of the European Union 27. There are two positive core movements that are evolving: a small rise of the fertility rate as well as an increase of the life expectancy.

Eurostat (2011a) analyses that lowest–low fertilities below 1.3 with an average of 1.6 have ended in the Member States but could develop to over 1.7 children per woman if changes for the postponement of births are considered. Nevertheless, although there is a small change, it could not hinder the population decreases as a result of a necessity fertility ratio of 2.1 children per woman, but it could result in a slower rate of population decline in the medium or longer term. The slight increase in fertility results from new family structures such as countries with a decrease of marriages, an increase of cohabitation and divorces as well as an older regular woman age at childbirth. The altering social conceptions of the function of marriage and a higher instability of relationships have ensued in a growing of extramarital births, also with a tendency towards more single parents respectively in childlessness. The influence of family policies on these developments is hard to consider because cultural aspects play an important role. Nevertheless, the data advise that postponement of childbirth to a later age is attended in certain countries by an increase of fertility rates and comparatively substantial public care for parents, e.g., in France, Denmark, Finland and the Netherlands. On the other hand, in countries such as Romania, Slovakia and Hungary, a lower age at childbirth is not related to high fertility. This would also be stable with the first indications that fertility advances again with the wealth situation (Eurostat, 2011a).

3.2.2 Life expectancy

Although it is difficult to forecast the effect of the policies of the countries in the European Union 27, Eurostat´s (2011a) analyses of the fluctuations in population configurations are more straightforward in contrast to the fertility rates. Low fertilities are only one element of demographic development; another significant component is the increase of the life expectancy of the population. The median age of the population will increase in future with the projection that the working-age population will begin to shrink, because the large baby-boom generation born soon after World War II is now entering retirement age. The number of individuals aged 60 and more in the European Union 27 is now growing by more than two million per annum, which is around twice the percentage detected until roughly five years ago. The age of the working population is also increasing with the result of a higher share of older workers in employment related to the generations of younger workers. Every year around 5 million children are born in the European Union member states, and more than 2 million persons emigrate from other third countries. The birth rates outweigh the death ratios by several hundred thousand per year, while the net migration is more than a million. Consequently, migration is the key driver for the largest quantity of the population growth in the European Union 27. Life expectancy in the European Union is on a high level at approximately 76.4 for men and 82.4 for women. Nevertheless, dissimilarities among member states are still very important, fluctuating from 13 years for men to 8 for women. Infant mortality is also still high in some countries such as Romania with 10.1 % and Bulgaria with 9.0 %, although a drop of around 50 % for the European Union 27 has been realised over the last 15 years. Socio-economic status plays a main role, particularly in some Central European countries. Therefore, by increasing the life expectancy of disadvantaged clusters, a general rise in general life expectancy is to be projected. A potential development is the enhancement in healthy life expectancy by delaying the period at which physical circumstance starts to decline quickly, thus postponing mortality to later ages of the population. Policies, which have a focus to the ageing of the populations as well as the work force circumstances, focus on enabling older working cohorts to continue being active and productive for a longer life period. Advantages of an ageing population are more opportunities for flexible periods in education, greater working-time possibilities and productive retirement through an increase of engagement in civil society (Eurostat, 2011a).

3.2.3 Migration

In the view of Eurostat (2011a), migration, particularly from non-EU countries, could provide a temporary reprieve from the ageing of the population, because most individuals who migrate are between 25 and 34. A significant amount of immigration from third states and within the European Union as an intra-EU mobility over the past decade has considerably enlarged the share of inhabitants in the European Union 27. Consequently the member states comprise some 20 million non-EU nationals. Because most of these migrants are established in working age, they belong to the labour force in the European Union 27. Furthermore, in the future the labour force of people with a migration background will develop. Among European Union nationals, there are nearly 8% of foreign-born individuals inhabiting the European Union. Moreover, 5% have at least one foreign-born parent, with the prediction that this group will increase. Until 2060, individuals of all nationalities with one foreign-born parent are expected to compose nearly one third of the European Union 27 population; a still higher ratio of the work force is projected to be of foreign descent. As a result of these trends there is the necessity for further efforts to assure that immigrants have the prospect to amalgamate into their host society. Moreover, they have to be able to be part of the labour market by having an education. A moveable populace can be seen as an asset to the host countries of the European Union 27, because individuals can contribute to a more efficient as well as productive economy (Eurostat, 2011a).

Nevertheless, the development of future migration ratios for the European Union are difficult to forecast as political as well as economic occurrences of countries will have an enormous influence on the willingness of inhabitants to emigrate to foreign countries. Hence also e.g. the quantity of populations in total as well as age structures could evolve differently to current prognoses.

3.2.4 Household-sizes

In the Eurostat research (2011a), also the household structure is continuously altering, which is a key driver for the residential trade and industry. On the one hand, as a result of the changing age structures of the populations, more individuals live in smaller households. On the other hand, several young adults, particularly young men, delay leaving the parental household to establish their own. The regular family as well as household size has been decreasing since the 1960s. There are many reasons for the fluctuations detected in family as well as household sizes over the past half century. The ageing structures of the populations in the European Union 27 point towards a decline in the share of young individuals, with the consequence of fewer new applicants for marriage and family building. Furthermore, varying value structures point to minor fertility percentages and a rise in the number of childless couples. The drop in family sizes related with lower fertility proportions as well as population ageing has been attended by a fall in the amount of married couples, because non-marital relationships and single childcare have become more accepted. The share of single-person households has also increased, because older persons have become less likely to live together with their own children and are more likely to be living alone. The share of young adults aged 25 to 29 living with their parents differs from 15 % or less in countries such as France, the Netherlands and Finland to 55 % or more in countries, e.g., Bulgaria, Slovenia and Slovakia. Cultural characteristics or dissimilar life-styles, which are difficult to evaluate, may help to clarify variances between the countries of the European Union 27. A key component is material difficulties that are the central difficulty preventing young individuals leaving the parent household. These material difficulties result in developments in the housing as well as labour markets, for example, because of a deficiency of education or job safety. These complications are also mirrored in the large amount of young individuals living in their parent's households although they are employed. The young adults' difficulties in creating new family structures as well as the growing share of the elderly generations are reducing the average household size in the European Union (Eurostat, 2011a).

As analysed before, the demographic development comprises a strong shift in the economies as well as real estate branches in the European Union countries. Consequently decision-making processes are crucial for stabilising and evolving economies and real estate assets.

3.3 Characterisation of the decision-making process

The cognition of an individual in correlation with the decision-making process plays an important role in the demographic development of the European Union 27 to realise the best possible residential trade and industry portfolio until 2050, following the methodology of Saaty described in Chapter 5. Therefore, in this section of this chapter the managerial cognition and the decision-making process in political systems, research departments as well as organisations in the real estate sector with different ways of seeing and interpreting the demographic development, the real estate assets and the environments in diverse countries are highlighted.

3.3.1 A definition of cognition

For Lang (1984) cognition is a mental development integrated in the realisation of knowledge as well as creating, thinking, memorising, interacting and problem-solving. These higher-level functions of the brain cover fields such as imagination, perception and planning. Cognition is the theoretical intangible usage of information, which is crucial for the fundamental systematised expression of a response (Lang, 1984). In Miller´s view (2003) this multi-disciplinary field comprises psychology, linguistics, anthropology, philosophy, computer science as well as the neurosciences. Each of these theories takes attention on the systems the mind works (Miller, 2003):

- Psychological emphasis: Sensitivity and memory in the inner structures of mind
- Linguistics emphasis: Connections between knowledge, thought and language
- Anthropology emphasis: Valuation of cognition across cultures and species
- Philosophy emphasis: Coverage of the theories on the nature of the mind and knowledge
- Computer science: Treatment of intelligence and problem-solving
- Neurosciences: Understanding of cognitive methods at the biological level.

Festinger (1957) states that the validity of an individual's cognition could result in failures known as cognitive dissonances. Cognitive dissonances classify a circumstance where inconsistent attitudes, beliefs or behaviours are related. Therefore, if an individual embraces a belief that does not correspond with the behaviour then the outcome will be two cognitions that are inconsistent, respectively dissonant with each other (Festinger, 1957): "If a person holds cognitions A and B such that A follows from the opposite of B, then A and B are dissonant" (Cooper, 2007).

Cognition improves in a variety of stages, specifically the field of management and functions in all types of organisations with a consequence for the decision-making processes and outcomes.

3.3.2 A definition of organisation´s management

Research by Spender (1989) indicate that the classical management theory comprise that organisations reflect firstly on the markets, specifically the socio-economic environment with the relationships to the market participants such as customers, who are in the case of real estate markets the occupants and the residential trade and industry as the supplier. Therefore, management chooses specific products such as dwellings, prices that are in this context, e.g., living costs, new construction and modernization costs as well as living locations to fulfil the 'Theories of the Firm'. Additionally, the organisation is a collaborating organism with a structure and stability of different categories of work clusters and responsibilities within Organisation Theory. The theory has a strong concentration on the market place, the firm as well as the individual. Thirdly, every individual or manager has a specific rationality (Spender, 1989), which in Weber´s opinion (1969) flows in kinds of activities such as a rational accomplishment in relation to the target, or in connection with a value, respectively the emotional action. For Spender (1989) the various pre-conditions, developments, results and organisational guidelines focus on goal-oriented systems of an organisation. All of these types of management arena produce dissimilar types of activities and necessitate decisions on all the organisational stages (Spender, 1989). To fulfil these levels according to Watson (1986), the organisational management has to bring people together to realise selected objectives and using obtainable resources in an efficient and effective manner. Management includes planning, organising as well as controlling organisations. Management can also be described as human action to empower the production of valuable outcomes for an organisation (Watson, 1986). Alvesson et al. (1996) state: “Managers are employed in diverse organisations. They perform a wide variety of roles and tasks; they are trained and located within different specialisms; and they work at different levels in organisational hierarchies. They also work in uncertain conditions, are in possession of imperfect information and are under pressure to be responsive to a plurality of demands.” Consequently, managers are responsible for their organisations and their existence. They are also responsible for the efforts of their external stakeholders, specifically the occupants. Therefore, for Hales (1986) the issues of managerial work are mainly:

- Work parts differ in relations of short-, mid- and long-term periods and unexpectedness
- Trouble-shooting and ad-hoc problem-solving are a basic work element
- Contradictions, cross-pressures and conflicts are common in the organisational context
- High numbers of decisions and activities in the structural effort are crucial
- Managerial work has a flexibility in the content of choice and negotiation

Therefore, matters, data and capabilities as well as practices and developments typify in the view of Bowman and Bussard (1991) the plans of the organisational managerial structures. These characterisations are both cognitive and action based with an influence on the construction and implementation of the strategies of organisations. They are not just decisions, but rather embrace activities, objects and concerns (Bowman and Bussard, 1991). Therefore, the managerial fields comprise a widespread scope of decision-making.

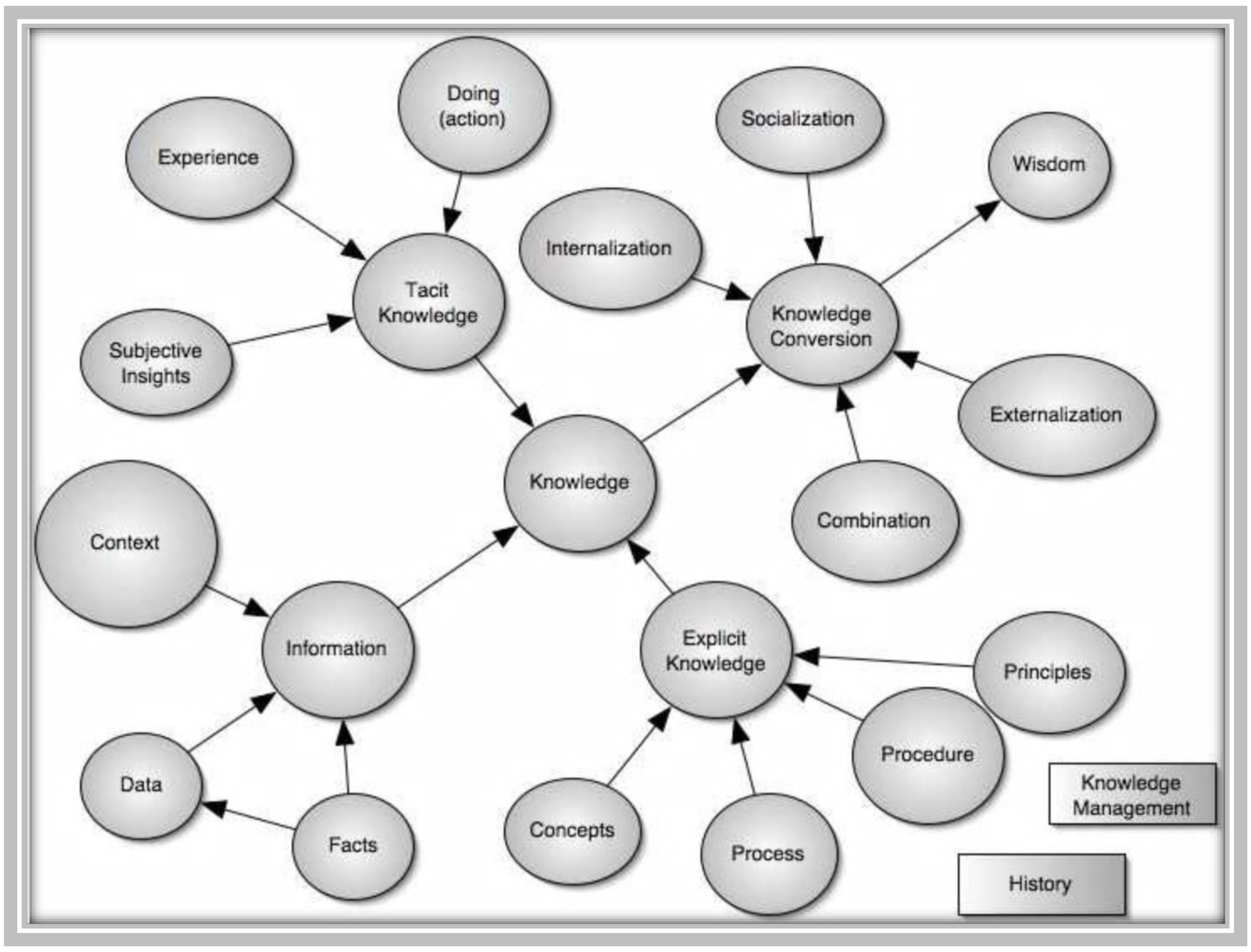
3.3.3 Managerial cognition

For Greve (1998), in organisations managers are challenged with numerous substantial decisions that require knowledge of the opportunities and threats in the organisation's market. Organisations occasionally differentiate their business, modify their products, choose between competing technological standards, and respectively advance their strategies if the market is changing. These decisions affect the performances of organisations. The aims and challenges are not just given and can also change their issues over the business periods. However, the information, which is central to improving the business, is imperfect since future decisions regarding, e.g., occupants and real estate assets are unidentified and uncertain. Analysing how market applicants will respond comprises the effective practice of evaluating information that is complete, complex, and of unclear significance (Greve, 1998).

Nevertheless, researchers such as Leidner (1993) and Williamson (1985) analyse whether individuals or managers perform with limited rationality. The rationality of human behaviour is bounded and strongly manipulated by the individuality of each person (Leidner, 1993; Williamson, 1985). For Cooke (2003), each party performs in a restricted rational system by limits of information and knowledge, environmental uncertainty, volatilities, and the complexity of the various stakeholders and shareholder groups. Thus, according to Clapham and Schwenk (1991), management clusters of decision-makers work under the conditions of these rationalities. The manager's understandings and clarifications of environmental proceedings regulate how their organisations react to these dealings and how they perform (Clapham and Schwenk, 1991). For Walsh (1995), managerial performance is influenced by the manager's cognition. Managerial cognition has an important correlation with thinking or information handling, while being involved in organisational and managerial matters with a strong focus on decision-making and problem-solving. Cognition affects individual behaviour in a fundamental way with the outcome of impacting the organisation's behaviour (Walsh, 1995).

According to Achterbergh and Vriens (2002), knowledge structures are used for decision-making and activities. Therefore, managerial cognition affects the behaviour and the decision-making developments in a major way (Achterbergh and Vriens, 2002):

Figure 3.2 Knowledge Structure



Source: Achterbergh and Vriens (2002)

As highlighted earlier, there are various challenges to overcome. On the one hand, real estate assets embrace special characterisations and comprise strong influences on economies. On the other hand, residential trade and industry assets and its economies have to handle the significant importance of the demographic movements in the European Union 27. To stabilise and increase these assets also in future periods, an effectual portfolio management is required.

3.4 Classification and structure of portfolio management

"We allocate too little to it and pay too little heed to real estate tion" (Firstenberg et al., 1988). Firstenberg et al. (1988) mention that investors and real estate owners have traditionally assumed that real estates in an inefficient market have to be selected and negotiated as an individual investment.

Nevertheless, today real estate investments as a portfolio with its overall risks as well as return characteristics are becoming more important, as analysed in the previous chapters. There is a necessity to examine real estate investments not only regarding their separate advantages, but also their impact on the overall real estate portfolio in various economic climates. Additionally, there has to be a focus on the setting of risks as well as the asset stability for the residential trade and industry portfolio as a whole, which relates to the goals of real estate owners, respectably occupants. Furthermore, creating strategies for accomplishing these targets and evaluating the degree to which single transactions conform to these strategies have to be further portfolio goals (Firstenberg et al., 1988).

3.4.1 Risk management as a foundation of portfolio management

According to Steinert and Crowe (2001), a risk is defined as a possibility, respectively a hazard of damage or any other negative occurrence affected by outside or inside vulnerabilities, and which could be avoided through positive activity. For financial assets a risk is a prospect that the value of an investment will be lower than the expected value (Steinert and Crowe, 2001). In the view of Hoesli and Lekander (2007), risks in the residential trade and industry can be mainly categorised in segments. Nevertheless, as a consequence of their special characterisations, a general classification is not available (Wellner, 2002):

- Environmental risks
    - Ruin of the real estate
    - Legal changes
    - Ecological and social requirements
    - Political risks

- Economic risks
    - Business cycle
    - Unemployment
    - Development of income and purchasing power
    - Changes in the interest level

- Sectorial risks
    - Business cycle in the residential trade and industry
    - Supply and demand behaviour
    - Vacancy risks
    - Price declines
    - Technological innovations

- Location-specific risks
    - Economic potential of the community
    - Demand and supply at the location
    - Vacancy risks in the community
    - Neighbourhood building development
    - Location infrastructure

- Residential trade and industry risks – along the lifecycle
- Development risks:
    - Planning risks
    - Cost risks
    - Time-limit risks
    - Quality risks

- Evaluation risks:
    - Change in value risks
    - Location risks
    - Built volumes or technical risks

- Utilisation risks:
    - Operating costs
    - Administrative expenses
    - Maintenance and repair
    - Operational capability

- Loss of revenue risks
    - Renter validity
    - Inflation risks
    - Vacancy risks
    - Contract risks

- Exploitation risks
    - Flexibility
    - Suitability
    - Selling risks

As mentioned before, for Khumpaisal et al. (2012) a positive handling to minimise or avoid these risks is a positive activity. This kind of activity has to be developed in the risk management, which embraces diverse process steps. Following ISO 31000:2009, an amendment by the International Organization for Standardization, the following phases have to be included (International Organization for Standardization, 2009):

The risk identification is the first step of the risk management and it develops the finding of the source of the internal or external risk. There are different methods of risk identification, e.g.:

- Common-risk checking: According to Lustig et al. (2011), some risks are common to every branch. Analysing the branch or business environment can develop the risk analysis (Lustig et al., 2011).

- Objective-based risk identification: In the view of Beebe and Clark (2005), every branch pursues special targets; therefore, any proceedings that could avoid these targets have to be identified as risks.

- Taxonomy-based risk identification: For Carr et al. (1993) this kind of identification is a finding of possible risk sources. Using the knowledge of best practices and categorisation enables possible risks to be identified (Carr et al., 1993).

- Scenario-based risk identification: King et al. (2003) state that identifying risks comprises recognising potential scenarios that could place the business in hazard if they appear.

For Wellner (2002), the risk analysis embraces the analysis as well as measuring of the risk and its vulnerability. Risk analysis involves quantitative as well as qualitative proceedings. If risks are measurable, mathematical statistical methods are available to quantify them such as calculations of standard deviations and simulations to realise the negative abnormalities from the regular conditions. If risks are not measurable, indirect assessments are accessible such as utility analysis or scoring methodologies with the aim of classifying the risks as an ordinal priority (Wellner, 2002).

In the analysis of Wellner (2002) the risk control is a step in the procedure of systems and policies, which are necessary to be managed for all the detected risks when they arise. If risks are not manageable, then they have to be transferred to a third party competent to realise the handling of the risks. Several kinds of risk control are available (Wellner, 2002):

- Risk avoidance: A disclaim of the adoption of risks as a consequence of a desist of situations could be managed, if the risk could not be minimised or avoided with potential strategies.

- Risk adoption with direct responsibility: The risk implementation belongs to the real estate investor. The investor deals with the consequences in a conscious manner.

- Risk shifting: The risks are shifted to a third party that has the ability to handle the risk management.

- Risk neutralisation: In this process opposing independent targeted risks are interconnected to revoke their effects.

- Risk minimisation: The target of this methodology is a decrease of the probability of risk occurrence, which is related to the strategies that are measured related to causes and effects. Another aim could be to restrict the impacts of the risks, which are strategies that are actions related to causes and effects.

- Risk diversification: The aim of a diversification strategy in different investment types with opposite developments is a risk compensation of the entitled portfolio.

Nevertheless, as a consequence of the special aforementioned characteristics of real estates, the complicated economy as well as the bride range of possible real estate risks, it is difficult to realise and classify potential arising risks. Thus a reactive instead of active performance could be developed that hinders methods of risk identification and types of risk control. Best-possible market knowledge, a continuous view to quick changeable risks as well as realistic probability calculations can minimise the critical factors of procedure but are not able to avoid them.

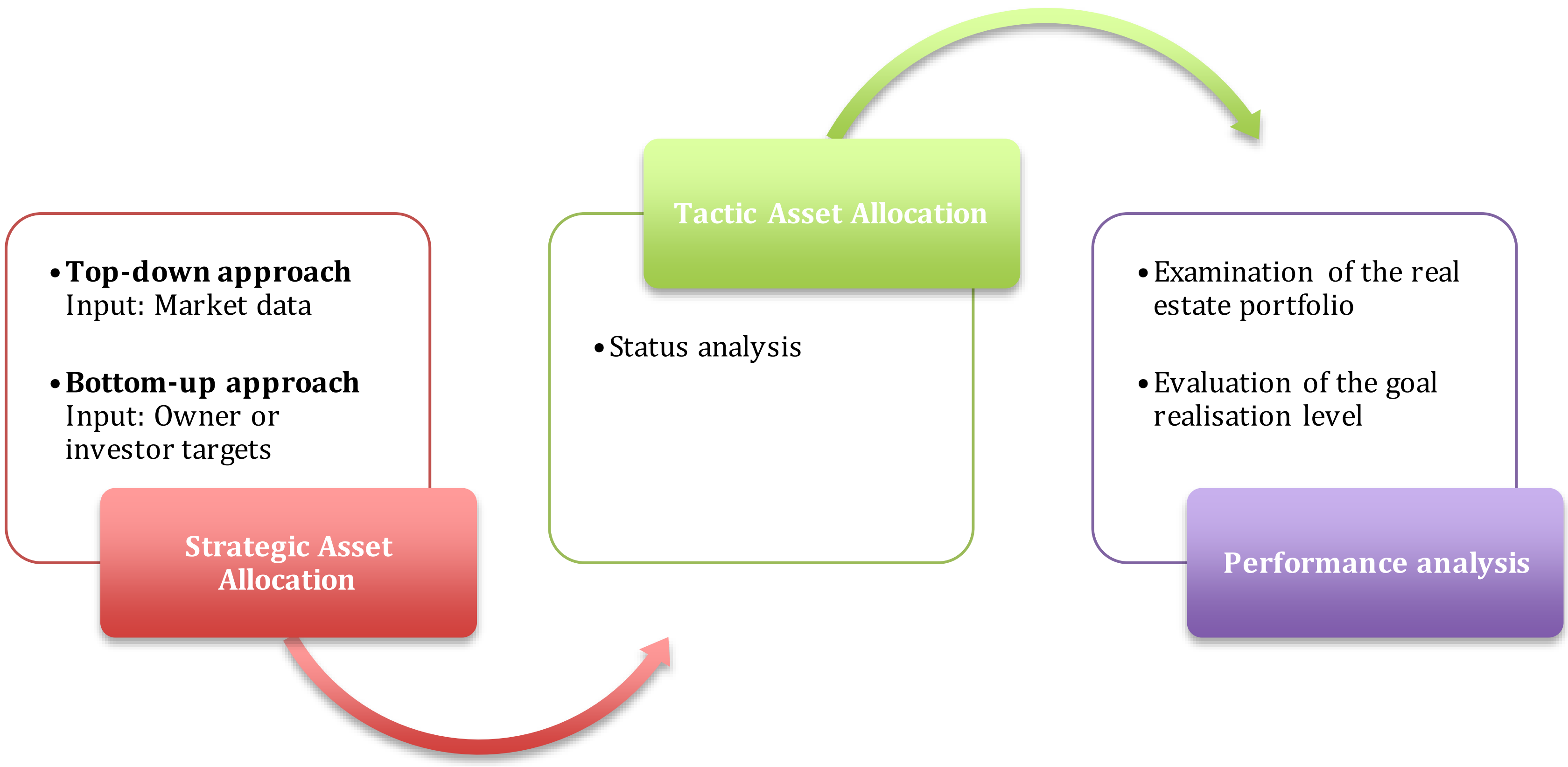
3.4.2 Portfolio management

For the Decision Lens Proprietary Information Company (2013) and researchers such as Hoesli and Lekander (2007), portfolio management is a complex, continual and systematic process of analyses, planning, regulation and controlling the real estate assets with the target to increase transparency for the real estate owner or investor in order to balance profits and risks for the entire real estate portfolio. According to Walbröhl (2001), in the investment policy of portfolio management a differentiation of the passive as well as active management is accessible. For Wellner (2002), passive management can be defined as the classical buy-and-hold strategy with an automatic realisation of a valorisation as a result of saturation of the inflation as well as a shortage in the residential trade and industry market. Passive management acts on the assumption that markets are perfect in the long term and generate an automatic efficiency of the market. Therefore, an investment in a real estate portfolio is correlated to the market portfolio, respectively an index to the market portfolio. In contrast, active management is used if there is the possibility to generate an opportunity compared to the real market. Based on the fact of the imperfection of the market, active management tries to have a lead over the market circumstance through making use of additional past, current and future information (Wellner, 2002).

In Swensen´s view (2009) two approaches are available in portfolio management: top-down and bottom-up. The top-down approach is based on the targets of the real estate owner or investor; portfolio relationships of newly constructed portfolio assets find consideration from the top – the target strategy – to the bottom – the implementation of the new portfolios in practise. This approach is rarely used because in the real estate environment current real estates and, therefore, real estate portfolios are often available (Swensen, 2009). For Wellner (2002) the bottom-up approach is introduced when the focus is on an innovative structure, respectively a rearrangement of a current real estate portfolio. This approach embraces a detailed but isolated analysis of the real estate assets of the current portfolio as well as future assets. The disadvantage of this approach is that the isolated asset evaluation that contradicts the investment objective could correspond in a portfolio combination with the conditions of an optimal portfolio with the result of a decrease of potential chances (Wellner, 2002).

For various researchers such as Auckenthaler (1994), Bruns and Meyer-Bullerdiek (2003), Garz et al. (2002) and Wellner (2002), the portfolio management process of the investment theory is an instrument for constructing optimal multi-asset portfolios. Mainly it is based on quantitative analysis and prognosis methodologies to aid decision-making. This process mainly comprises the following stages: After the analysis of the asset instruments in the marketplace as well as the target orientation, the asset allocation is the resulting stage that includes the strategic asset allocation as well as the tactic asset allocation. The strategic asset allocation includes the aim of the value-optimised portfolio composition for the real estate owner or investor. The orientation is the risk attitude as well as the investor's imagined profits. The tactic asset allocation comprises the selection of concrete assets for the portfolio construction corresponding to the aims of the strategic asset allocation and realises the specific actions. The tactic asset allocation supports the choices of the assets and weights them for the formerly evaluated targets based on analyses by the current market situation as well as the prognoses of the future market development. The last stage contains the performance analysis with possible deviations from the portfolio target. Nevertheless, the top-down approach has to be converted as illustrated in the following figure, because real estate portfolios are mainly existent and real estate assets are not just quantitatively evaluable (Auckenthaler, 1994; Bruns and Meyer-Bullerdiek, 2003; Garz et al., 2002; Wellner, 2002).

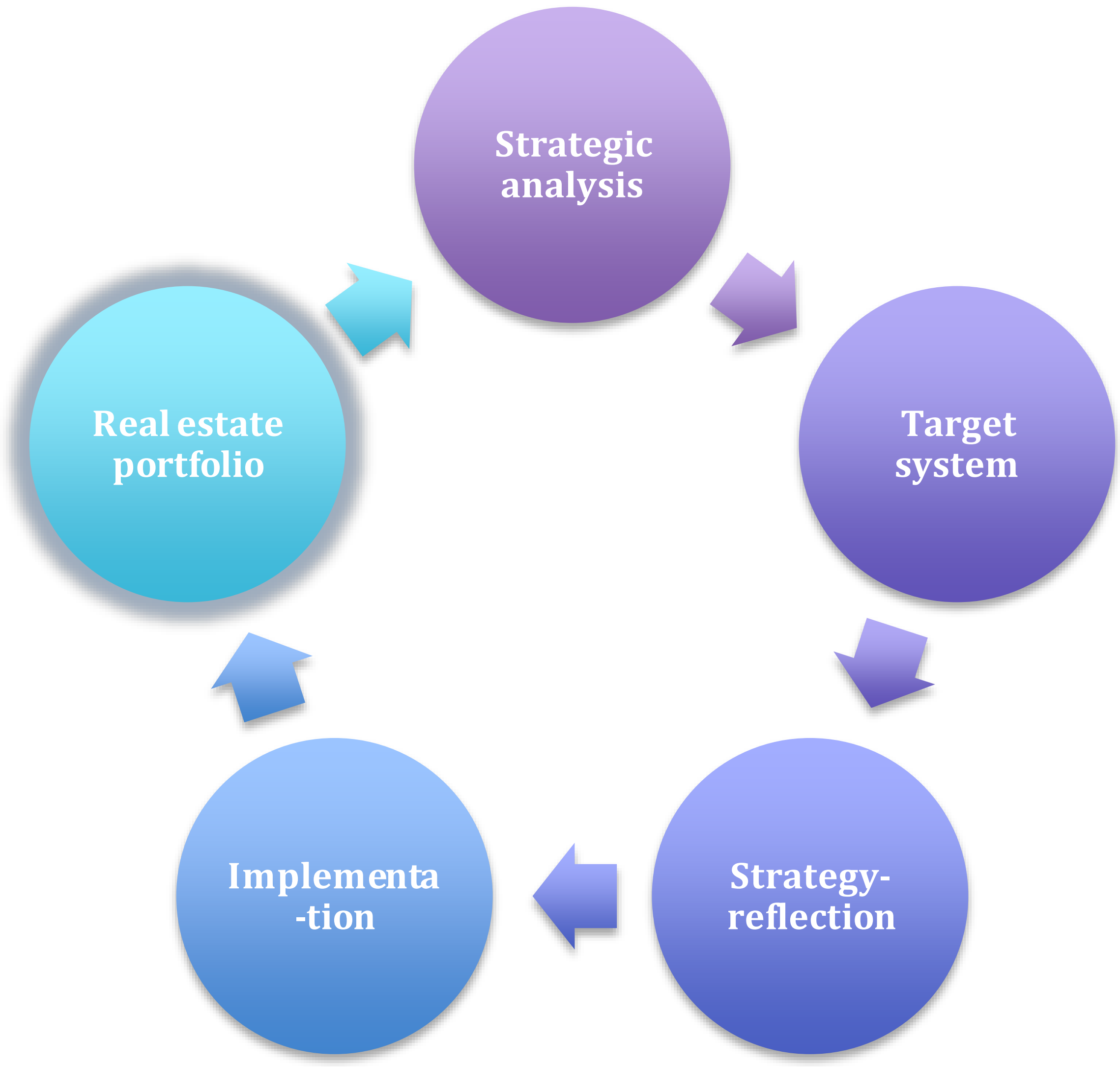
Figure 3.3 Portfolio management process of the capital market theory



Source: Wellner (2002); own representation

David (2011) states that the portfolio management process of the strategic management is a tool to realise the qualitative portfolio analysis. Herein the first step is the introductory strategic analysis to develop the target system. This target system again is the foundation of the resulting strategies in correspondence to the targets. The following implementation includes the construction of an action plan with a concrete procedure, the implementation control as well as success control (David, 2011). As already mentioned in the portfolio management process of the investment theory, in Wellner´s view (2002) also this theory has to be developed to the requirements of an ideal typical real estate management process. Besides methodical weaknesses, the key reason is the correlations of the portfolio elements under each other (Wellner, 2002).

Figure 3.4 Portfolio management process of the strategic planning theory



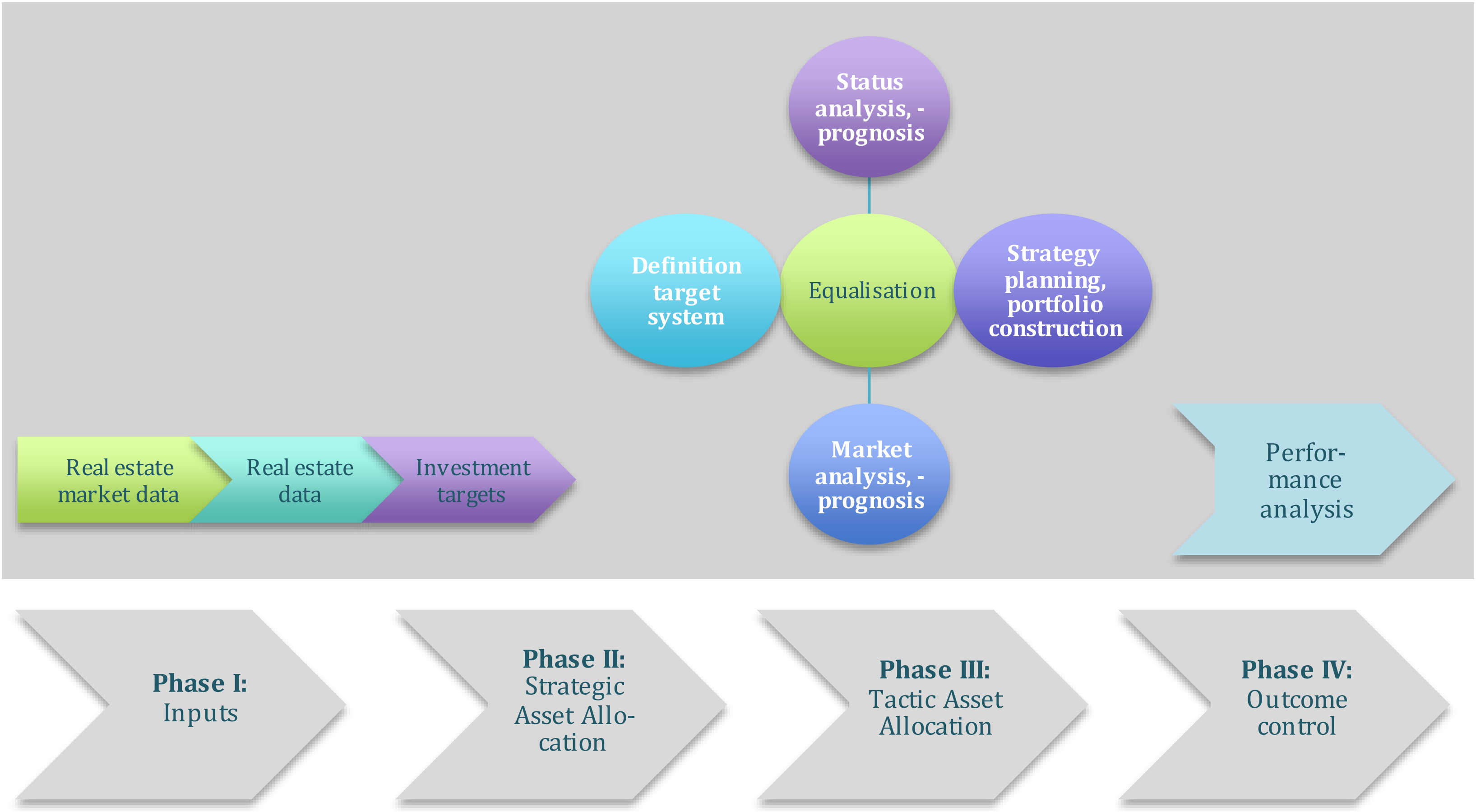
Source: Staehle et al. (1999); Steinmann and Schreyögg (1997); own representation

For Wellner (2002), a combination of both theories creates the ideal typical real estate portfolio management process. In this ideal typical process the possibility of quantitative as well as qualitative projections are available with a strong focus on the specialities of real estate assets (Wellner, 2002).

In her phase I – Inputs – the foundation is a problem adequate registration, suitable preparation and allocation of strategic relevant databases for an establishment of a strategic awareness of problems. An important requirement besides the targets of the real estate owners or investors is the optimisation of the market and real estate data of the real estate portfolios. The existence of these databases is the basis for resulting stages of this process. For a target-oriented data collection diverse analyses have to be obtainable. Potential analyses in the first phase are market, real estate as well as environmental analyses. The objective of these analyses is to evaluate the strengths, weaknesses, opportunities as well as threats of real estate portfolios (Wellner, 2002). However, it is inevitable to work with helpful databases. This could be a challenge since various data are secondarily sources originally collected and analysed in a different context. Another problem is the handling of future databases, because prognoses can change over time with the result of a foundation made on non-incidence assumptions. These circumstances could deform at worst the own portfolio management phase I. Wellner´s Phase II – Strategic asset allocation – determines the target systems with the parameters of the target portfolio. For Hoesli and Lekander (2007) at this juncture the real estate owners or investors respectively portfolio-relevant objectives have to be in focus (Hoesli and Lekander, 2007; Wellner, 2002). This strategic asset allocation has to be carried out under comprehension of a constructive risk management as well as a cost-benefit equation as the cost perspective play a significant role in the context of portfolio targeting. Phase III of Wellner (2002) – Tactic asset allocation – includes the concrete choice of the real estate assets through analyses by step I. The targets of stage II are implemented in phase III, which is also the portfolio construction phase. In the tactic asset allocation the objectives are transformed into action strategies. Also for Smietana, decision-making is based on quantitative investment or disinvestment calculations, respectively on qualitative value benefit analysis such as scoring models. Nevertheless, portfolio shifting, e.g., investment, growth or disinvestment strategies has to be oriented on the asset strategy and risk evaluation. Because the specific choice of real estate assets could not be developed in the short term – because of the real estate characteristics such as immobility, uniqueness, long-term production and high capital commitment as analysed before – there also has to be a mid-term as well as long-term focus on phase III (Smietana, 2014; Wellner, 2002).

Phase IV of the researcher Wellner (2002) – Outcome control – is a comparison of the current and target state. In practise an achievement of objectives at the first attempt is not common. Therefore, also for Hoesli and Lekander (2007), the portfolio management process passes through the different phases again and again. This is an endless cycle, because the optimal situation develops at a snail's pace (Hoesli and Lekander, 2007; Wellner, 2002). Herein the strategic and the tactic asset allocation build the chemical reactor. For Smietana (2014) and Wellner (2002), the market and real estate databases build the basic elements and the risk evaluation correlates to a catalyst that enables the development of the end product. After a deviation diagnosis in the outcome control, the tactic asset allocation has to start again. If the initial position changes, the phase of strategic asset allocation has to be cycled through again, because objectives have to be transformed if the inputs change (Smietana, 2014; Wellner, 2002).

Figure 3.5 Holistic portfolio management process



Source: Wellner (2002); own representation

To realise this portfolio management process in the European Union 27 countries with mainly shrinking populations, a market analysis with available real estate and residential trade and industry databases has to be realised in order to deviate investment targets and performance analysis.

4 Sense making of management and strategy for real estate assessment and improvement

Major demographic developments in recent decades have caused economies to fluctuate, effecting supply and demand in the residential trade and industry. The industry has had to react in order to stabilise, expand and avert shrinkage of its assets. Rational decision-making is a must when dealing with this situation. There is a high necessity for sense making of managerial decisions and strategies to protect asset values.

To successfully manage the situation, it is necessary to focus on various fields such as demographic, space and environmental social areas in order to gain an overview of the diverse movements and developments in the different countries of the European Union, as analysed in Chapter 3.

The aim of this chapter is to realise a market and status analysis and to identify the different variables in order to differentiate between several streams and analogical tendencies. In the focus of the analyses are the countries of the European Union 27 experiencing decreasing populations in contrast to Spain whose population is expected to increase (Appendix 1-8).

4.1 The progress in the European Union 27

The European Union is an economic and political alliance established in 1992 after ratification of the Maastricht Treaty by members of the European Community. This alliance includes the 27 member states and expanded the political coverage of the European Economic Community, mainly in the field of foreign and security affairs. The European Union advocated the establishment of a European bank and the implementation of a common valuta, named the Euro (European Union, 2014a).

In 2014 the GDP of the European Union economy amounted to 14.303 trillion euros (International Monetary Fund, 2014). With around 7.0% of the world´s population, the European Union trades about 20.0% of all global exports and imports. Approximately 67.0% of the European Union states trade with other European Union countries. The European Union was the largest importer with a share of 16.4% in 2011, followed by the United States with 15.5% and China with 11.9%. The European Union was also the most important exporter with 15.4% of all exports, followed by China with 13.4% and the United States with 10.5% (European Union, 2014b). Therefore, this alliance has strong macro- and micro-economic power with a high potential for the European Union member states.

To realise an overview of the analysed European Union countries, there follows now brief descriptions of these states covering their historical and economic developments of the last few decades:

The American Heritage (2013a) illustrates that Bulgaria is a country located in southeast Europe. It was first populated in the 6th century A.D. From the 14th century it was occupied by the Ottoman Empire, sometimes referred as the Turkish Empire, and became independent in 1908. After invading Bulgaria in 1944, the Soviet Union founded the People’s Republic of Bulgaria, after which the country had a communist government until 1989. The state established a demographic constitution in 1991. Bulgaria’s capital is Sofia (The American Heritage, 2013a). It gained admission to the European Union in 2007 (European Union, 2014b).

Estonia is a state located in northern central Europe west of Russia. The country was settled before the 1st century A.D. In the period between the 13th and 18th centuries Estonia was occupied by the states Denmark, Germany, Sweden and Russia. It became independent in 1918. In 1940 it was annexed by the USSR. In 1941 the country was occupied by Germany, but in 1944 it reverted to being a Soviet state named the Estonian Soviet Socialist Republic. Complete independence was established in 1991. The capital of Estonia is Tallinn (The American Heritage, 2013b). Its EU entry was in 2004 (European Union, 2014b).

Germany is located in northern central Europe. In 500 B.C. it was annexed by Germanic tribes. In the 6th century A.D. Germany became part of the Frankish empire. Afterwards it became a federation of different princedoms and the core of the Holy Roman Empire. In 1806 this imperial state was finished by Napoleon. After 1815 Germany became an alliance and from 1871 to 1918 it was an empire located around Prussia. After defeat in the First World War, it was restructured as the Weimar Republic, which came to an end when Adolf Hitler formed the Third Reich. With Germany's defeat in 1945 at the end of the Second World War the country was divided into four occupation zones controlled by the Allied powers. In 1949 the zones of the allies USA, France and Britain formed West Germany, while the Soviet zone became East Germany. These two parts of Germany were reunified in 1990 after the collapse of the East German Communist regime. The capital of Germany is Berlin (The American Heritage, 2013c). Germany was one of the EU's founding members and prior to this was a member of the European Economic Community from 1952 (European Union, 2014b).

Hungary is a state in central Europe. Before the late 9th century Hungary was under the authority of the Roman, Hunnish, Gothic, and Slavic federations. Foreign control ended when the country was captured by Magyars. In 997 St. Stephen founded the first Hungarian state. After 1526, Hungary was ruled by the Ottoman Turks. It later fell under Habsburg control, during which time in 1867 it became part of Austria-Hungary. In 1918 Hungary became independent again. A communist regime was installed in 1949, which lasted until 1989 when the country became democratic. Budapest is the capital of Hungary (The American Heritage, 2013d). It entered the European Union in 2004 (European Union, 2014b).

Latvia is positioned in northern central Europe. In the 1200s the ancestral inhabitants, the Letts, were captured and Christianised by German knights, named the Livonian Brothers of the Sword, who controlled the area until 1561 when Latvia passed to Poland. From the 18th century, the country was under Russian control. After the First World War, Latvia became independent. In 1940 the state was annexed by the USSR and was named the Latvian Soviet Socialist Republic. In 1990 Latvia declared independence. Riga is its capital city (The American Heritage, 2013e). It entered the European Union in 2004 (European Union, 2014b).

Lithuania is placed in northern central Europe. Its different regions were first brought together in the 1200s whereby it became one of the largest countries in medieval Europe. In 1569 Lithuania merged with Poland, but was annexed into three Russian parts of Poland in 1772, 1793 and 1795. Lithuania was an independent country from 1918 to 1940, when it became a constituent regime of the USSR. From 1941 until 1944 it was occupied by Germany, but after the Second World War it reverted to Soviet rule as the Lithuanian Soviet Socialist Republic. In 1991 Lithuania again achieved independence. Vilnius is its capital (The American Heritage, 2013f). The country has belonged to the European Union since 2004 (European Union, 2014b).

Poland is a country in central Europe. In the 10th century it was unified as a kingdom, and was established under the Jagiello Dynasty in the period from 1386 until 1572. It was a major power in the 15th and 16th centuries. In 1697 Poland lost its independence and was fragmented into three parts in 1772, 1793 and 1795. In 1918 Poland was reconstituted as a republic. Its current borders were fixed at the end of the Second World War. Warsaw is the capital of Poland (The American Heritage, 2013g). Its EU entry was in 2004 (European Union, 2014b).

Romania is a state in southeast Europe. From the 3rd to the 12th century, the state was annexed by a succession of invaders including the Goths, Huns, Magyars and Mongols. In the 13th century the princedoms Moldavia and Wallachia emerged within the Ottoman Empire and the Russian protectorates. In 1862 the princedoms were united then became an independent state in 1878. As a result of a growing fascist system in the 1930s the monarchy regime what changed to a dictatorship in 1940. During the Second World War, Romania surrendered to the USSR and the state was declared a communist regime in 1947. In 1989 the regime was overthrown with military-backed revolts. The capital of Romania is Bucharest (The American Heritage, 2013h). Its entry to the European Union was in 2007 (European Union, 2014b).

Slovakia is a landlocked state in central Europe. In the 6th century A.D. it was settled by Slavic peoples. In the early 10th century the area was conquered by the Magyars. It later became part of the Hungarian regime, which lasted until 1918. Afterwards it became part of the state of Czechoslovakia. In 1945, Slovakia was annexed by the Soviets as a result of the Second World War and was again made part of Czechoslovakia, which became a communist regime in 1948. With the end of the communist regime in 1989, the country was split into two independent republics. On 1st January 1993, the Republic of Slovakia came into its existence. Bratislava is the capital (The American Heritage, 2013i). Slovakia has been a member of the EU since 2004 (European Union, 2014b).

Spain is a country in southwest Europe. The area was colonised by the Phoenicians and Greeks and was ruled after 201 B.C. by Carthage and Rome. In 409 A.D. the Barbarians penetrated Spain and were eliminated by the Moors from North Africa from 711 until 719. The Moors were displaced by Christian countries and ousted from their last fortress in Granada in 1492. Ferdinand of Aragon and Isabella of Castile then became lords of Spain. In the 18th and 19th centuries the empire was lost and Spain experienced social and economic turbulence as a result of the Spanish Civil War from 1936 until 1939 and the reign of Francisco Franco. After the death of Franco, the monarchy was rebuilt in 1975 under King Juan Carlos, who created a parliamentary democracy. Madrid is the capital of Spain (The American Heritage, 2013j). Prior to the advent of the European Union Spain had been a member of the EEC from 1986 (European Union, 2014b).

The following sub-chapter offers the market and status analysis for these aforementioned countries with a focus on the demographic progress.

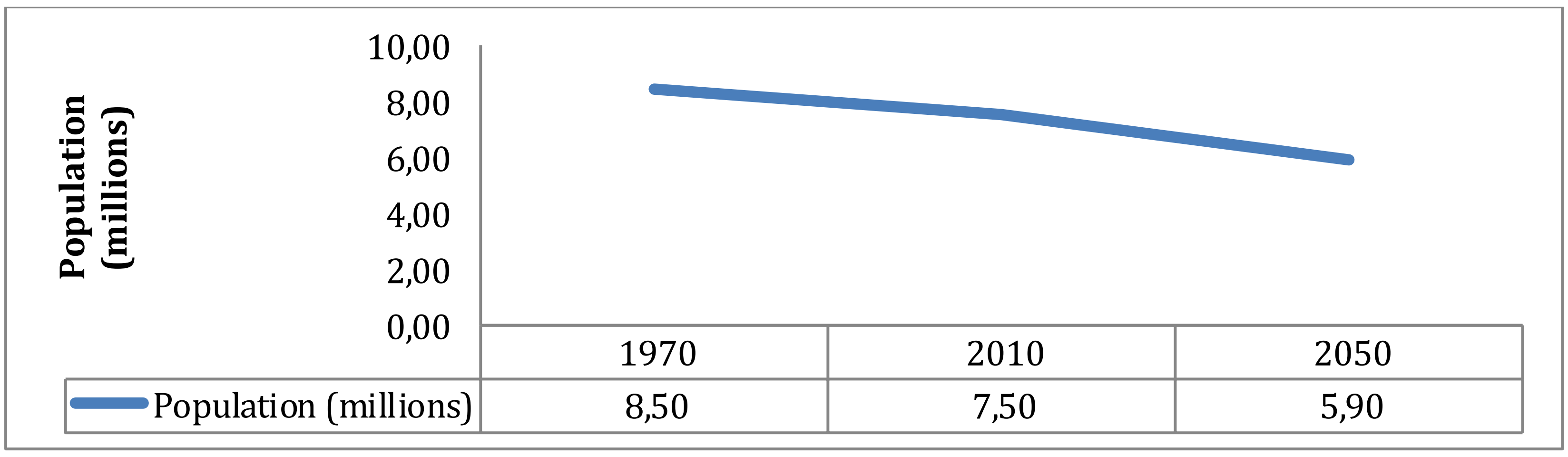
4.1.1 Demographic progress

The demographic progress that embraces the demand perspective outlines the different developments and tendencies of the various countries with significant characteristics from basically 1970 until 2050 as analysed next.

○ *Bulgaria*

Related to research by the European Commission (2012a), Bulgaria has a population of around 7.5 million, which is in decline. Eurostat (2010a) analyses that in 1970 the population was 8.5 million, which represents an 11.8% reduction compared to the recorded figure for 2010. In 2050 the population is predicted by the European Commission to be 5.9 million, which will mean a fall of 21.5% (Figure 4.1). This reduction would be much greater without the increase of the net migration ratio from minus 9.9 thousand in 2010 to plus 3.8 thousand predicted for 2050 (European Commission, 2012a), which would balance the population shrinkage in a positive manner. For Eurostat (2011a), the reason for the population fall is a low fertility rate, which had fallen from 2.2 in 1970 (Eurostat, 2011a) to 1.6 in 2010, based on analyses of the European Commission (2012a). Nevertheless, the fertility rate is one of the highest for the analysed countries. It is forecasted by the European Commission (2012a) that this rate will stabilise at this low insufficient level.

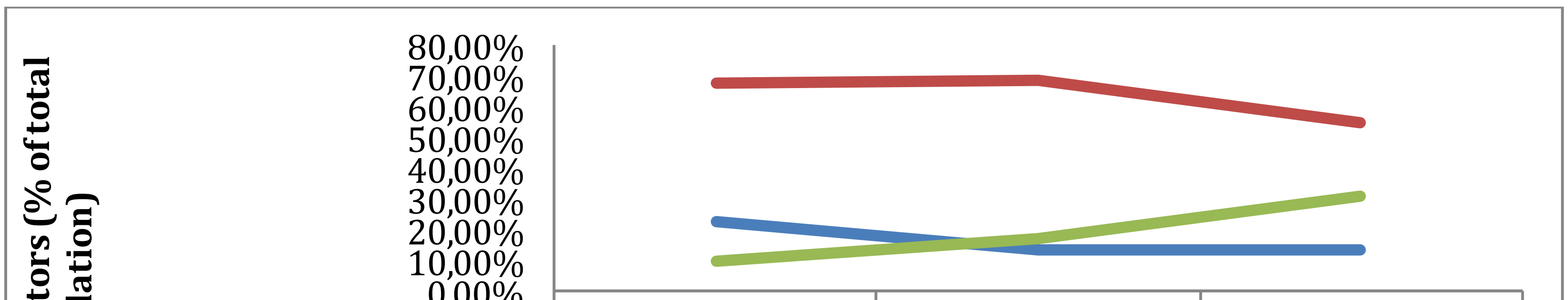
Figure 4.1 Development of the population in Bulgaria



Source: European Commission (2012a); Eurostat (2010a); own representation

Various research institutes such as Eurostat analyse that the age structures have shown a significant shift in Bulgaria. As mentioned before, the fertility rate is low with the consequence of a decline of younger generations. On the other hand, live expectancy is increasing. From a male life expectancy of 69.1 and female of 73.5 in the base year 1970 (Eurostat, 2011a), research by the European Commission (2012a) demonstrates that the figures had risen to 70.3 and 77.5, respectively, by 2010. In 2050 it is forecasted by this institute (2012a) that the figure will be 79.7 and 85.0, respectively. This shows a growth trend of around 15.4% for males and 15.7% for females from 1970 to 2050. As a result, the ageing indicators are changing rapidly. The United Nations illustrate, that in 1970 children aged 0 to 14 represented 22.8% of the population. The working-age population aged 15 to 64 represented 67.5% and the elderly population aged 65 years and older 9.6% (United Nations, 2013a). Today with the latest base year 2010 of analyses by the European Commission (2012a), children have shown a shift of nearly minus 40.0%, while for the elderly population it is plus 83.0%; the working population is mainly stable at 68.7%. In 2050 a marginal difference of the children's population of 13.5% in total is expected, a significant shift of minus 19.5% in the working population, and one of 77.5% in the elderly population (European Commission, 2012a), which demonstrates the demographic trends in a clear way (Figure 4.2). For the United Nations (2013a), the median age will develop from 43.0 today to 48.1 in 2050. The current median age is the second highest after Germany; nevertheless, it will stabilise by 2050 to a mid-table position among the researched states.

Figure 4.2 Formation of the ageing indicators in Bulgaria

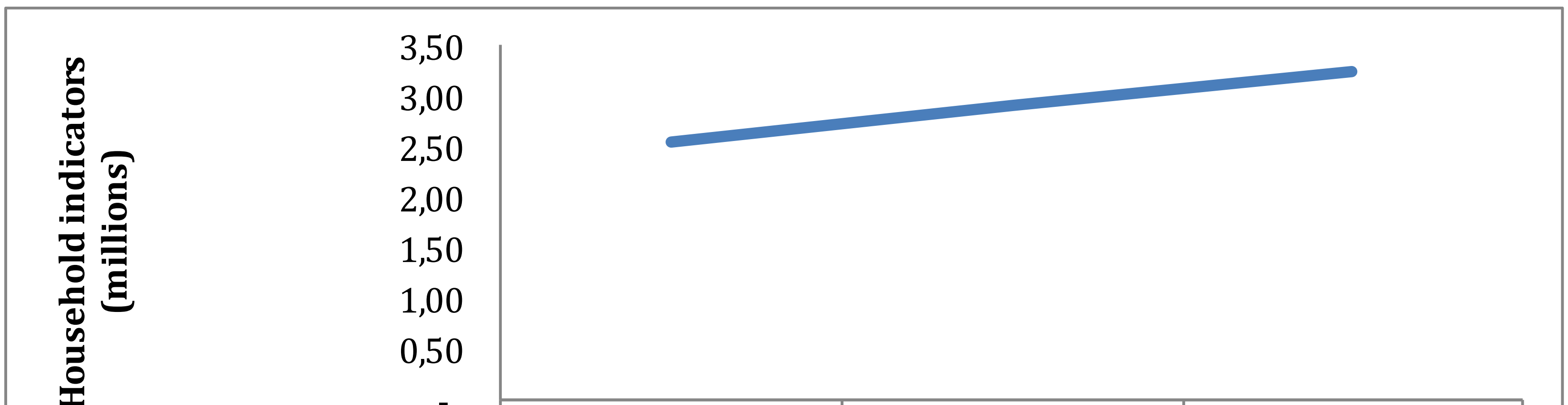


	1970	2010	2050
Children population (0-14 years)	22,82%	13,70%	13,50%
Working age population (15-64 years)	67,54%	68,70%	55,30%
Elderly population (age 65+)	9,64%	17,60%	31,20%

Source: European Commission (2012a); United Nations (2013a); own representation

The trend in the residential trade and industry has been the opposite. According to the United Nations (1974), the number of households in 1965 was 2,542,480, which according to Cecodhas (2012) had risen to 2,900,800 by 2009; by 2030 it is forecasted by the United Nations (2001) to be 3,236,000 after a period of continuous growth (Figure 4.3). This tendency demonstrates an increase of 27.3% compared to 1965. For the United Nations (1974) the reason is the development of the household clusters: In 1965 the approximate share of 1-person households was 17.0%, 2-person households 20.7%, 3-person households 21.6% and 4-and-more-person households 40.6% with an average number of persons per household of 3.2 (United Nations, 1974). Related to Cecodhas (2012), in 2009 the average number of households was 2.4. Although the percentage of clusters of households is not available for this base year, it represents a change from 3-and-more-person households to smaller 1-and-2-person households with the result of an increase of households in total.

Figure 4.3 Trend of the number of households in Bulgaria



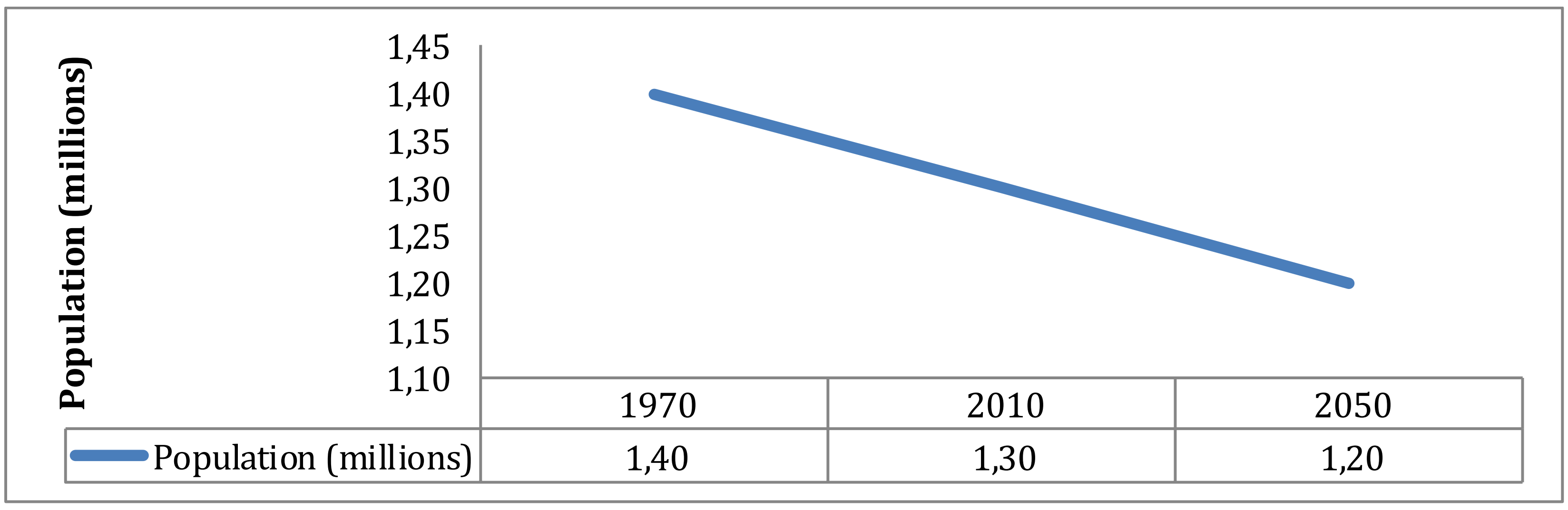
	1965	2009	2030
Number of households (millions)	2,54	2,90	3,24

Source: Cecodhas (2012); United Nations (1974); United Nations (2001); own representation

- *Estonia*

For the European Commission (2012a), in 2010 the population of Estonia was around 1.3 million, which is also in decline. According to Eurostat (2010a), in 1970 it was 1.4. In 2050 population is predicted by the European Commission to be 1.2 million, which is also a decrease of around 15.0% from 1970 to 2050 (Figure 4.4). According to the European Commission (2012a), like Bulgaria this trend would be more significant without the development of the net migration from minus 0.5 thousand in 2010 to plus 0.8 thousand predicted for 2050. Again like Bulgaria, this population fall is a result of a low fertility rate, which was 1.6 in 2010, representing the highest fertility level of the researched countries together with Bulgaria (European Commission, 2012a). By 2050 it is forecasted to have risen to 1.7 children per woman (European Commission, 2012a), which would also be among the highest of the analysed states.

Figure 4.4 Development of the population in Estonia

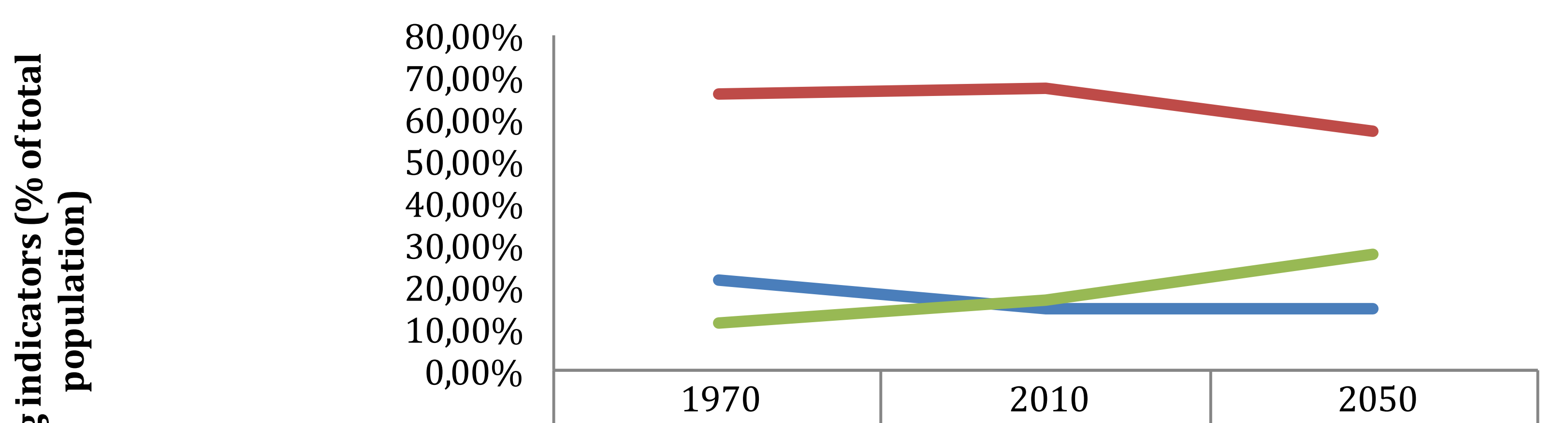


Source: European Commission (2012a); Eurostat (2010a); own representation

Furthermore, there is movement in the age indicators in Estonia. The age clusters for the base year 1970 are not available (Eurostat, 2011a); nevertheless, in accordance with analyses by the European Commission (2012a), in 2010 the life expectancies were 69.8 for males and 80.1 for females. In 2050 the forecast of the European Commission (2012a) is 79.6 and 86.6, respectively. This trend represents a development of plus 9.8 years for males and plus 6.5 years for females from 2010 to 2050. Consequently the ageing indicators will change. Researches of the United Nations (2013a) demonstrate in 1970 that the cluster of the children's population aged 0 to 14 represented 22.0% of the total population. The working-age population aged 15 to 64 represented 66.2% and the elderly population aged 65 and older nearly 12% (United Nations, 2013a). According to the European Commission (2012a), today the children's population has fallen to 15.2% and the elderly population increased to 17.0%; the working population has increased to 67.7%. In 2050 it is forecasted by that institute (2012a) that the children's population will represent 15.0% of the total, the working-age population 57.1% and the elderly population 27.9%.

This is a significant shift of minus 31.8% for children, minus 13.7% for the working population and a higher one of plus 137.0% for the elderly from 1970 to 2050 (Figure 4.5). For the United Nations (2013a), the result is an increase of the median age in years from 40.9 in 2013 to 44.4 in 2050, which falls in the middle of the analysed states today, but will develop to become one of the youngest median ages in future.

Figure 4.5 Formation of the ageing indicators in Estonia

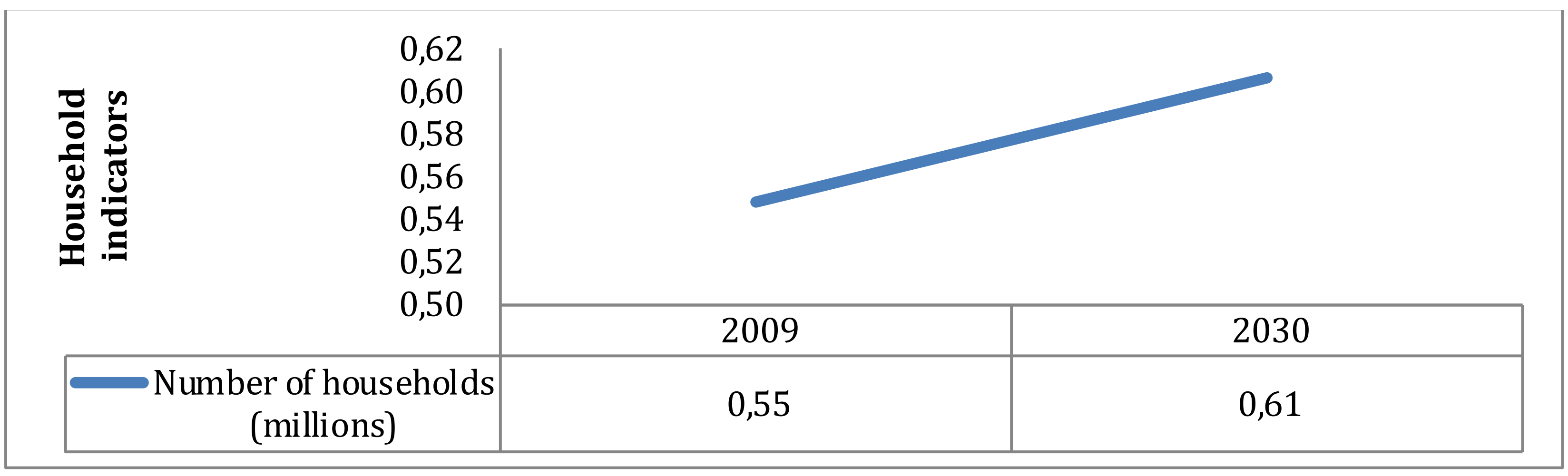


	1970	2010	2050
Children population (0-14 years)	22,00%	15,20%	15,00%
Working age population (15-64 years)	66,23%	67,70%	57,10%
Elderly population (age 65+)	11,77%	17,00%	27,90%

Source: European Commission (2012a); United Nations (2013a); own representation

The tendency in the residential trade and industry is the opposite. As a result of the annexation by the USSR for the base year 1965 of the United Nations (1974) there is just the total number of USSR households available, 50,333,000; the number for Estonia is not available. Analyses by Cecodhas (2012) demonstrate in 2009 the number for Estonia was 548,500. An increasing trend is forecasted by the United Nations (2001) until 2030 to reach 607,000, which is a development of approximately 10.6% over a period of 21 years (Figure 4.6). For the Ministry of the Interior and Kingdom Relations (2010) in 2008 1-person households represented 33.0% of the total, 2-person households 30.0%, 3-person households 20.0% and 4-and-more-person households 17.0%. Despite the lack of available base-year data, it can still be determined on the basis of analyses by the United Nations (1974) that Estonia has experienced an increase in smaller 1- and 2-person households, because the average number of persons per household was 3.7 in 1965 (United Nations, 1974) compared to 2.4 in 2009 (Cecodhas, 2012). For Eurostat (2010b) the shift in age structures is clearly visible in the context of the household compositions: The share of the single adults under 65 is 18.3%; single adults aged 65 and over 15.4%; couples both under 65 11.1%; couples with at least one aged 65 and older 7.8%; others, no under 18s 19.1%; single adults with children 4.2%; and two and more adults with children 24.2%. This demonstrates senior households represent a minimum of 23.2% of the total, which is a significant share held by senior households. The Ministry of the Interior and Kingdom Relations (2010) states that 8% of dwellings were vacant in 2009, what is high in comparison to the other analysed European Union states.

Figure 4.6 Trend of the number of households in Estonia

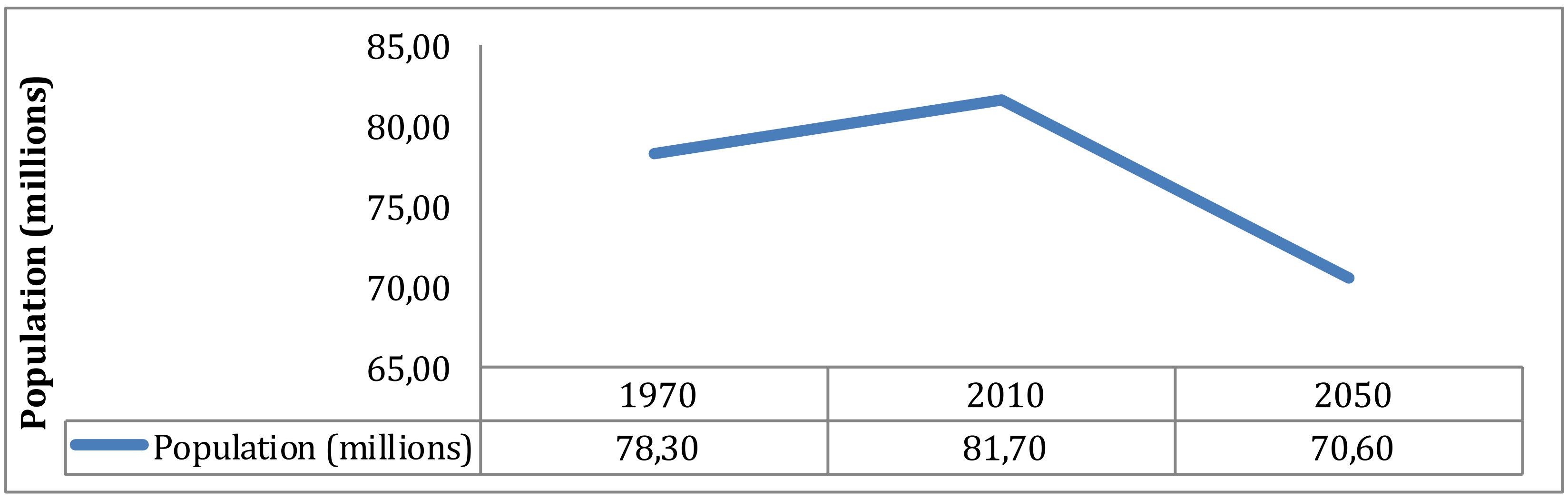


Source: Cecodhas (2012); United Nations (2001); own representation

- *Germany*

According to the European Commission (2012a), in 2010 Germany population was 81.7 million, an increase of 4.3% from 78.3 million in 1970 (Eurostat, 2010a). Nevertheless, it is forecasted by the European Commission (2012a) that the population will have fallen to 70.6 million in 2050, which is again a negative trend of around minus 9.8% from 1970 to 2050 (Figure 4.7). Also, in Germany net migration will prevent a higher decline; from 41.0 thousand migrants coming to Germany in 2010, the figure is predicted by the European Commission (2012a) to have risen to 87.7 thousand by 2050. Like in the afore-mentioned countries, Germany's fertility rate was quite low at 1.4 children per woman in 2010 (European Commission, 2012a). This figure is predicted by that organisation (2012a) to have risen to 1.5 by 2050, which is also low and the average for the EU.

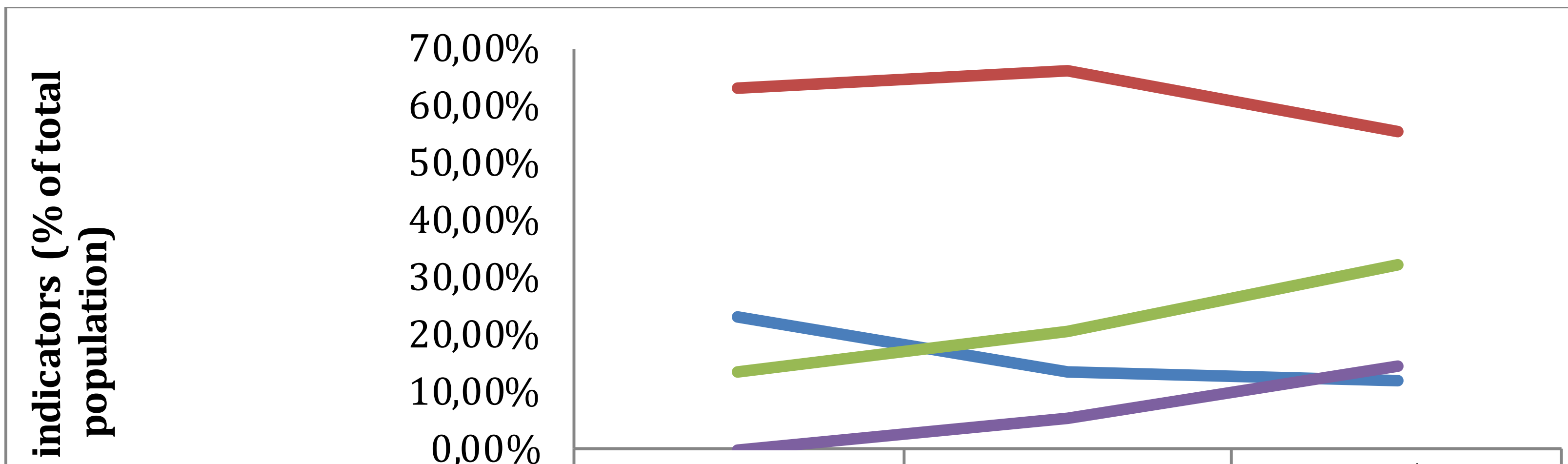
Figure 4.7 Development of the population in Germany



Source: European Commission (2012a); Eurostat (2010a); own representation

In Germany the age indicators demonstrate strong demographic development. According to Eurostat (2011a), in 1970 the life expectancies were 67.5 for males and 73.6 for females, in 2010 the figures of the European Commission (2012a) were 77.6 and 82.7, respectively, with the expectation that they will continue to rise until 2050 to reach 83.6 and 87.8, respectively. This demonstrates a high rise of plus 16.1 years for males and plus 14.2 years for females from 1970 to 2050. Consequently the ageing indicators will change significantly in this country. Mentioning the United Nations (2013a), in 1970 the children's population aged 0 to 14 represented 23.3% of the total population, the working-age population aged 15 to 64 63.1%, and the elderly aged 65 and older 13.6%. For the European Commission (2012a), today the children's population has had a negative shift to 13.4%, the elderly an increase to 20.6%, the working population an increase to 66.0%. In the forecast year 2050 of the European Commission (2012a) it is estimated the children's population will represent 12.1%, the working-age population 55.6% and the elderly 32.3% including a cluster of the very elderly aged 80 years and older of 14.5% (Figure 4.8). This is a significant deviance of minus 48.1% in the children's population and plus 138.2% of the elderly population from 1970 to 2050. Therefore, the median age in years is predicted by the United Nations (2013a) to grow from 45.5 in 2013 to 51.5 in 2050. These median ages for today and the future are the highest among the analysed countries, meaning that Germany's population is and will be in future much older than in other countries with shrinking populations in the European Union.

Figure 4.8 Formation of the ageing indicators in Germany

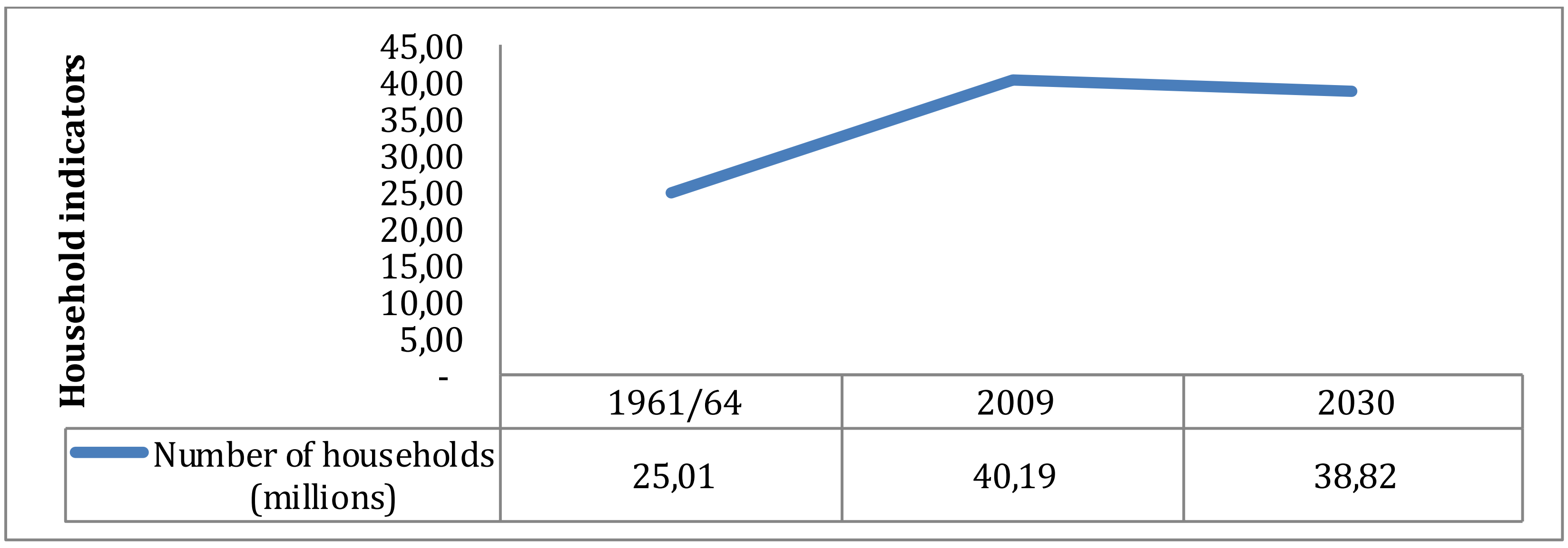


	1970	2010	2050
Children population (0-14 years)	23,30%	13,40%	12,10%
Working age population (15-64 years)	63,14%	66,00%	55,60%
Elderly population (age 65+)	13,56%	20,60%	32,30%
Very elderly population (age 80+)	-	5,10%	14,50%

Source: European Commission (2012a); United Nations (2013a); own representation

The residential trade and industry in Germany has shown a decline. For the United Nations (1974) the number of households was 25,008,191 in the base year 1961 for the Federal Republic of Germany and 1964 for the Democratic Republic of Germany. Compared to research by Cecodhas (2012) in 2009 the number was 40,188,000. The forecast of the United Nations (2001) for 2030 is a fall to 38,815,000 households, which is a development of approximately minus 3.4% over the period 2009 to 2030 (Figure 4.9). For the United Nations (1974) in 1961/1964 1-person households represented 22.2% of total households, 2-person households 28.1%, 3-person households 22.1% and 4-and-more-person households 27.6%; in 2008 the figure of the Ministry of the Interior and Kingdom Relations (2010) were 1-person households 39.0% and 2-person households 34.0%; 3-person households had fallen to 13.0% and 4-and-more-person households to 14%. Therefore, the research by the United Nations (1974) demonstrates the average number of persons per household was 2.8 in 1961/ 1971, which had fallen to 2.0 in 2009, according to Cecodhas (2012). This is the lowest for the researched states. The movement of the age structures of Eurostat (2010b) stands out sharply in the household compositions of Germany: The share of single adults under 65 is 24.4% of the total population; single adults aged 65 and older 14.0%; couples both under 65 14.7%; couple where at least one is aged 65 and older 14.2%; others, no under 18s 11.5%; single adults with children 3.1%; and two and more adults with children 18.1%. This demonstrates a high proportion of senior households at a minimum of 28.2%. According to the United Nations (1974), the vacant conventional dwelling quote as a percentage of the total dwelling stock amounted in 1968 in the Federal Republic as well as 1971 in the Democratic Republic to 1.7% rising to 8.0% in 2006 according to the Ministry of the Interior and Kingdom Relations (2010), which demonstrates a fall in the number of real estate assets without a custom function.

Figure 4.9 Trend of the number of households in Germany

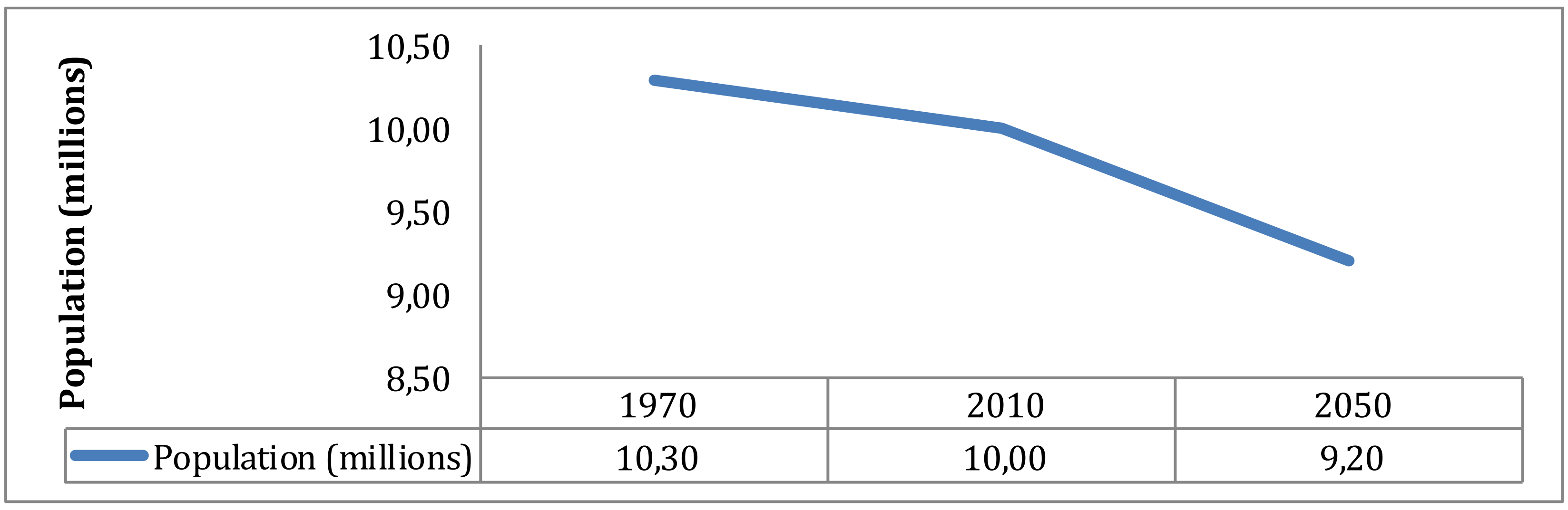


Source: Cecodhas (2012); United Nations (1974); United Nations (2001); own representation

- *Hungary*

According to the European Commission (2012a), Hungary's population in 2010 was around 10.0 million, which represents a 2.9% fall over the period of 1970 to 2010 from 10.3 million in 1970 according to Eurostat (2010a). The 2050 population is forecasted by the European Commission (2012a) to be 9.2 million, which is again a declining trend of around minus 8.0% from 2010 to 2050 (Figure 4.10). It is predicted by the European Commission (2012a) that Hungary's net migration will increase; 22.5 thousand migrants came to Hungary in 2010 and this is expected to rise to 22.0 thousand in 2050. This will be one of the most important migrations in the analysed European Union countries. For Eurostat (2011a) the fertility rate is low: in 1970 the rate was below the average of balanced populations at 2.0 children per woman with a significant drop in analyses by the European Commission (2012a) to 1.3 in 2010. This current fertility rate joints with Latvia the lowest of the researched states. For 2050 the estimation of the European Commission (2012a) is marginally more positive at 1.5 children per woman. Nevertheless, this is the lowest rate across the decreasing populations of the European Union 27.

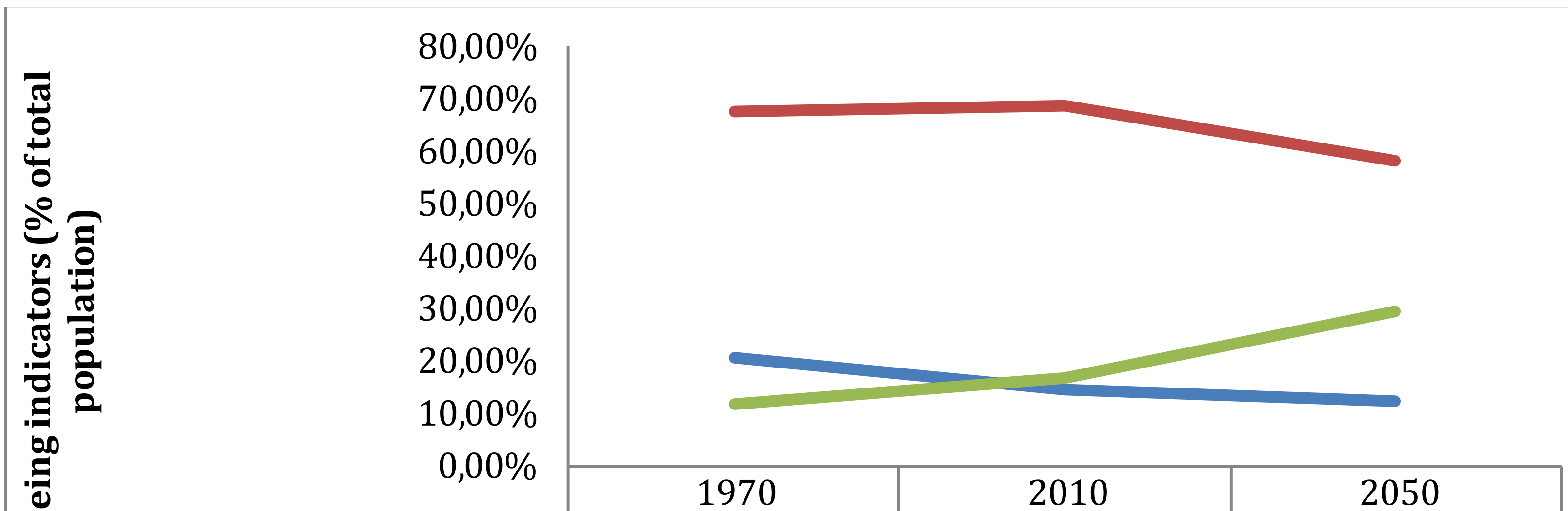
Figure 4.10 Development of the population in Hungary



Source: European Commission (2012a); Eurostat (2010a); own representation

The shift of the age indicators points to a tendency towards a more senior-focussed population. In 1970 the average life expectancy calculated by Eurostat (2011a) was 66.3 for males and 72.1 for females, which had risen to 70.4 and 78.4, respectively, in 2010 (European Commission, 2012a). The predicted figures of the European Commission (2012a) for 2050 are 80.0 and 85.9, respectively, representing an increase of 20.7% for males and 19.1% for females across the period 1970 to 2050. Also the ageing indicators will change as a result. For the United Nations (2013a) in 1970 the children's population aged 0 to 14 represented 20.9% of the total population, the working-age population aged 15 to 64 67.5% and the elderly population aged 65 and older 11.6%. Mentioning the European Commission (2012a), in 2010 the children's population had dropped to 14.7%, the elderly population increased to 16.7%, the working population had risen to 68.6%. In 2050 it is predicted by that organisation (2012a) that the children's population will be 12.5%, the working-age population 58.1% and the elderly population 29.4% (Figure 4.11). This is a deviance of minus 40.2% in the children's population and plus 154.1% in the elderly population from 1970 to 2050. From the view of the United Nations (2013a) the median age in years will change from the current 40.6 to 46.1 in 2050. These ages fall in the mid-range of the analysed countries.

Figure 4.11 Formation of the ageing indicators in Hungary

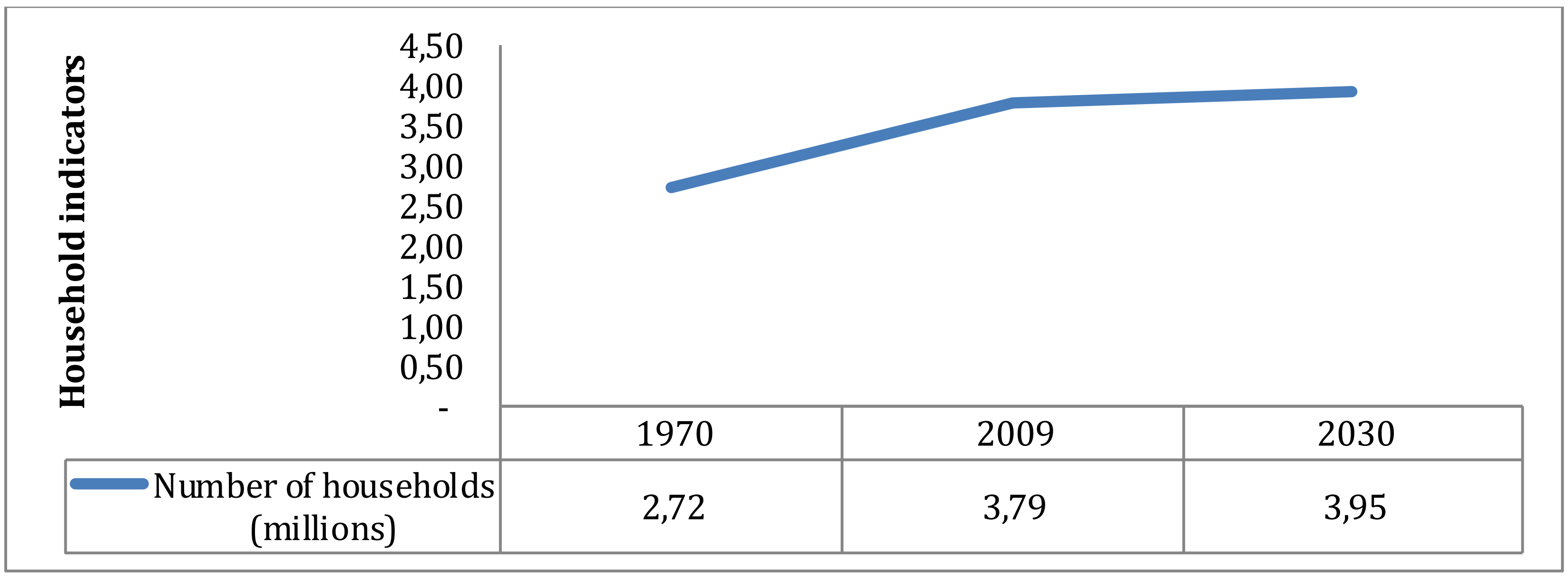


	1970	2010	2050
Children population (0-14 years)	20,89%	14,70%	12,50%
Working age population (15-64 years)	67,54%	68,60%	58,10%
Elderly population (age 65+)	11,57%	16,70%	29,40%

Source: European Commission (2012a); United Nations (2013a); own representation

The residential trade and industry has shown an increase. According to the United Nations (1974) in 1970 the number of households was 2,720,500. Corresponding to Cecodhas (2012), by 2009 the number had risen to 3,790,600. It is forecasted by the United Nations (2001) that by 2030 it will have risen further to 3,946,000, which represents a strong shift of approximately 45.0% over the period 1970 to 2030 (Figure 4.12). The household clusters have shifted accordingly. For the United Nations (1974) in 1970 1-person households represented 0.0% of the total, 2-person households 29.6%, 3-person households 29.3% and 4-and-more-person households 41.2%. Denoting the Ministry of the Interior and Kingdom Relations (2010), 2004 saw a tendency towards smaller households: 1-person households 29.0%, 2-person households 30.0%, 3-person households 19.0% and 4-and-more-person households 23.0%. According to the United Nations (1974), the average number of persons per household was 3.0 in 1970 and had fallen to 2.6 by 2009 (Cecodhas, 2012). The movement of the age structures is apparent from the household compositions of Hungary: Eurostat (2010b) states that in 2007 single adults under 65 represented 11.5% of the total population; single adults aged 65 and older 12.8%; couples both under 65 12.8%; couples where at least one is aged 65 and older 8.6%; others, no under 18s 22.6%; single adults with children 3.2%; and two and more adults with children 28.6. This means senior households represent a minimum of 21.4% of the total; nevertheless, this is relatively low in comparison to the other countries. In compliance with research by the United Nations (1974), in 1970 3.4% of dwellings were vacant, which had risen to 5.6% by 2005 (Ministry of the Interior and Kingdom Relations, 2010). This is more balanced and lower than for the other analysed countries.

Figure 4.12 Trend of the number of households in Hungary

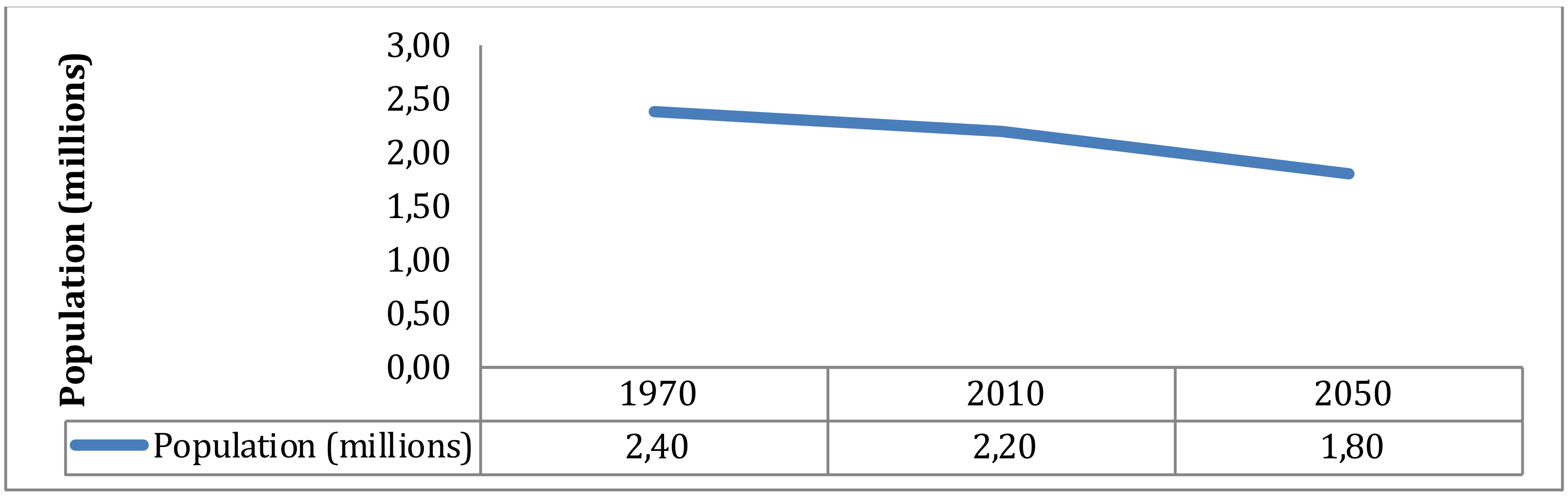


Source: Cecodhas (2012); United Nations (1974); United Nations (2001); own representation

○ *Latvia*

According to the European Commission (2012a), Latvia's population in 2010 was around 2.2 million, which is in decline; corresponding to Eurostat (2010a), in 1970 it was 2.4 million with 1.8 million forecasted by the European Commission (2012a) for 2050 (Figure 4.13). This represents a high reduction of 25.0% from 1970 to 2050. Also in Latvia, net migration is expected by the European Commission (2012a) to take a positive swing: while net migration in 2010 was minus 3.4 thousand, it is predicted to be 1.9 thousand in 2050. While the past fertility rate is not available, the figure for 2010 was 1.3 children per woman (European Commission, 2012a). Along with Hungary this is the lowest fertility trend among the researched European Union countries. For 2050 it is forecasted by the European Commission (2012a) to have increased marginally to 1.5. Although this trend is low in which the demographic characteristics will continue in the future.

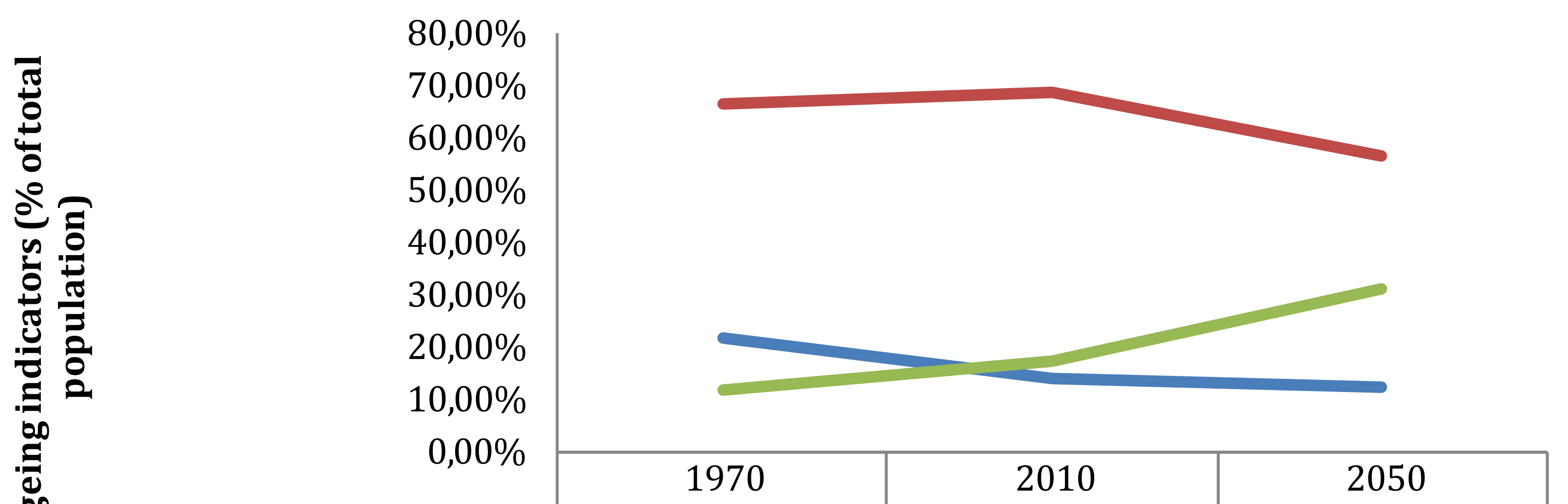
Figure 4.13 Development of the population in Latvia



Source: European Commission (2012a); Eurostat (2010a); own representation

According to the European Commission (2012a), the life expectancies are developing in a mostly analogical manner compared to the afore-mentioned countries: While the figures for 1970 are not available, in 2010 they were 68.3 for males and 78.0 for females. In 2050 they are forecasted to have risen to 78.9 and 85.6, respectively (European Commission, 2012a), representing a significant increase of 15.5% for males and 9.7% for females from the base year 1970 to 2050. For the United Nations (2013a), in 1970 the children's population aged 0 to 14 represented 21.6% of the total population, the working-age population aged 15 to 64 66.4% and the elderly population aged 65 and older 12.0%. Today with a current base year of 2010 of the European Commission (2012a) the children's population has a negative development with a quotation of 13.8%, the elderly population increases to a share of 17.3%; the working population will marginal increase to a percentage of 68.9%. In 2050 it is estimated that the children's population will be 12.3% in total, the working-age population 56.6% and the elderly population 31.2% (European Commission, 2012a). The figure for the very elderly generation aged a minimum of 80 years will be 10.7% (European Commission, 2012a), which is the 3rd highest of the population (Figure 4.14). This is a crucial difference of minus 43.1% in the children's population and plus 160.0% in the elderly population between 1970 and 2050. In the view of the United Nations (2013a) the median age in years will also increase from 41.5 per person to 42.7 in 2050.

Figure 4.14 Formation of the ageing indicators in Latvia



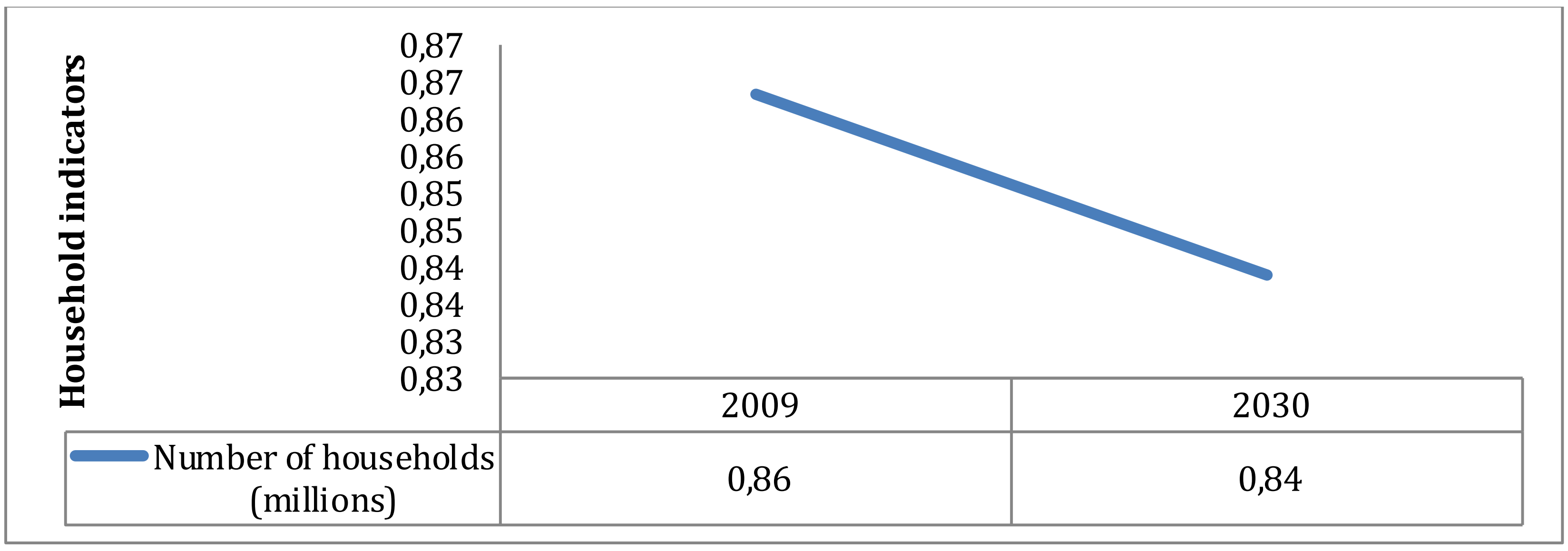
	1970	2010	2050
Children population (0-14 years)	21,61%	13,80%	12,30%
Working age population (15-64 years)	66,38%	68,90%	56,60%
Elderly population (age 65+)	12,01%	17,30%	31,20%

Source: European Commission (2012a); United Nations (2013a); own representation

The residential trade and industry of Latvia is on a downward trend in contrast to most of the afore-mentioned countries. According to the United Nations (1974), in 1970 the total number of households was only analysed for the whole of the USSR. Nevertheless, for Cecodhas (2012) in 2009 the figure was 863,400. In 2030 it is forecasted by the United Nations (2001) to have fallen to 839,000, which demonstrates a negative trend of minus 2.8% over the period 2009 to 2030 (Figure 4.15). While the data for clusters of households are not available for 1970 and 2030, the Ministry of the Interior and Kingdom Relations (2010) states that in 2004 each had the following share: 1-person households 24.0%, 2-person households 30.0%, 3-person households 23.0% and 4-and-more-person households 23.0%. In 1965 the average number of persons per household in the former USSR was 3.7 (United Nations, 1974); the 2009 figure for Latvia was just 2.5 (Cecodhas, 2012). The 2007 share of age structures of Eurostat (2010b) are as follows: single adults under 65 represent 12.8% of the total population; single adults aged 65 and older 12.4%; couples both under 65 8.6%; couples where at least one is aged 65 and older 6.5%; others, no under 18s

25.7%; single adults with children 4.0% and two and more adults with children 30.1%. This is a relatively low level of senior households with a minimum of 18.9% with the result of a more balanced household structure in comparison to other European Union states. Research by the Ministry of the Interior and Kingdom Relations (2010) shows that in the base year of 2008 8.6% of dwellings were vacant, which can be viewed as high.

Figure 4.15 Trend of the number of households in Latvia

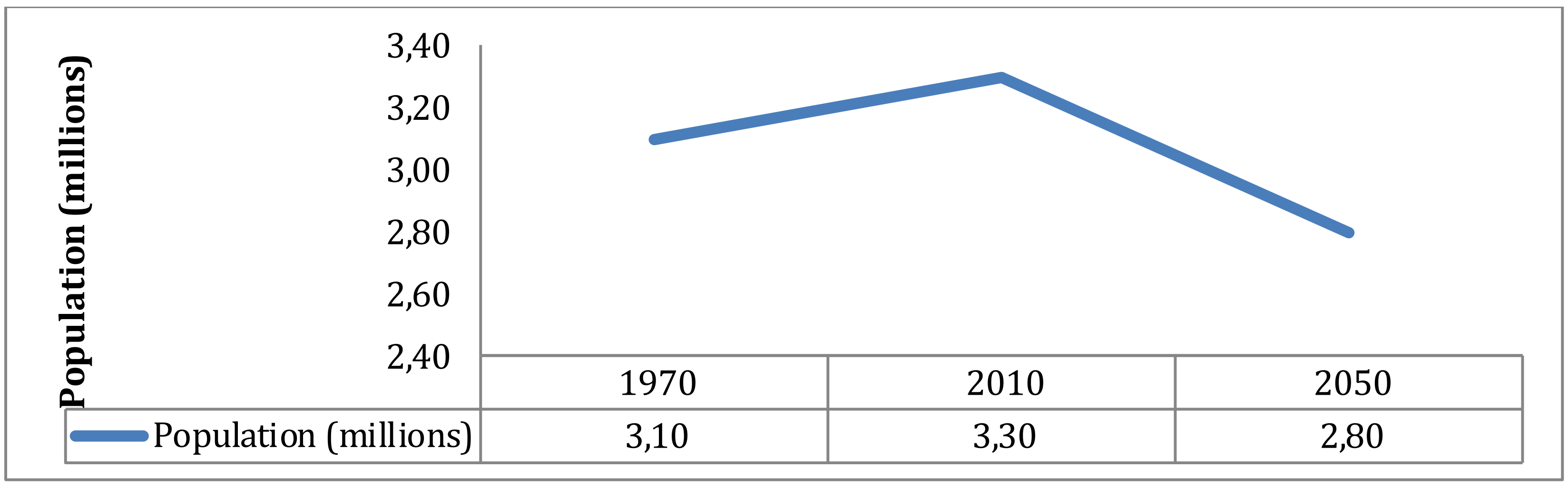


Source: Cecodhas (2012); United Nations (1974); United Nations (2001); own representation

○ *Lithuania*

Lithuania's population in Eurostat´s (2010a) base year 1970 was 3.1 million, which according to the European Commission (2012a) had grown to around 3.3 million by 2010. Nevertheless, in 2050 the population is predicted to have fallen to 2.8 million (European Commission, 2012a), which represents a shift of minus 9.7% across this whole timeframe from 1970 to 2050 (Figure 4.16). The high net migration in 2010 caused a negative change of minus 13.0 thousand people, but it is predicted to have increased to plus 2.2 thousand by 2050 (European Commission, 2012a). This positive trend will prevent higher population shrinkage. For Eurostat (2011a), Lithuania had a positive fertility rate in 1970 of 2.4 children per woman, but this had fallen to a low of 1.5 in 2010, according to analyses by the European Commission (2012a). It is forecasted that it will remain more or less stable until 2050 when it will be 1.6 children, which is also low (European Commission, 2012a).

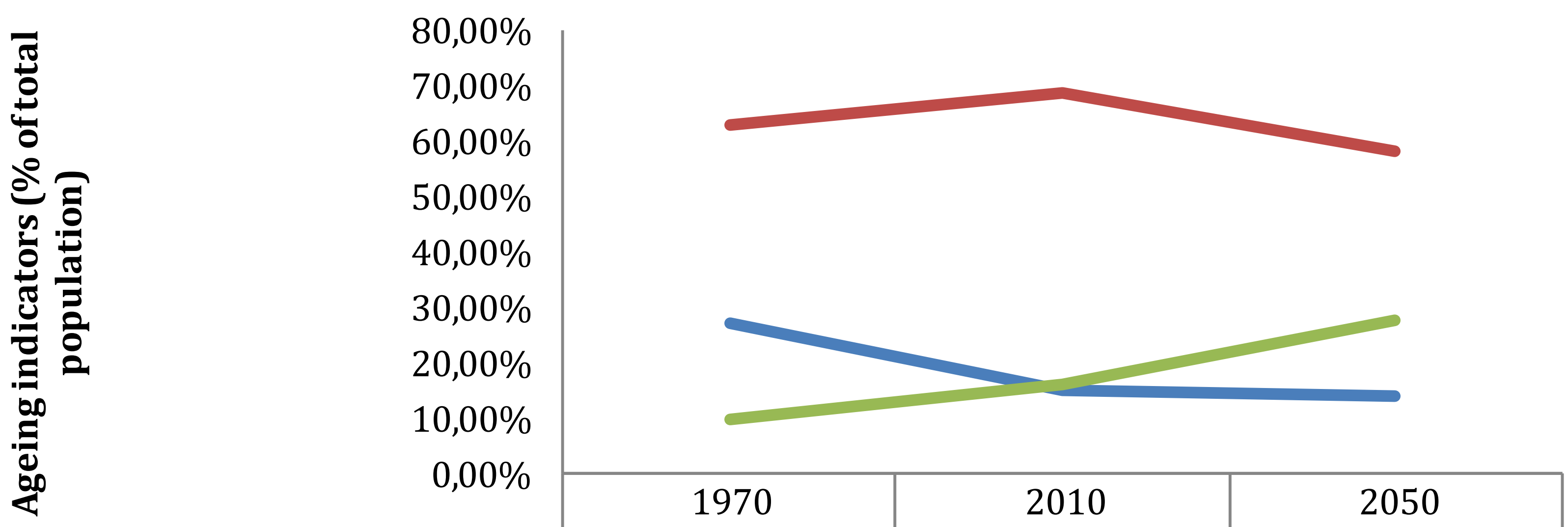
Figure 4.16 Development of the population in Lithuania



Source: European Commission (2012a); Eurostat (2010a); own representation

In Lithuania the age indicators show a demographic shift. While in 2010 the average life expectancy for the European Commission (2012a) was 67.7 years for males and 78.7 for females, it is expected to have risen by 2050 to 78.5 and 85.6, respectively. This demonstrates an increase of 10.8 years for males and 6.9 years for females from 2010 to 2050. As a consequence the ageing indicators will rapidly change. Research by the United Nations (2013a) reveals that in 1970 the cluster of the children's population aged 0 to 14 represented 27.0% of the total population, the working-age population aged 15 to 64 had a percentage of 62.8% and the elderly population aged 65 and older had a share of nearly 10.1%. According to the European Commission (2012a), today the children's population has a negative shift to a quotation of 15.0%, the elderly population growths to a share of 16.1%; the working population will increase to 68.9%. In the forecast year 2050 there is estimated a percentage of the children's population of 14.0% in total, the working-age population of 58.2% and the elderly population with 27.8% in total, which includes a cluster of a very elderly population aged 80 years and older of 10.2% (European Commission, 2012a). This is a significant deviance of minus 48.2% in the children's population and plus 174.2% of the elderly population from 1970 to 2050 (Figure 4.17). Therefore, the median age in years is estimated by the United Nations (2013a) with a growing shift from an average age of 39.3 per person in 2013 to a median age of 44.2 in 2050. Anyway, this medium age is one of the lowest ages in the analysed countries.

Figure 4.17 Formation of the ageing indicators in Lithuania

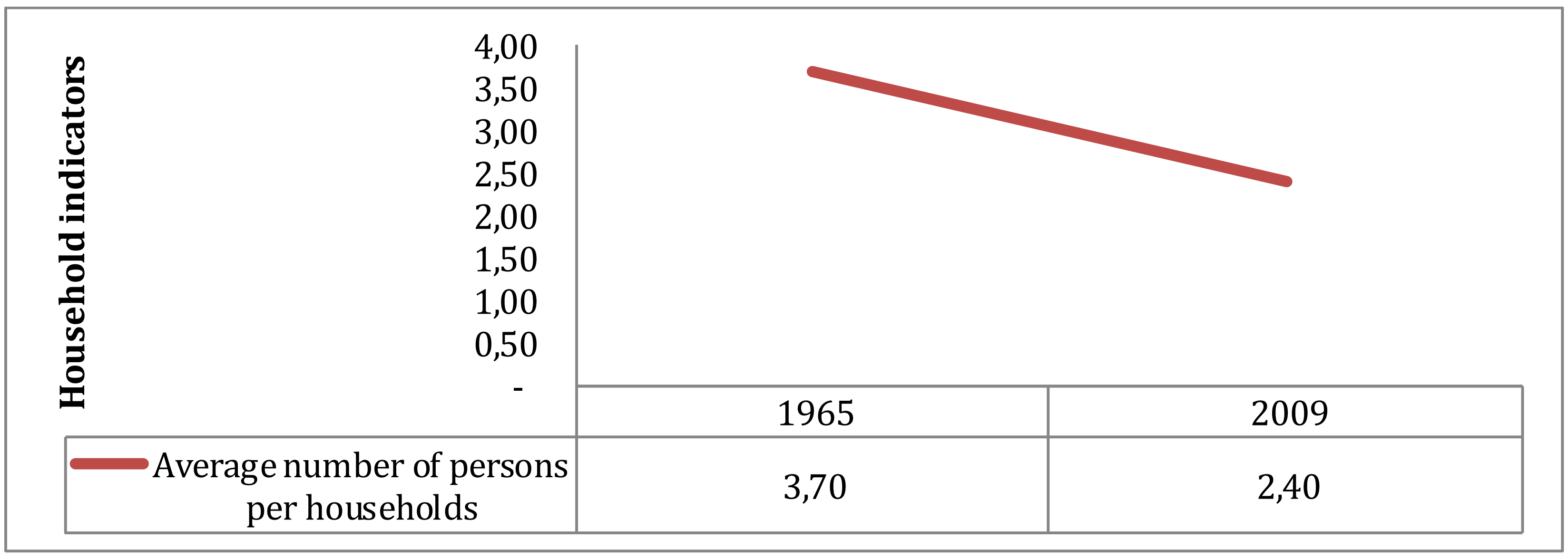


	1970	2010	2050
Children population (0-14 years)	27,03%	15,00%	14,00%
Working age population (15-64 years)	62,83%	68,90%	58,20%
Elderly population (age 65+)	10,14%	16,10%	27,80%

Source: European Commission (2012a); United Nations (2013a); own representation

The formation in the residential trade and industry in Lithuania has a positive growing development. For Cecodhas (2012), the number of households in 2009 was a sum of 1,392,700. By 2030 it is forecasted by the United Nations (2001) to have increased to 1,528,000 households, which demonstrates a development of approximately 9.7% over the period 2009 until 2030. The formation of the clusters of households for current and former decades is not available. Nevertheless, according to the United Nations (1974), the average number of persons per household of 3.7 in 1965 and in dependence to Cecodhas (2012) the number of 2.4 persons per household in 2009 demonstrates a trend towards smaller households over the years (Figure 4.18). The analyses of Eurostat (2010b) demonstrate that in 2007 the movement of the age structures is visible within the household compositions of Lithuania: The share of the single adults under 65 number 12.1% of the total population; single adults aged 65 and older 14.9%; couples both under 65 9.6%, couples where at least one is aged 65 and older 7.9%; others, no under 18s 21.9%; single adults with children 3.8% and two and more adults with children 29.8%. Research by the Ministry of the Interior and Kingdom Relations (2010) demonstrates senior households with a proportion of a minimum of 22.8% in total, which is a relative balanced composition level. 3.7% of the total dwelling stock were vacant in 2001, which is the lowest level of the analysed countries. Therefore, it is estimated that there is a basic realisation of custom-made dwellings.

Figure 4.18 Average number of persons per household in Lithuania

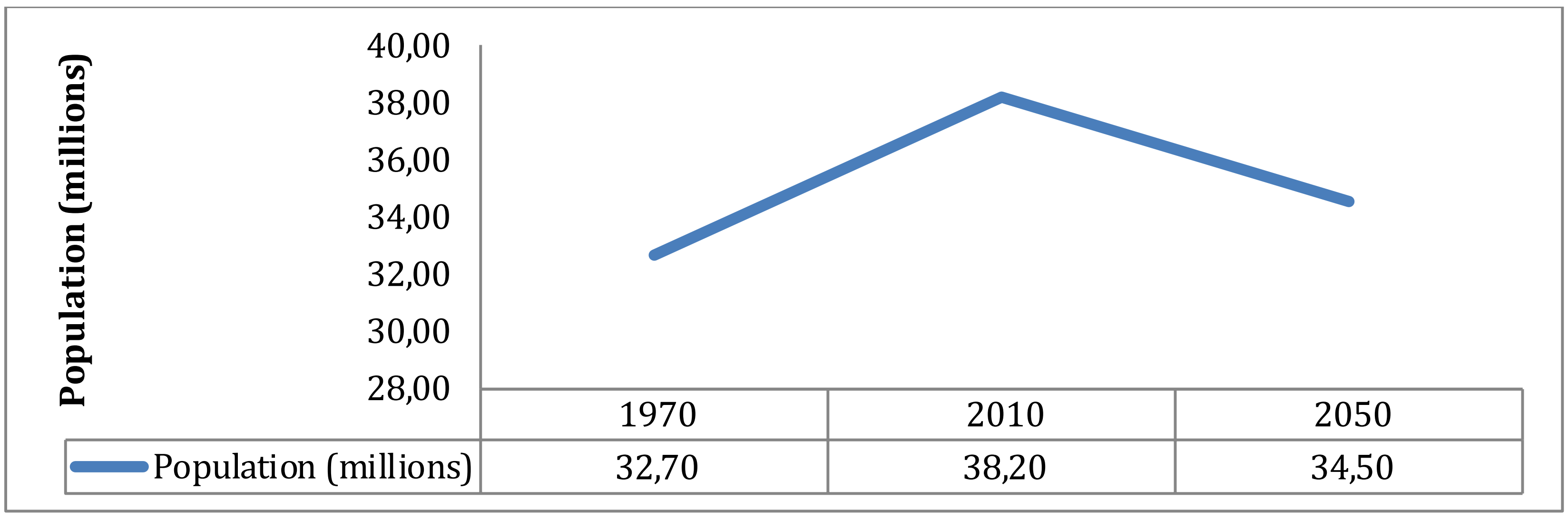


Source: Cecodhas (2012); United Nations (1974); own representation

○ *Poland*

For the European Commission (2012a), Poland embraced in 2010 around 38.2 million inhabitants, which is an increasing formation. According to Eurostat (2010a), in 1970 the population in total had a lower quotation with 32.7 million. According to the European Commission (2012a), by 2050 the population will have shrunk to 34.5 million, which is also a decreasing trend of around 9.7% in the period of 2010 to 2050 (Figure 4.19). Like the other before-analysed countries, this trend would be more important without the increasing development of the net migration percentage from 11.7 thousand in 2010 to 34.2 thousand calculated for 2050 (European Commission, 2012a). The population shrinkage is also like in the other states generated as a result of a small fertility rate, which is on a level of 1.4 in 2010 (European Commission, 2012a). For 2050 it is forecasted that this rate could be established with 1.5 children per woman, which is a marginal increasing level (European Commission, 2012a).

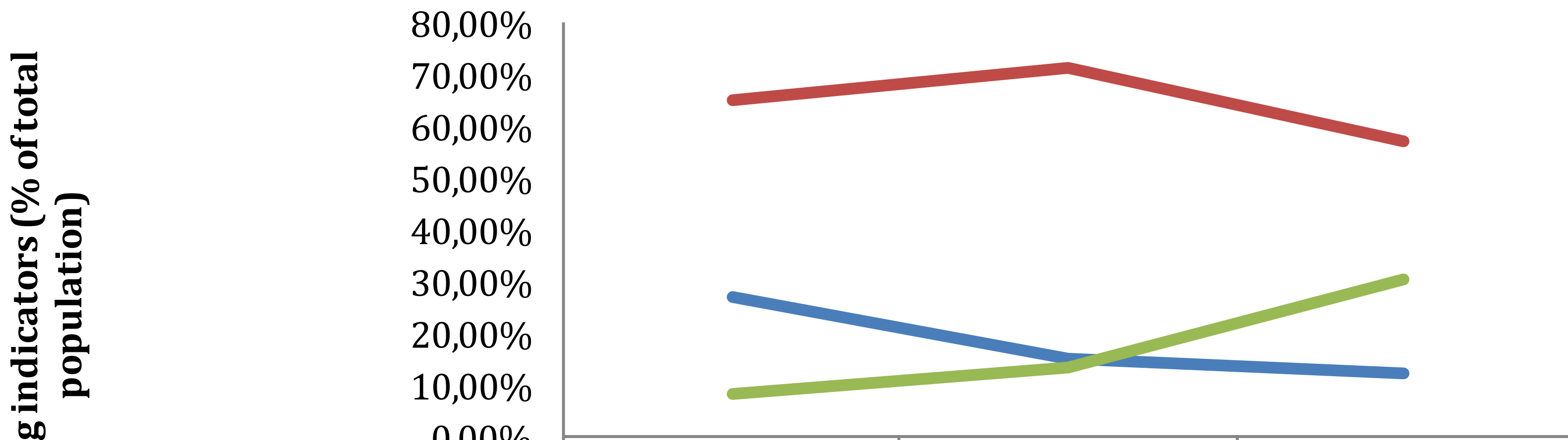
Figure 4.19 Development of the population in Poland



Source: European Commission (2012a); Eurostat (2010a); own representation

The age indicators also have a crucial demographic characteristic in Poland. The age clusters in the base year 1970 of Eurostat (2011a) are not available. According to the European Commission (2012a), today the life expectancies are fixed in 2010 with an average of 71.7 for males and 80.1 for females. In 2050 the forecasts of this organisation (2012a) focus on the life expectancy of the population of 80.6 for males and 86.6 for females. This trend represents a development of plus 8.9 years for males and plus 6.5 years for females from 2010 to 2050. These age tendencies point towards a high ageing process of the population in contrast to most of the other analysed countries. Consequently also the ageing indicators will change. For the United Nations (2013a) in 1970 the cluster of the children's population aged 0 to 14 represented 26.9% of the total population, the working-age population aged 15 to 64 64.9%, and the elderly aged 65 and older nearly 8.3%. Today in the base year 2010 of the European Commission (2012a) the children's population has seen a negative shift to 15.1%, while the elderly have risen to 13.5%. The working population has increased to 71.3%. In 2050 it is forecasted that the children's population will represent 12.5% of the total, the working-age population 56.9% and the elderly 30.6% (European Commission, 2012a). This is a significant shift of minus 53.5% for children, minus 12.3% for the working population and a higher more significant shift of plus 270.9% for the elderly from 1970 to 2050 (Figure 4.20). This development is one of the most important in the researched European Union areas and represents, therefore, a major challenge for the real estate sector. The outcome of the research by the United Nations (2013a) is an increase of the median age from 38.8 in 2013 to 48.9 in 2050.

Figure 4.20 Formation of the ageing indicators in Poland

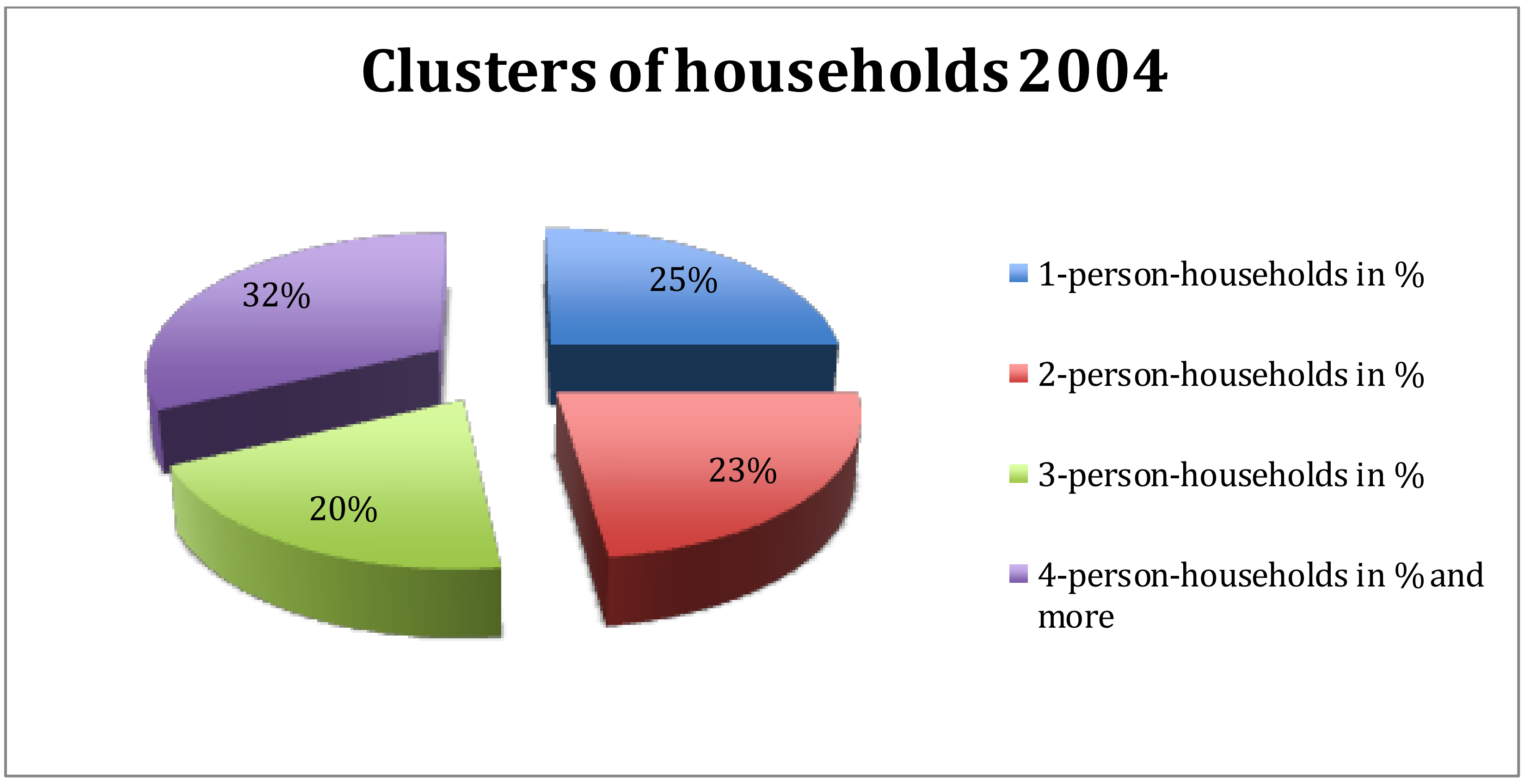


	1970	2010	2050
Children population (0-14 years)	26,89%	15,10%	12,50%
Working age population (15-64 years)	64,86%	71,30%	56,90%
Elderly population (age 65+)	8,25%	13,50%	30,60%

Source: European Commission (2012a); United Nations (2013a); own representation

There has been a tendency towards growth in the residential trade and industry in Poland. According to Cecodhas (2012), in 2009 the total number of households was 13,319,200. By 2030 it is forecasted by the United Nations (2001) to have risen to 14,362,000, which is an approximately 7.8% increase over a period of 21 years. Analyses by the Ministry of the Interior and Kingdom Relations (2010) demonstrate that the current household clusters for 2004 showed a balance: 25.0% 1-person households, 23.0% 2-person households, 20.0% 3-person households and 32.0% 4-and-more-person households (Figure 4.21). Although only the data for 2009 are available, it can still be determined that Poland is shifting towards smaller 1-and-2-person households as the average number of persons per household was 3.5 in 1970 (United Nations, 1974) and it had fallen to 2.8 by 2009 (Cecodhas, 2012). Corresponding to Eurostat (2010b), the movement of the age structures is apparent from the household compositions: In 2007 the share of the single adults under 65 amounted to 11.3% of the total population; single adults aged 65 and older 13.4%; couples both under 65 10.0%; couples where at least one is aged 65 and older 6.6%; others, no under 18s 24.6%; single adults with children 1.8%; and two and more adults with children 32.4%. This demonstrates that senior households represent a minimum of 20.0% of the total, which today points strongly to a balanced age structure. Referred to analyses by the United Nations (1974) and the Ministry of the Interior and Kingdom Relations (2010), the amount of vacant conventional dwellings has changed over the years: in 1970 the figure was 2.6% (United Nations, 1974) and in 2002 5.3% (Ministry of the Interior and Kingdom Relations, 2010). Nevertheless, this represents the 2nd smallest growth after Lithuania among the countries analysed, and it can be concluded that the country consists mainly of stable residential trade and industry portfolio assets because most are in use by the population.

Figure 4.21 Clusters of households in Poland

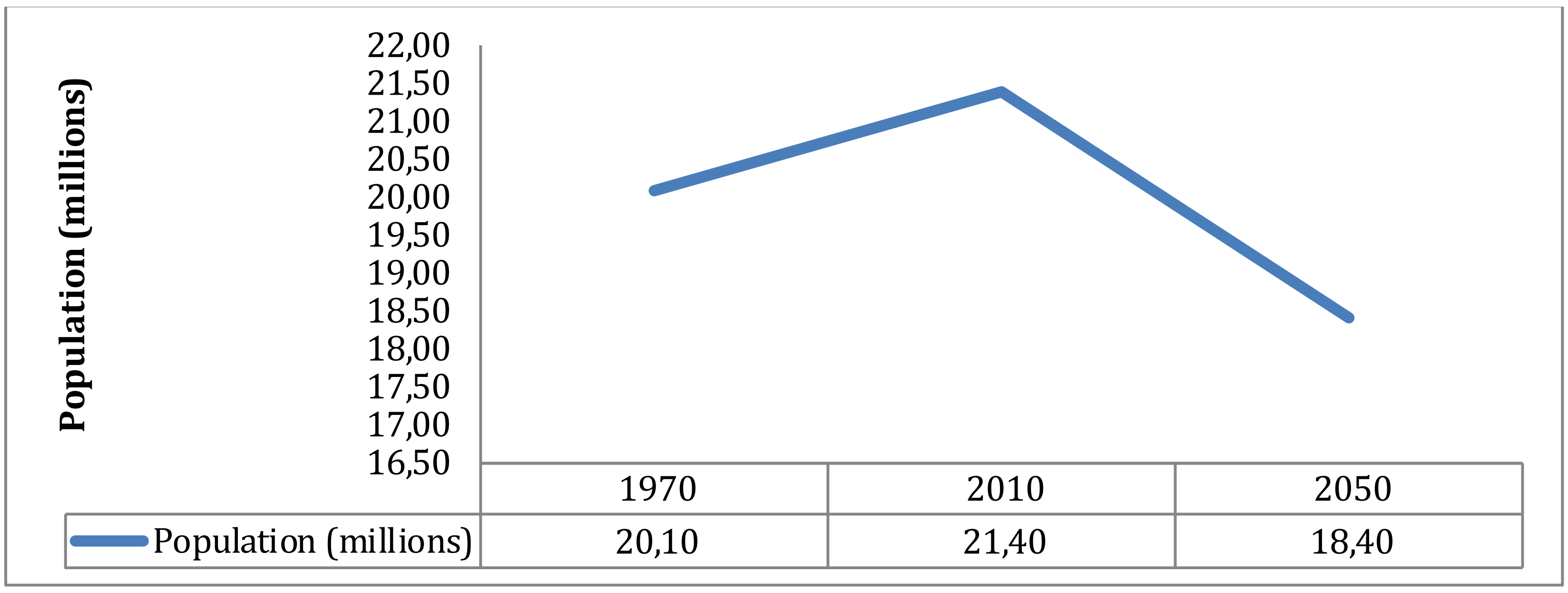


Source: Ministry of the Interior and Kingdom relations (2010); own representation

○ *Romania*

According to the European Commission (2012a), Romania's population in 2010 was around 21.4 million, which represents a decline; corresponding to Eurostat (2010a), in 1970 it was 20.1 million with 18.4 million forecasted by the European Commission (2012a) for 2050 (Figure 4.22). This points to an 8.5% drop from 1970 to 2050. For the European Commission (2012a) also in Romania the net migration has shown a positive development: while the current net migration figures for 2010 showed a negative trend of about minus 0.2 thousand, migration for 2050 is forecasted to be plus 16.8 thousand. While the past fertility rate is not available, the 2010 figure of 1.4 children per woman in 2010 is one of the lowest among the analysed countries (European Commission, 2012a). For 2050 the forecast is marginally more positive at 1.5 (European Commission, 2012a), but remains low.

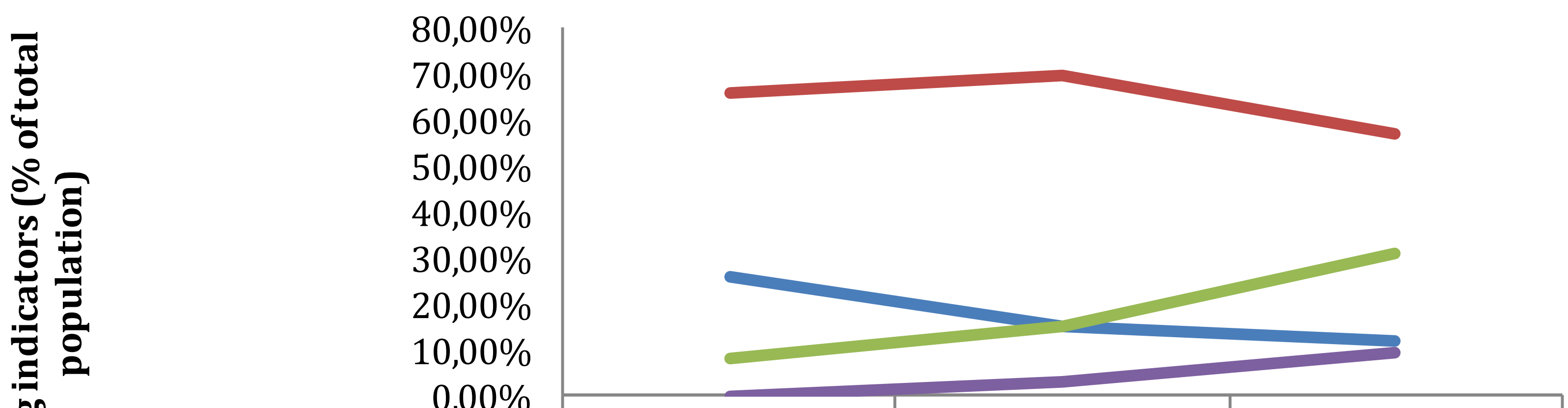
Figure 4.22 Development of the population in Romania



Source: European Commission (2012a); Eurostat (2010a); own representation

For research institutes such as Eurostat and the European Commission, life expectancy develops in an analogical way to the afore-mentioned demographic characteristics of the country: While in 1970 the average life expectancy was 65.8 for males and 70.4 for females (Eurostat, 2011a), in 2010 the figures had risen to 70.0 and 77.5, respectively (European Commission, 2012a). By 2050 they are expected to have risen further to 79.8 and 85.1, respectively (European Commission, 2012a). This demonstrates the significant increase of 21.3% for males and 20.9% for females from the base year 1970 to 2050. According to the United Nations (2013a), in 1970 the children's population aged 0 to 14 represented 25.9% of the total population, the working-age population aged 15 to 64 65.6% and the elderly aged 65 and older nearly 8.5%. Today with the current base year of 2010 of the European Commission (2012a) the children's population has fallen to 15.2%, the elderly population increased to 14.9% and the working population increased to 69.9%. In 2050 it is estimated by the European Commission (2012a) that the children's population will have fallen further to 11.9%, the working-age population dropped to 57.0% and the elderly population increased to 31.1%. The very elderly aged at least 80 years will represent 9.6% (European Commission, 2012a), which is high for this population (Figure 4.23). This is a crucial difference of minus 54.1% in the children's population and plus 267.6% of the elderly population from 1970 to 2050, which is one of the most crucial shifts in the European Union with shrinking populations. According to the United Nations (2013a), the median age in years will also increase from 39.4 in 2013 to a much higher 48.8 in 2050.

Figure 4.23 Formation of the ageing indicators in Romania

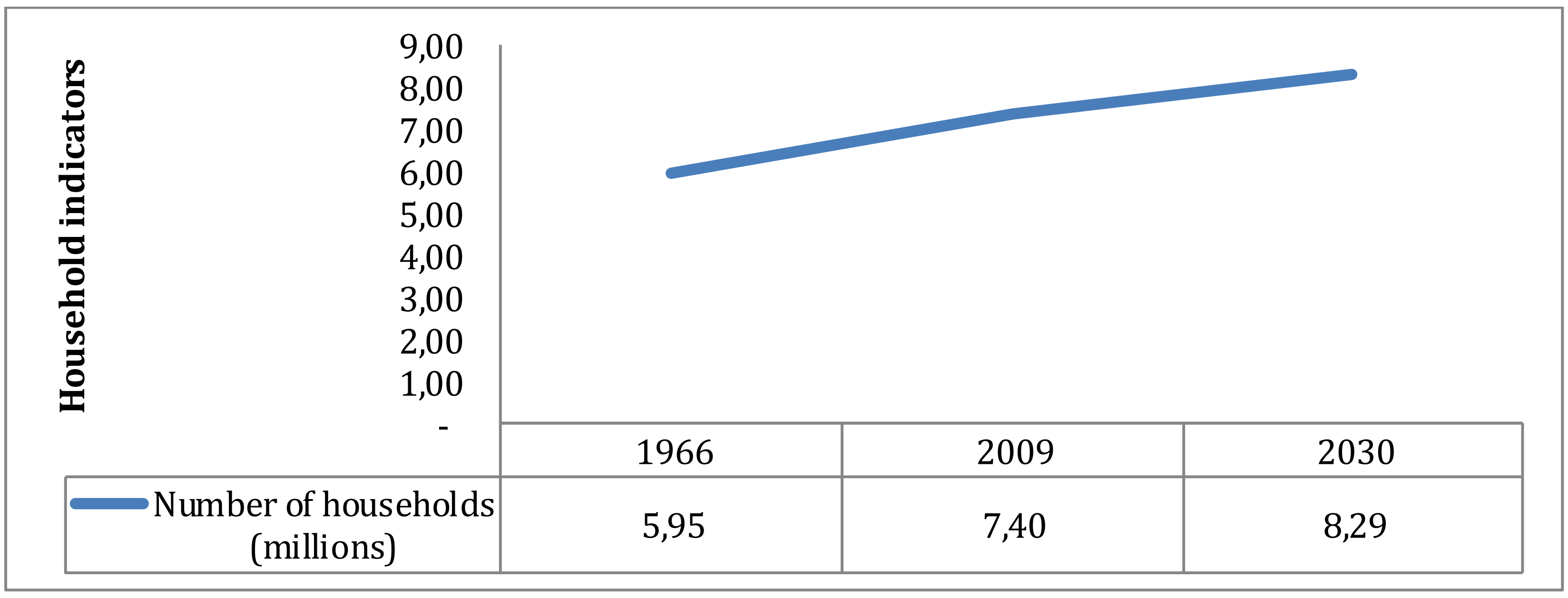


	1970	2010	2050
Children population (0-14 years)	25,91%	15,20%	11,90%
Working age population (15-64 years)	65,62%	69,90%	57,00%
Elderly population (age 65+)	8,46%	14,90%	31,10%
Very elderly population (age 80+)	-	3,20%	9,60%

Source: European Commission (2012a); United Nations (2013a); own representation

The residential trade and industry of Romania has growing structures. In 1966 the sum of households was analysed by the United Nations (1974) with 5,954,555. In accordance with Cecodhas (2012), in 2009 the number was 7,395,700. For the United Nations (2001), in 2030 the formation will increase with a total number of 8,288,000 households, which demonstrate a significant growing trend of about 39.2% over the period 1966 until 2030 (Figure 4.24). Analyses by the United Nations (1974) outline that the clusters of households embrace in 1966 for the 1-person households a share of 14.2%, for 2-person households of 23.4%, for 3-person households of 23.4% and for 4-and more-person households 39.1%; according to the Ministry of the Interior and Kingdom Relations (2010), in 2008 the quotations demonstrate the following shares: 18.0% 1-person households, 27.0% 2-person households, 23.0% 3-person households and 33.0% 4-and-more-person households. The average number of persons per household represents 3.2 in 1966 (United Nations, 1974) and decrease to 2.9 persons per household in 2009 (Cecodhas, 2012).

Figure 4.24 Trend of the number of households in Romania

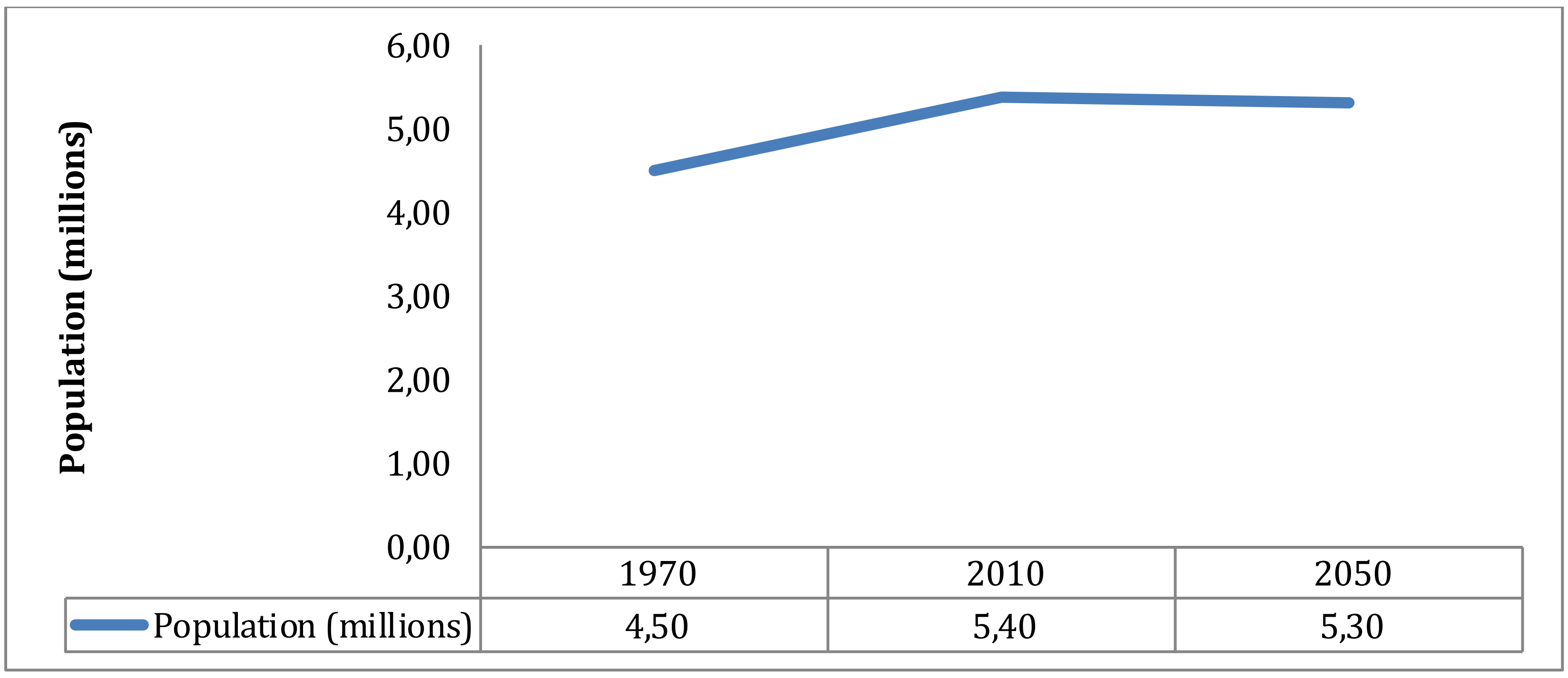


Source: Cecodhas (2012); United Nations (1974); United Nations (2001); own representation

○ *Slovakia*

On the basis of the research by the European Commission (2012a), Slovakia sums in 2010 around 5.4 million inhabitants, which is an important growing tendency of 20.0% in the period 1970 to 2010 as a result of 4.5 million in 1970 (Eurostat, 2010a). The future population 2050 is forecasted by a number of 5.3 million (European Commission, 2012a), which is a tendency to a marginal declining trend of around minus 1.9% in this timeframe from 2010 to 2050 (Figure 4.25). The net migration of Slovakia fixes a positive formation; the net-sum of migrants in 2010 embraces 10.6 thousand and is forecasted with a relatively stable level of 9.9 thousand in 2050 (European Commission, 2012a). According to Eurostat (2011a), the fertility quote of Slovakia is low: In 1970 the rate was on a balanced growing-level with 2.4 children per woman with the result of an increasing population-structure, but shrink to a significant tendency to 1.4 children per woman in 2010 (European Commission, 2012a). For 2050 the estimations of the European Commission (2012a) are marginal more positive with 1.5 children per woman.

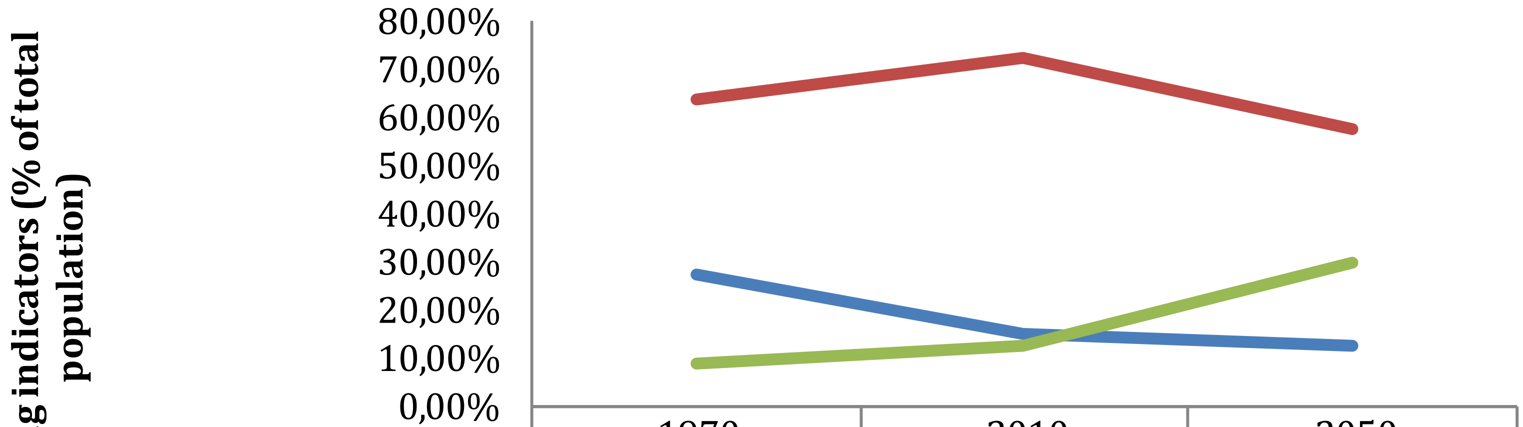
Figure 4.25 Development of the population in Slovakia



Source: European Commission (2012a); Eurostat (2010a); own representation

The shift of the age indicators shows a strong demographic tendency. According to Eurostat (2011a), in 1970 the life average expectancies were 66.8 for males and 73.0 for females, and according to the European Commission (2012a) in 2010 71.6 for males and 79.1 for females. This trend is predicted to develop strongly until 2050 with a life expectancy of 80.3 for males and 86.0 for females (European Commission, 2012a), which represents an increase of about 20.2% for males and 17.8% for females in the period 1970 to 2050. Consequently the ageing indicators will also change significantly. The United Nations (2013a) researches demonstrate that in 1970 the cluster of the children's population aged 0 to 14 represented 27.4% of the total population, the working-age population aged 15 to 64 63.5%, and the elderly aged 65 and older nearly 9.1%. For the European Commission (2012a), by 2010 the children's population had shown a negative shift down to 15.3%, the elderly population an increase to 12.3% and the working population an increase to 72.4%. In 2050 it is forecasted that the children's population will be 12.7%, the working-age population 57.4% and the elderly 29.9% (European Commission, 2012a). This is a significant deviance of minus 53.6% in the children's population and plus 229.7% in the elderly population from 1970 to 2050, which shows a strong shift mainly in the ageing indicators of the senior generation (Figure 4.26). From the point of view of the United Nations (2013a), the median age in years will increase significantly from the current 38.2 to 48.2 in 2050, which is a significant increase of 10 years across this timeframe.

Figure 4.26 Formation of the ageing indicators in Slovakia

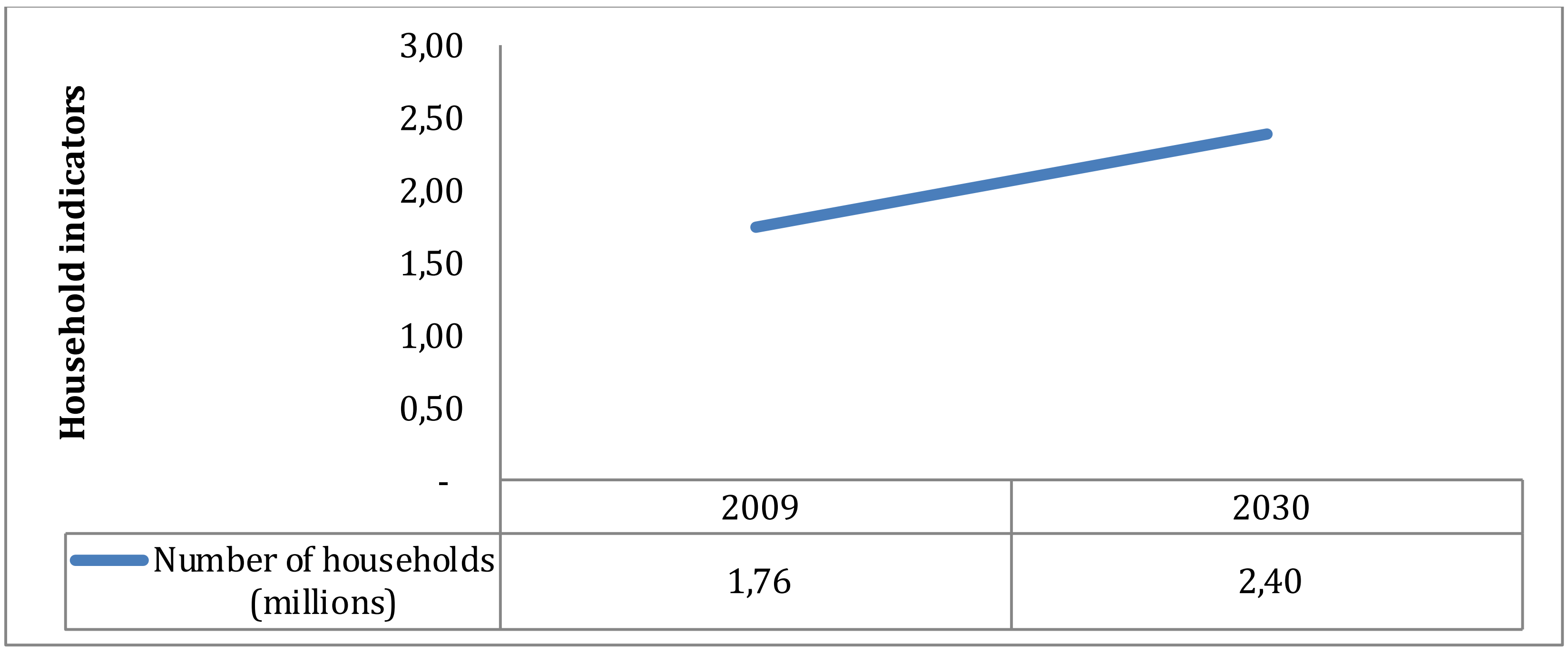


	1970	2010	2050
Children population (0-14 years)	27,43%	15,30%	12,70%
Working age population (15-64 years)	63,50%	72,40%	57,40%
Elderly population (age 65+)	9,07%	12,30%	29,90%

Source: European Commission (2012a); United Nations (2013a); own representation

Slovakia has positive residential trade and industry formations. In compliance with Cecodhas (2012), in 2009 it had 1,756,500 households, forecasted by the United Nations (2001) to have risen to 2,396,000 by 2030, which is an increase of approximately 36.4% over the period 2009 to 2030 (Figure 4.27). The developments in regard to household clusters are relevant here. In 1970 in Czechoslovakia 1-person households represented 14.2% of the total, 2-person households 26.8%, 3-person households 22.1% and 4-and-more-person households 36.9% (United Nations, 1974). For the Ministry of the Interior and Kingdom Relations (2010), by 2004 there had been a major change in 1-person households rising to 26.0%. 2-person households at 22.0% had declined and also 3-person households decreased at 18.0% as well as 4-and-more-person households at 35.0%. According to the United Nations (1974) and Cecodhas (2012), the average number of persons per household in 1961 in Czechoslovakia was 3.1 (United Nations, 1974), which had fallen to 2.8 by 2009 (Cecodhas, 2012). According to analyses by Eurostat (2010b), the changes of the age structure are tied to the household compositions in Slovakia: In 2007 single adults under 65 represented 11.4% of the total population; single adults aged 65 and older 13.1%; couples both under 65 8.0%; couples where at least one is aged 65 and older 7.9%; others, no under 18s 30.1%; single adults with children 1.3%; and two and more adults with children 28.2%. This means that senior households represent a minimum of 21.0%. In reference to the United Nations (1974) and the Ministry of the Interior and Kingdom Relations (2010), in 1961 0.2% of dwellings were vacant (United Nations, 1974) compared to 11.1% in 2008 (Ministry of the Interior and Kingdom Relations, 2010). This current vacancy level is the 2nd highest after Spain, which shows the significantly high non-use of real estate assets in Slovakia.

Figure 4.27 Trend of the number of households in Slovakia

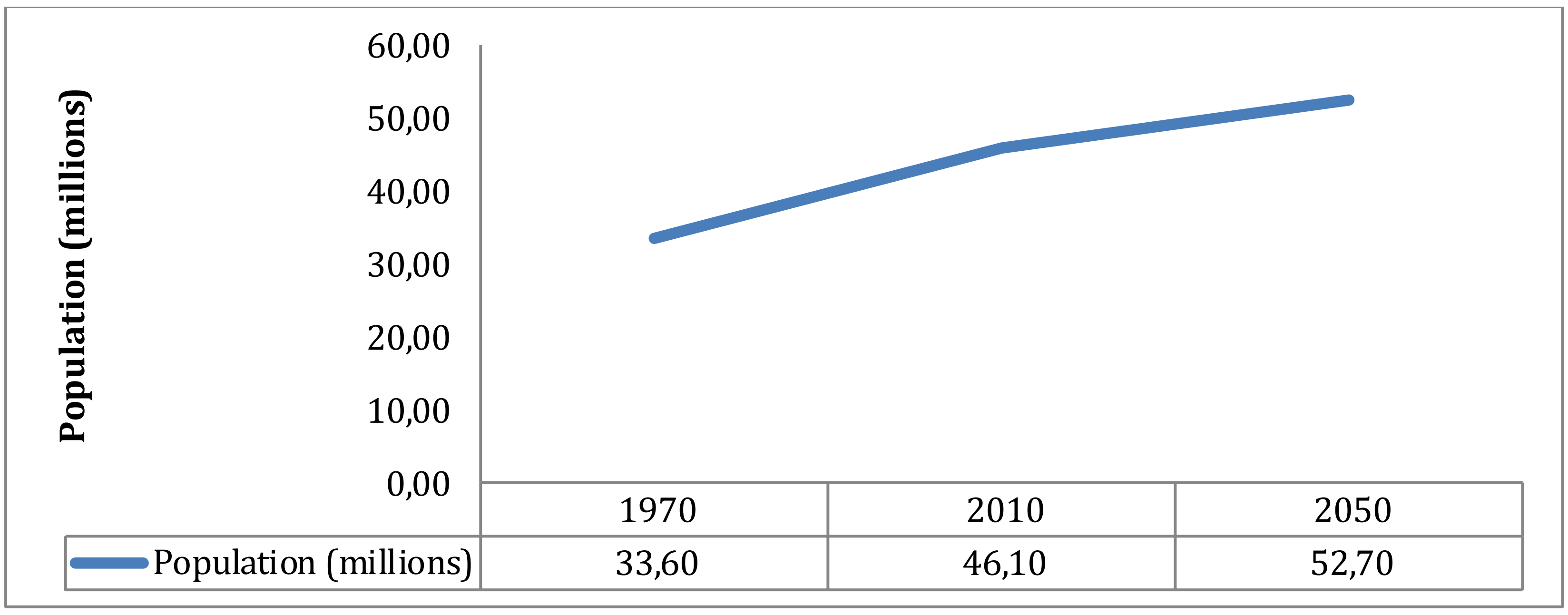


Source: Cecodhas (2012); United Nations (1974); United Nations (2001); own representation

○ *Spain*

The European Commission (2012a) highlights that in 2010 Spain had a population of about 46.1 million, which is an increase of 37.2% since 1970 when it was 33.6 million, according to Eurostat (2010a). In 2050 it is forecasted by the European Commission (2012a) to have risen to 52.7 million, which is again a significant growth trend of around 57.0% across the whole timeframe from 1970 to 2050 (Figure 4.28). The net migration of Spain points to a strong population formation; while the migration figure for 2010 was 79.1 thousand, it is expected to have increased to 209.7 thousand by 2050 (European Commission, 2012a). However, also Spain has low fertility rates: 1.4 children per woman in 2010 and a predicted 1.5 for 2050 (European Commission, 2012a), which is also low.

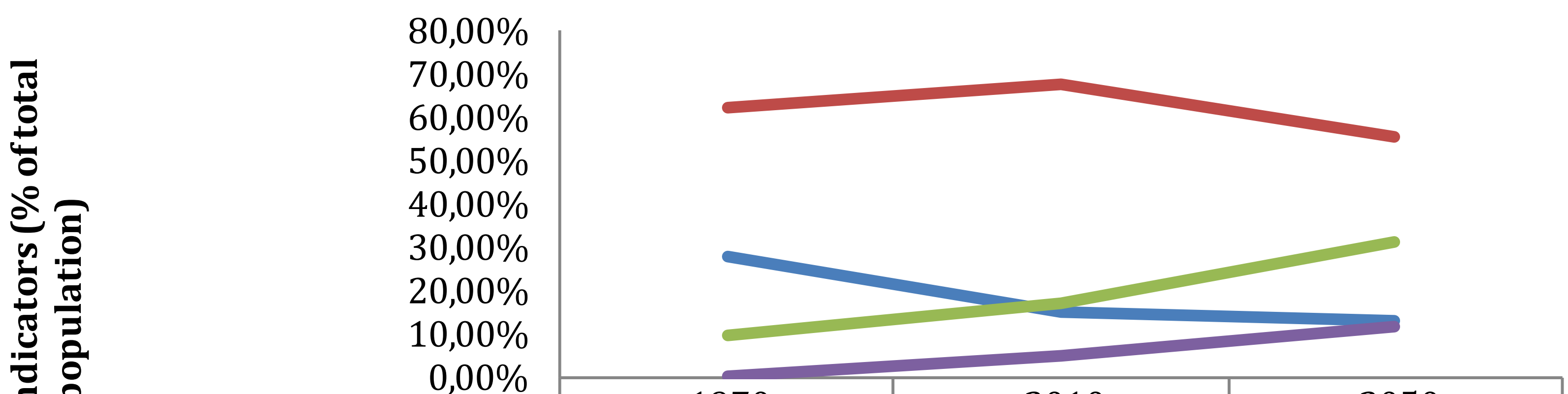
Figure 4.28 Development of the population in Spain



Source: European Commission (2012a); Eurostat (2010a); own representation

In Spain the age indicators demonstrate a shift to a more senior-focused society. The average life expectancies in the base year 2010 of the European Commission (2012a) were 78.6 for males and 84.7 for females. These are forecasted to have risen to 84.2 and 89.0, respectively, by 2050 (European Commission, 2012a). These are the highest for the analysed countries in the European Union, and represents a large increase plus 5.6 years for males and plus 4.3 years for females from 2010 to 2050. As a consequence the ageing indicators will change rapidly. According to the United Nations (2013a), in 1970 the cluster of the children's population aged 0 to 14 represented 27.9% of the total population, the working-age population aged 15 to 64 62.5%, and the elderly aged 65 and older nearly 9.7%. Relating to the European Commission (2012a), today the children's population has seen a negative shift to 15.0%, the elderly population increase to 17.0%, and the working population grow to 68.0%. In 2050 it is forecasted that the children's population will be 13.1%, the working-age population 55.3% and the elderly population 31.6%, which means a very elderly population aged 80 years and older of 11.5% (European Commission, 2012a). This is a significant deviance of minus 53.0% in the children's population and plus 227.1% in the elderly population from 1970 to 2050, which also shows a significant large difference between the former and future years (Figure 4.29). Therefore, the median age in years is estimated to increase from 41.4 in 2013 to 50.4 in 2050 (United Nations, 2013a). This predicted median age for 2050 is the 2nd highest age after Germany.

Figure 4.29 Formation of the ageing indicators in Spain

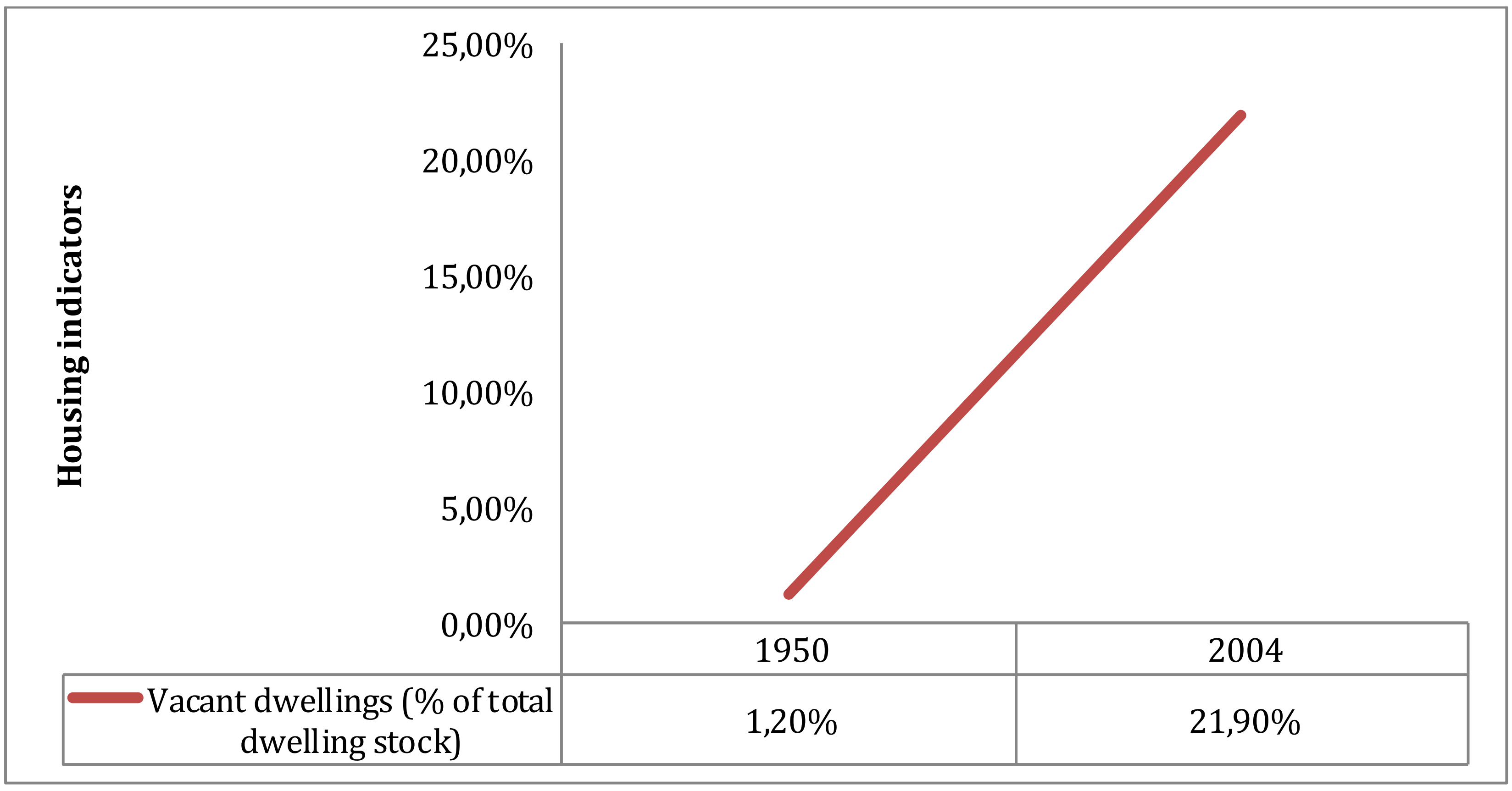


	1970	2010	2050
Children population (0-14 years)	27,89%	15,00%	13,10%
Working age population (15-64 years)	62,45%	68,00%	55,30%
Elderly population (age 65+)	9,66%	17,00%	31,60%
Very elderly population (age 80+)	-	5,00%	11,50%

Source: European Commission (2012a); United Nations (2013a); own representation

The formation in the residential trade and industry in Spain is declining. With regard to Cecodhas (2012), in 2009 the total number of households was 17,076,300. By 2030 it is forecasted by the United Nations (2001) to have fallen to 12,713,000, which is a significant decrease of approximately 25.6% over the period 2009 to 2030. For the Ministry of the Interior and Kingdom Relations (2010), in 2008 the development of household clusters was balanced: 1-person households 18.0% and 2-person households 29.0%, 3-person households 26.0% and 4-and-more-person households 26.0%. According to research by the United Nations (1974), the average number of persons per household was 4.0 in 1960, which had shown a marked decrease to 2.1 by 2009 (Cecodhas, 2012). The movement of the age structures are defined by Eurostat (2010b) within the household compositions of Spain: The share of single adults under 65 represents 8.6% of the total population; single adults aged 65 and older 8.7%; couples both under 65 12.2%; couples where at least one is aged 65 and older 10.0%; others, no under 18s 29.2%; single adults with children 1.1%; and two and more adults with children 30.2%. This demonstrates a balance among senior households with a minimum of 18.7%. According to the United Nations (1974), in 1950 1.2% of dwellings were vacant, with a crucial shift to 21.9% in 2004 (Ministry of the Interior and Kingdom Relations, 2010). This is the highest among the researched European Union countries, with the conclusion that the real estate sector is in a sharp decline today (Figure 4.30).

Figure 4.30 Formation of vacant dwellings in Spain



Source: Eurostat (2010b); Ministry of the Interior and Kingdom Relations (2010); own representation

For a widespread perspective, the space progress with its analyses is outlined in the following.

4.1.2 Space progress

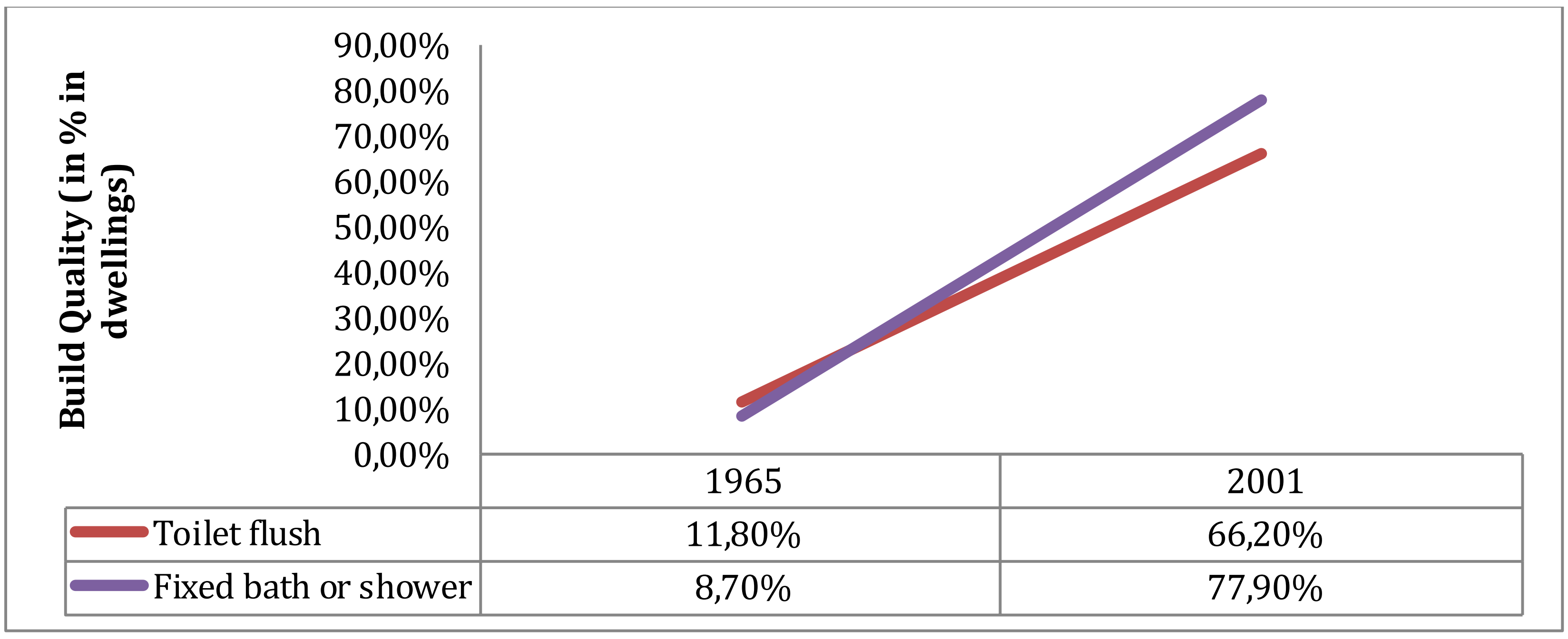
In this sub-chapter, the space progress within the analysed countries is evaluated to also embrace the supply perception of real estate markets.

- *Bulgaria*

Because the age distribution of the housing stock for this country is not available, an interpretation of the age distribution for the future is not possible. However, the housing amenities were recorded from 1965 to 2001 by the United Nations: Housing with flush toilets increased from 11.8% (United Nations, 1974) to 66.2% (United Nations, 2012); residences with a fixed bath or shower rose from 8.7% (United Nations,

1974) to 77.9% (United Nations, 2012) which demonstrates a significant movement towards custom-fit real estate assets:

Figure 4.31 Build quality inside the housing in Bulgaria

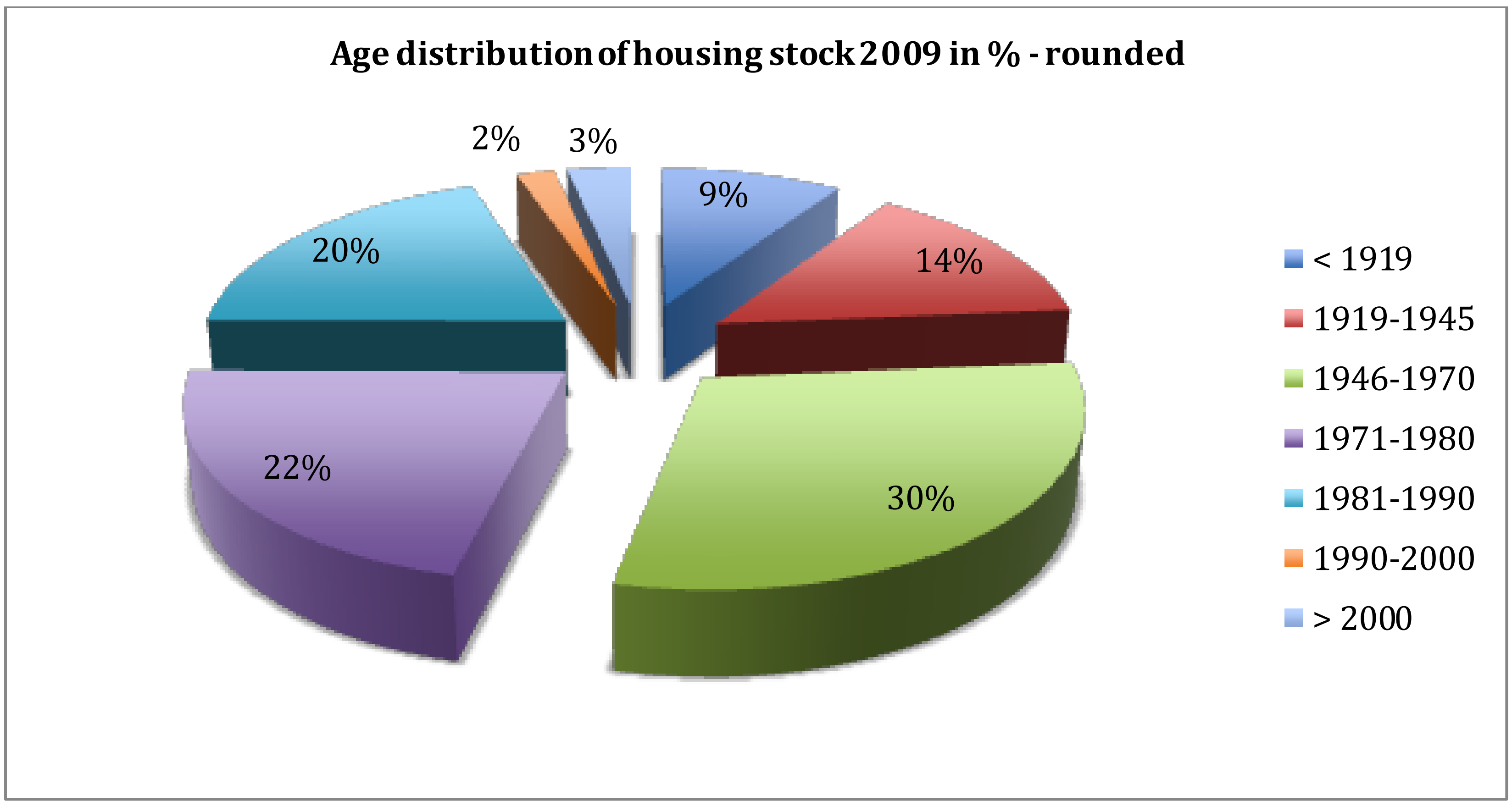


Source: United Nations (1974); United Nations (2012); own representation

- *Estonia*

According to analyses by the Ministry of the Interior and Kingdom Relations (2010), the age composition of housing stock of Estonia in 2009 is remarkable: a relatively high share of 9.4% of the housing stock had a construction year older than 1919; 14.2% were constructed between 1919 and 1945, 30.0% between 1946 and 1970, 21.5% between 1971 and 1980, 19.6% between 1981 and 1990, 2.0% between 1990 and 2000 and 3.3% are relatively new built since 2000. The result is housing stock, of which 53.6% is older than 45 years with the earliest construction at least > 96 years (Figure 4.32). Consequently a need will arise for refurbishments, new constructions and modernizations in the coming years and decades. The average number of rooms per dwelling is 3.3 (Ministry of the Interior and Kingdom Relations, 2010), which is in contrast to the demographic shift of the state.

Figure 4.32 Trend of the age distribution of housing stock in Estonia

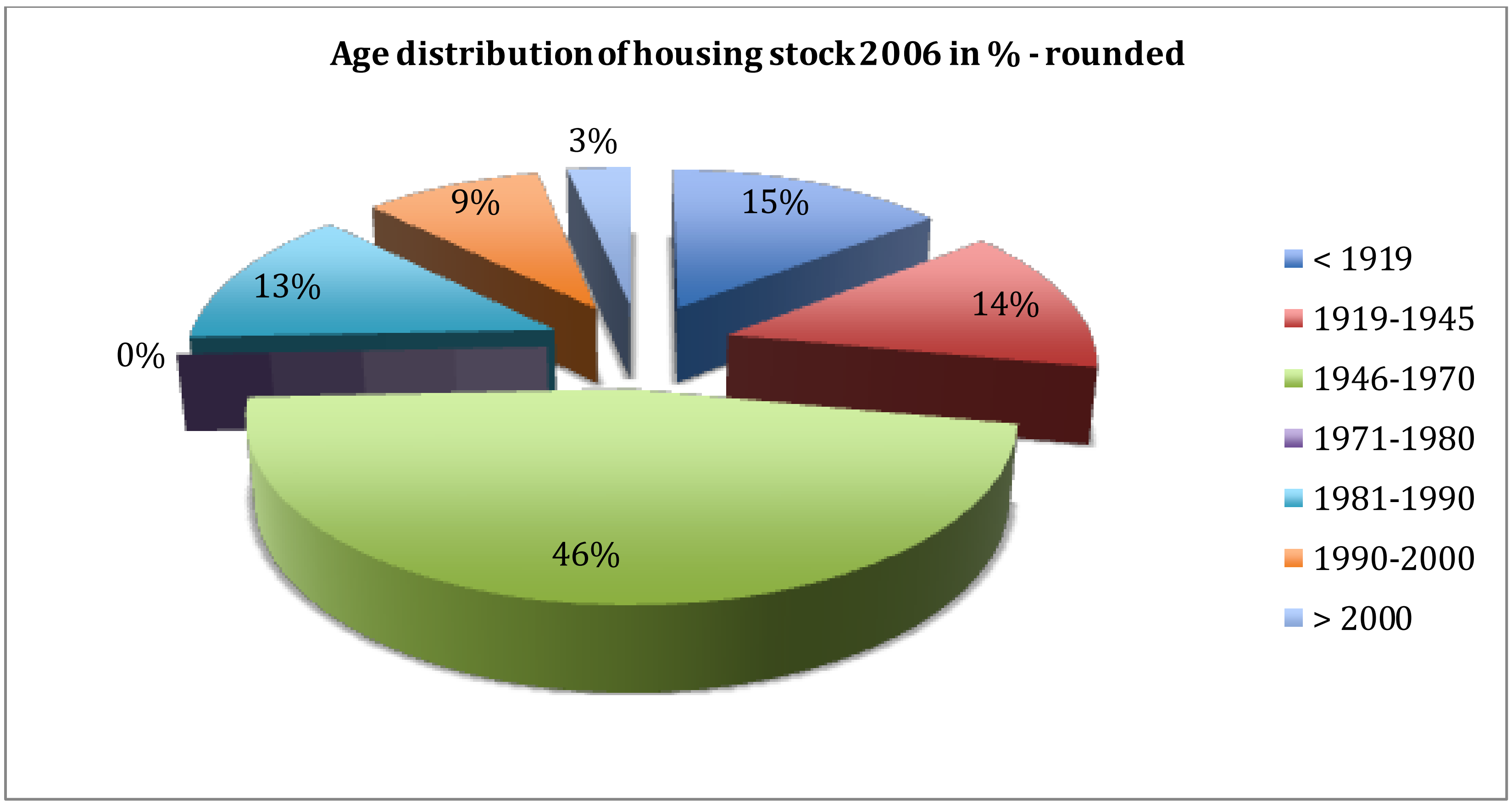


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

- *Germany*

For the Ministry of the Interior and Kingdom Relations (2010) in Germany the age formation of housing stock in 2006 had a strong and unbalanced tendency: a high share of 14.4% was built prior to 1919, 13.6% between 1919 and 1945, a significant 46.3% between 1946 and 1970, near 0.0% between 1971 and 1980, 13.2% between 1981 and 1990, just 9.2% between 1990 and 2000 and a low rate of 3.3% since 2000 (Figure 4.33). Consequently 74.3% of housing stock is older than 45 years, which demonstrates a high rate of old residential trade and industry assets with the need of advancement and further development. The average number of rooms per dwelling also has an adverse balance and was 4.4 in 2008 (Ministry of the Interior and Kingdom Relations, 2010). This points to a tendency that runs counter to the demographic development of household sizes in Germany.

Figure 4.33 Trend of the age distribution of housing stock in Germany

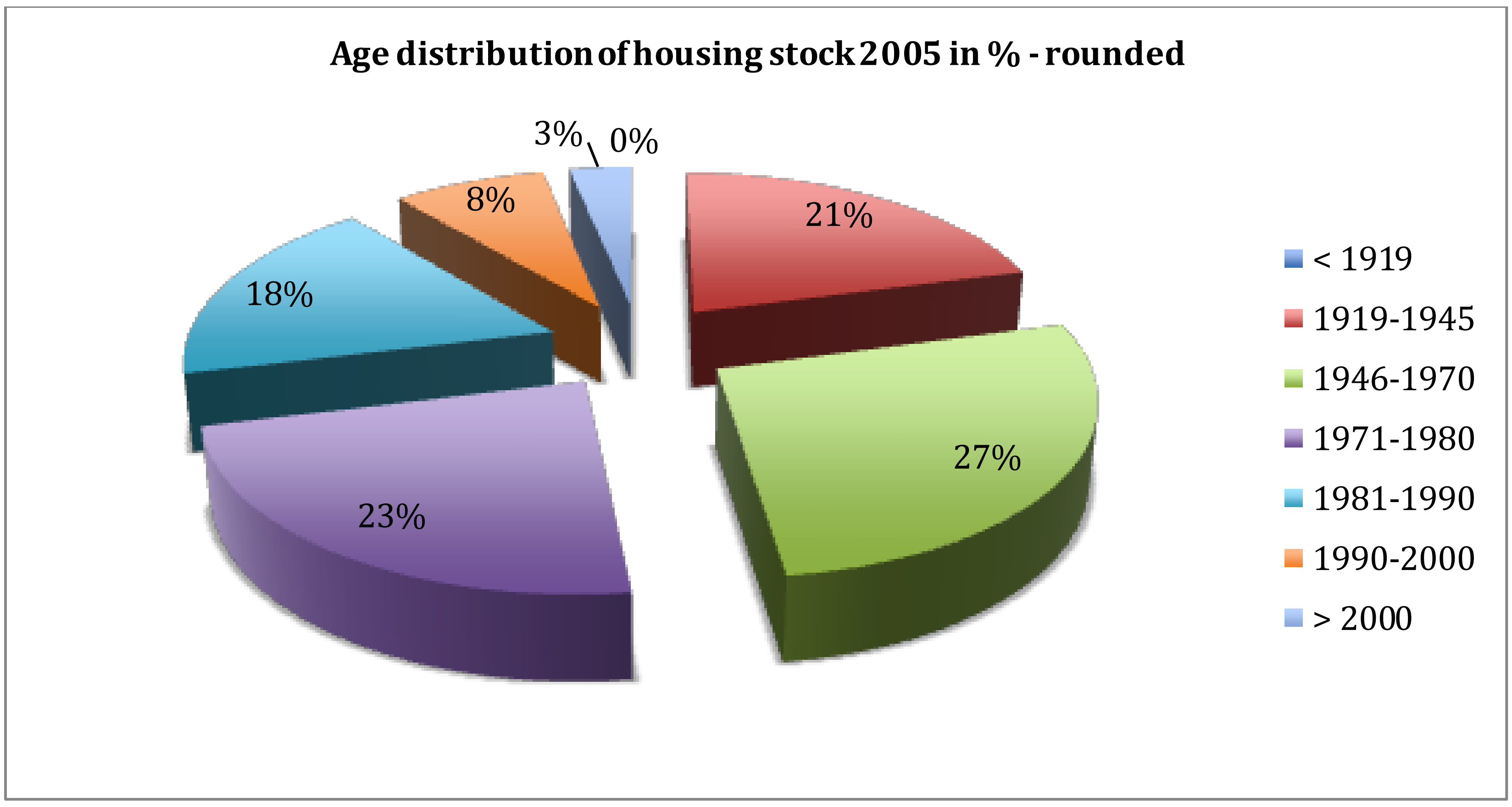


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

- *Hungary*

According to the Ministry of the Interior and Kingdom Relations (2010), the age composite of housing stock of Hungary in 2005 was as follows: near 0.0% of the housing stock had a construction year prior to 1919, 20.8% had one between 1919 and 1945, a significant 27.2% between 1946 and 1970, 23.1% between 1971 and 1980, 17.8% between 1981 and 1990, 7.9% between 1990 and 2000, and just 3.2% are new constructions built after 2000 (Figure 4.34). As a result the share of housing stock built earlier than 1970 is 48.0%, which demonstrates a more balanced rate of old residential trade and industry assets in contrast to the afore-mentioned analysed states. The average number of rooms per dwelling was 2.6 in 2010 (Ministry of the Interior and Kingdom Relations, 2010), which is low and in line with the trend of smaller households in future. Corresponding to the United Nations (1974, 2012), the housing amenities were recorded from 1970 to 2001: housing with a flush toilet increased from 32.7% (United Nations, 1974) to 86.5% (United Nations, 2012); residences with a fixed bath or shower rose from 32.2% (United Nations, 1974) to 88.8% (United Nations, 2012), which is a significant development.

Figure 4.34 Trend of the age distribution of housing stock in Hungary

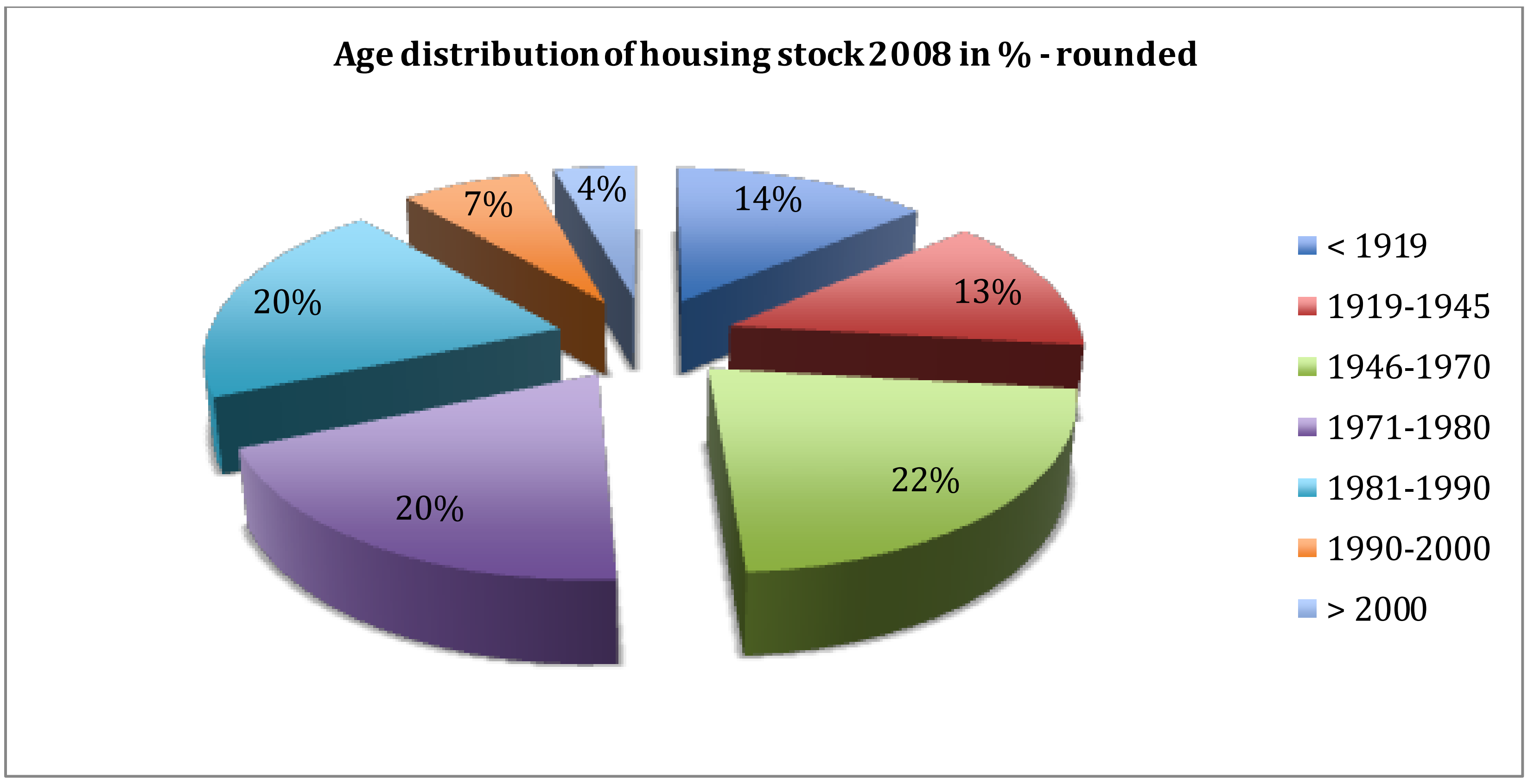


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

○ *Latvia*

Corresponding to research by of the Ministry of the Interior and Kingdom Relations (2010), the age consistency of housing stock of Latvia in 2008 was at a high percentage of 13.8% for buildings built before 1919, 13.1% were constructed between 1919 and 1945; a significant 22.1% between 1946 and 1970, 19.4% between 1971 and 1980, 20.2% between 1981 and 1990, 7.0% between 1990 and 2000 and just 4.4% after 2000. 49.0% of housing stock was constructed earlier than 1970, which points to a more balanced rate of newer residential trade and industry assets in contrast to other countries mentioned before (Figure 4.35). In 2008 the average number of rooms per dwelling was 2.5 (Ministry of the Interior and Kingdom Relations, 2010). These shifts could be useful for the movement to smaller households in future. Furthermore, according to the United Nations (2012), the interior quality of housing stock is improving: in 2000 79.7% of the total dwelling stock had a piped water system, 72.8% a flush toilet, 98.6% electric lighting, and 67.3% a fixed bath or shower.

Figure 4.35 Trend of the age distribution of housing stock in Latvia

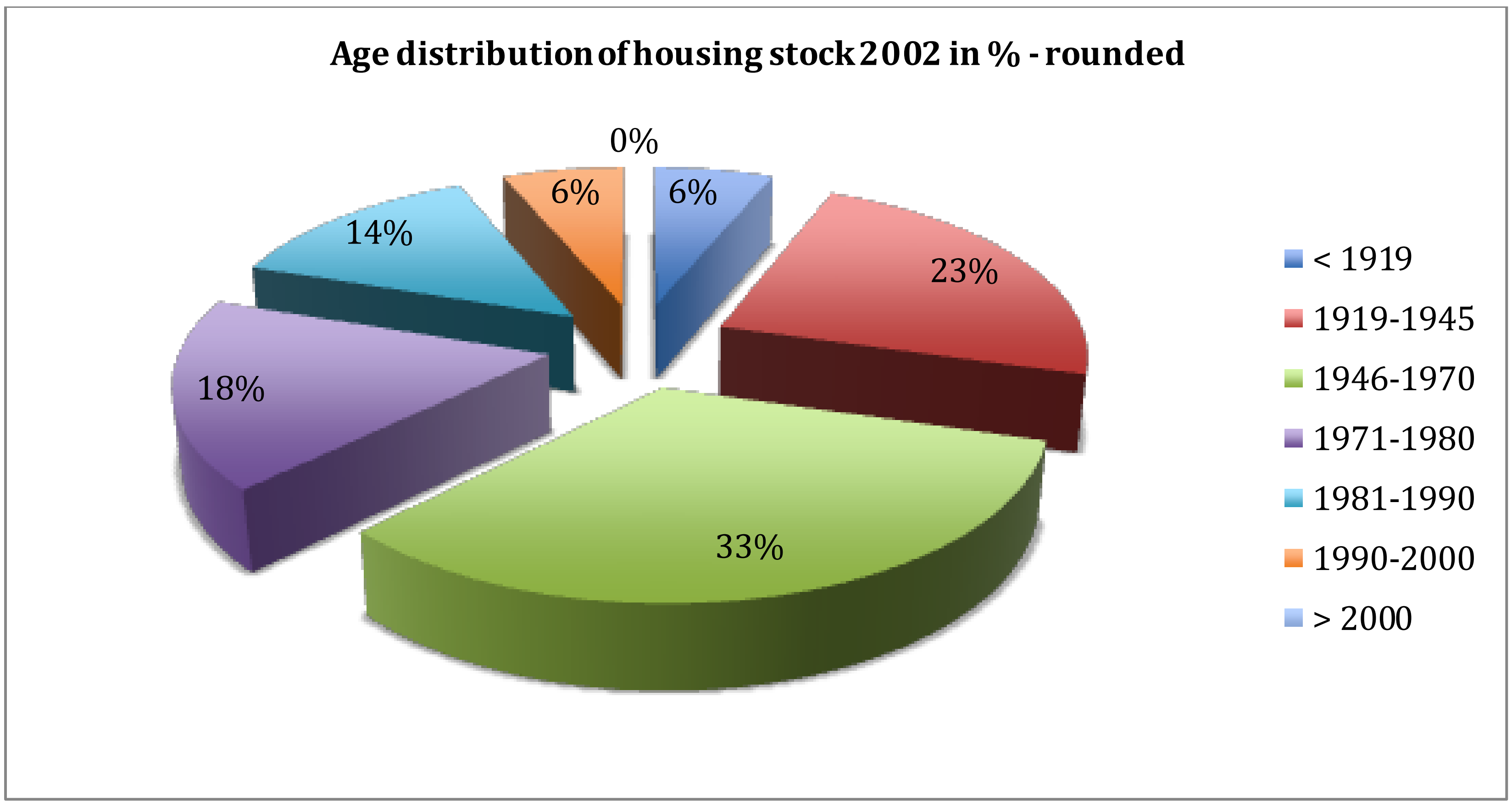


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

o *Lithuania*

For the Ministry of the Interior and Kingdom Relations (2010), in 2002 in Lithuania the age mixture of housing stock was at an unbalanced level: 6.2% of the housing stock was built prior to 1919, a significant 23.3% between 1919 and 1945, a high 33.1% between 1946 and 1970, 17.6% between 1971 and 1980, 14.5% between 1981 and 1990, 6.3% between 1990 and 2000, and nearly 0.0% after 2000 (Figure 4.36). As a result the share of housing stock older than 45 years was 62.6%, which demonstrates a significant rate of old residential trade and industry assets and nearly a zero percentage of new buildings built after 2000. The average number of rooms per dwelling was 2.5 in 2003 (Ministry of the Interior and Kingdom Relations, 2010). This figure makes concessions to the demographic tendency in this country, which is an advantage for the residential trade and industry in this field.

Figure 4.36 Trend of the age distribution of housing stock in Lithuania

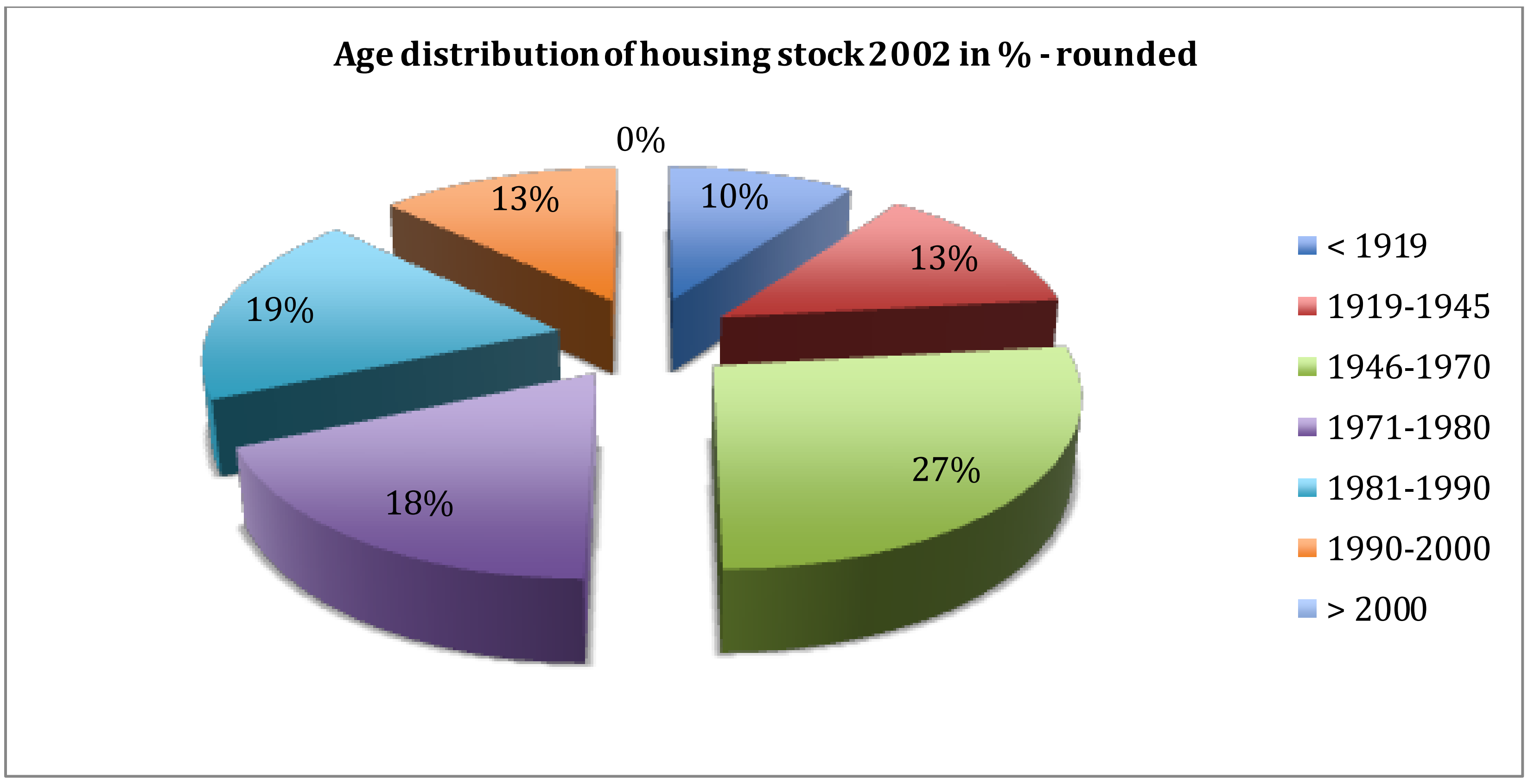


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

- *Poland*

Corresponding to the Ministry of the Interior and Kingdom Relations (2010), in Poland the age of housing stock in 2002 comprised a high 10.1% built prior to 1919, 13.1% between 1919 and 1945, again a high 26.9% between 1946 and 1970, 18.3% between 1971 and 1980, 18.7% between 1981 and 1990, 12.9% between 1990 and 2000, and nearly 0.0% after 2000 (Figure 4.37). 50.1% of the housing stock is at least 45 years old; therefore, there will be a need for asset development such as in regard to refurbishments, new constructions and modernizations in the coming years and decades. The average number of rooms per dwelling was 3.7 in 2008 (Ministry of the Interior and Kingdom Relations, 2010). This is high with a view to the country's demographic development tending towards non-custom-fit dwellings.

Figure 4.37 Trend of the age distribution of housing stock in Poland

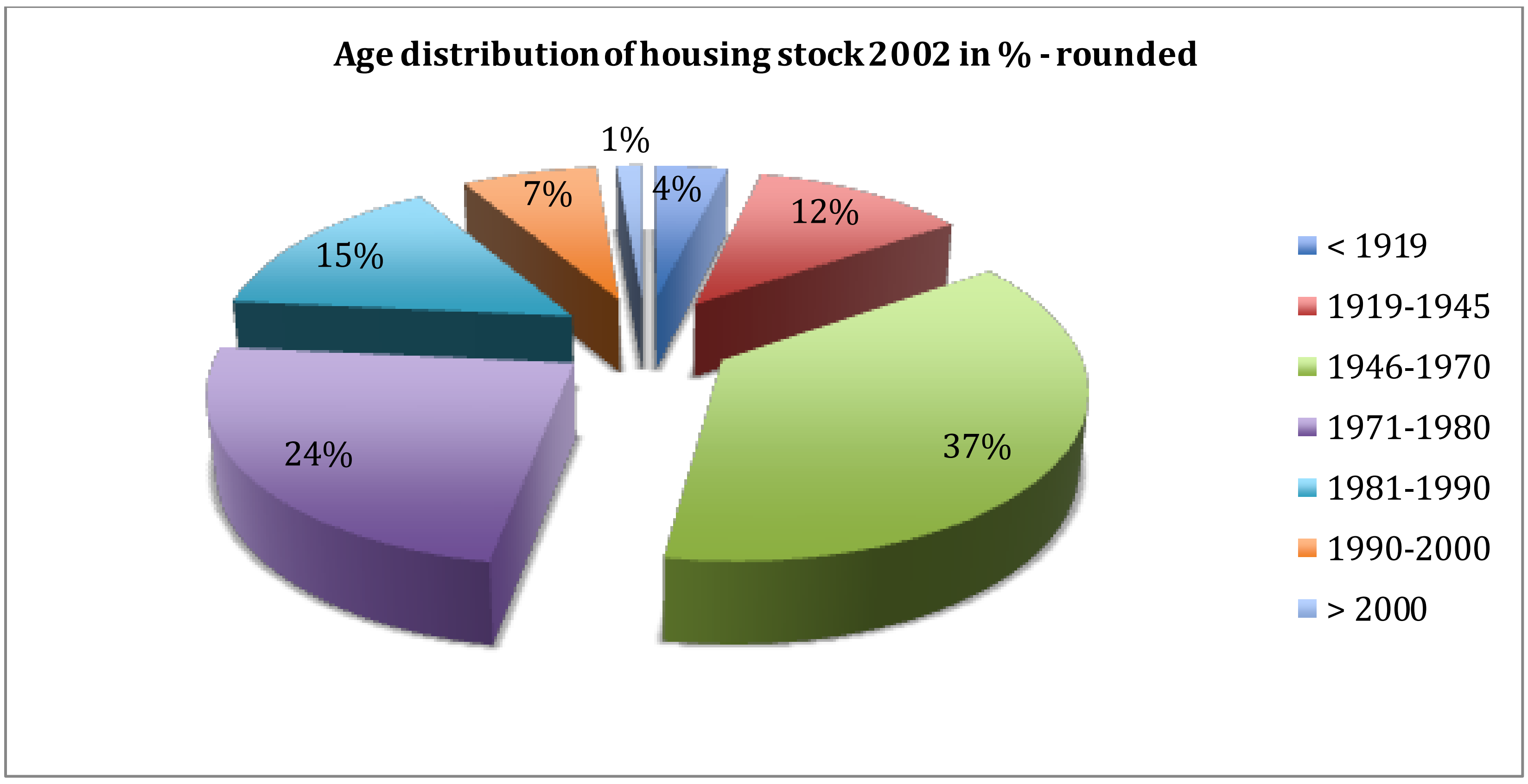


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

- *Romania*

Research by the Ministry of the Interior and Kingdom Relations (2010) highlights that Romania had the following age distributions of housing stock in 2002: just 3.9% was constructed later than 1919, 11.5% between 1919 and 1945, a significant 37.3% between 1946 and 1970, 23.8% between 1971 and 1980, 14.8% between 1981 and 1990, 7.3% between 1990 and 2000, and just 1.4% after 2000 (Figure 4.38). 52.7% of housing stock was constructed earlier than 1970, which points to a more balanced rate of newer residential trade and industry assets in contrast to other countries mentioned earlier. In 2008 the average number of rooms per dwelling was 2.6 (Ministry of the Interior and Kingdom Relations, 2010). This represents a shift in a direction that could be useful for the movement to smaller households in future.

Figure 4.38 Trend of the age distribution of housing stock in Romania

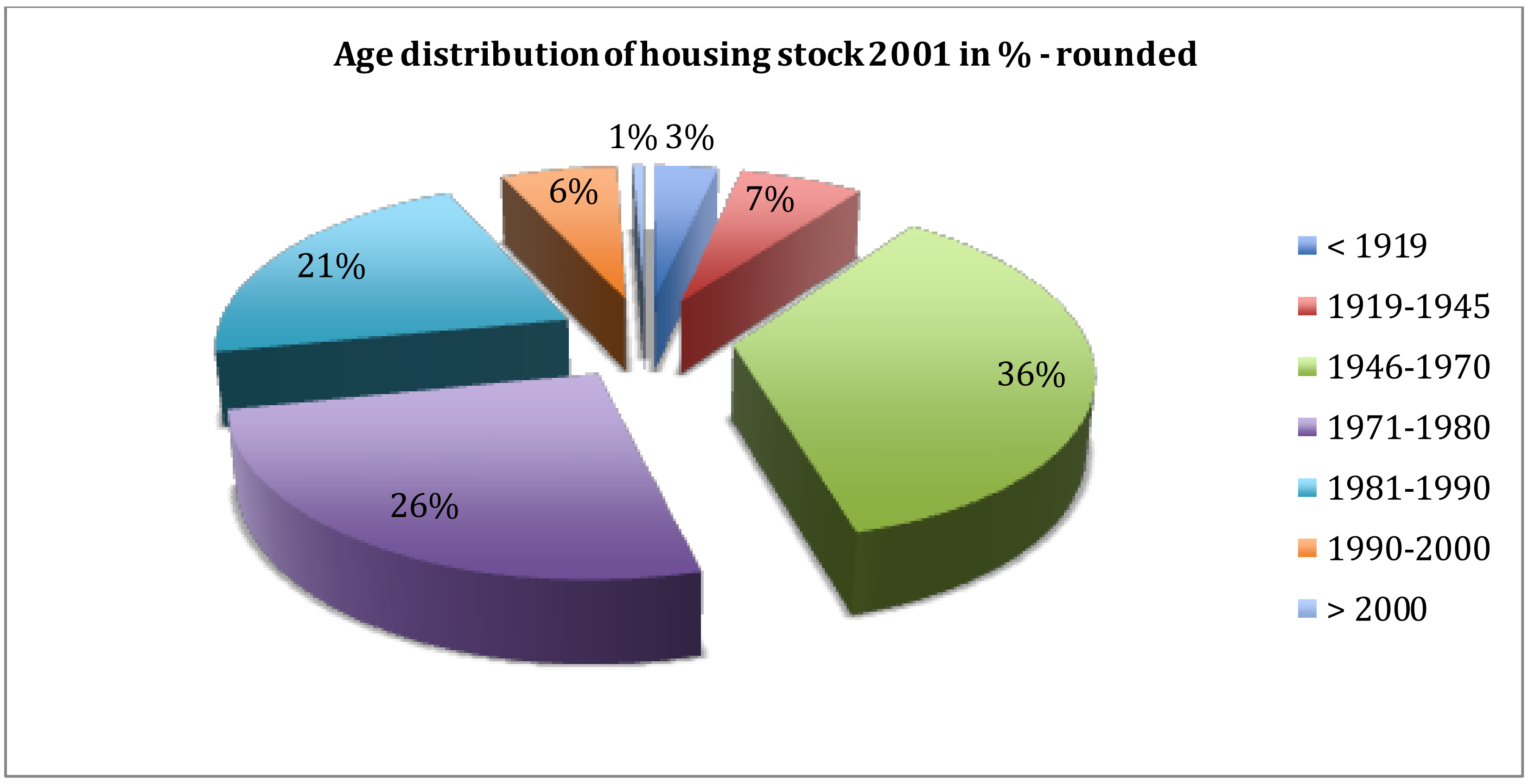


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

○ *Slovakia*

According to the Ministry of the Interior and Kingdom Relations (2010), Slovakia has a more balanced rate of old real estate assets. The age distribution of real estate assets in 2001 was as follows: 3.4% had a construction year prior to 1919, a low 6.6% between 1919 and 1945, the major portion of 35.1% between 1946 and 1970, a high 25.6% between 1971 and 1980, 21.0% between 1981 and 1990, just 6.2% between 1990 and 2000, and a marginal 0.6% are newer buildings built after 2000 (Figure 4.39). Therefore, the share of housing stock constructed in 1970 and earlier was 45.1%, which is a low and balanced rate of old residential trade and industry assets. The average number of rooms per dwelling was 3.2 in 2001 (Ministry of the Interior and Kingdom Relations, 2010). This share is high in front of the demographic development of the country.

Figure 4.39 Trend of the age distribution of housing stock in Slovakia

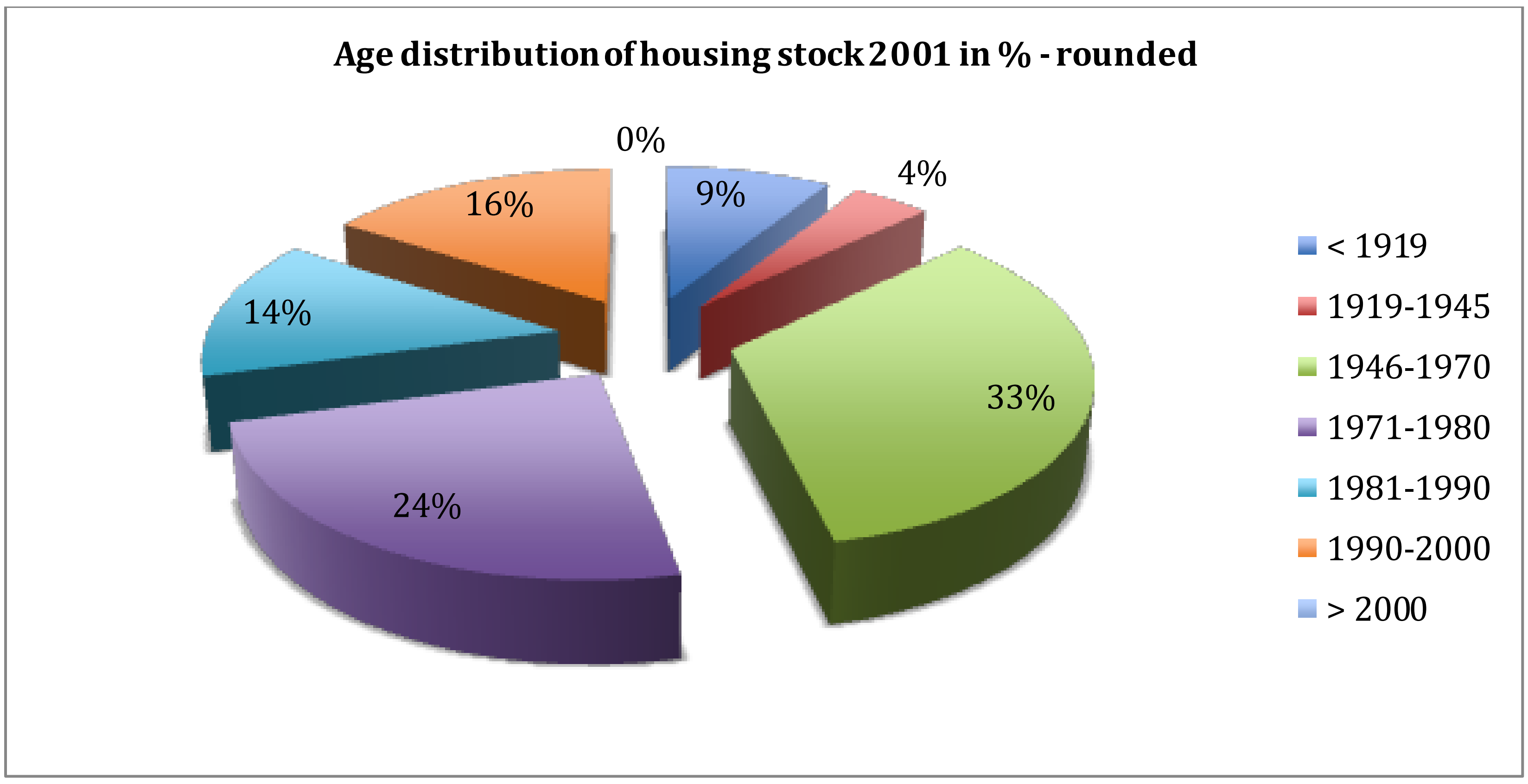


Source: Ministry of the Interior and Kingdom Relations (2010); own representation

○ *Spain*

For the Ministry of the Interior and Kingdom Relations (2010), the age mixture of housing assets of Spain in 2001 is notable: 8.9% of the housing stock was built prior to 1919, 4.2% between 1919 and 1945, a significant 33.5% between 1946 and 1970, again a high 24.1% between 1971 and 1980, 13.6% between 1981 and 1990, 15.7% between 1990 and 2000, and a remarkable nearly 0.0% after 2000 (Figure 4.40). Therefore, 46.6% of housing was older stock constructed before 1970; these rates demonstrate an equated proportion of age distributions. The average number of rooms per dwelling was 5.1 in 2008 (Ministry of the Interior and Kingdom Relations, 2010), which is very high and stands in significant contrast to the demographic tendencies of the country.

Figure 4.40 Trend of the age distribution of housing stock in Spain



Source: Ministry of the Interior and Kingdom Relations (2010); own representation

To round off the basic developments within the residential trade and industry, the environmental social progress is highlighted next.

4.1.3 Environmental social progress

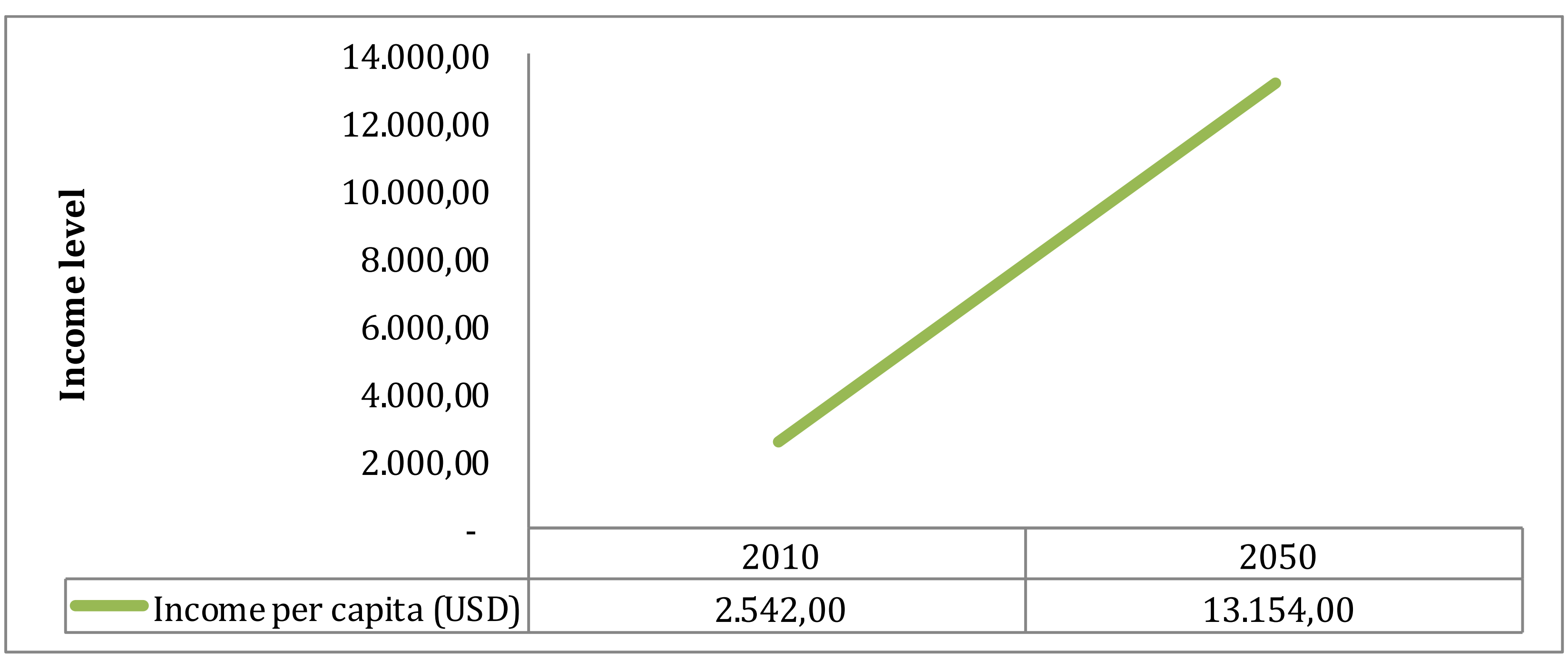
As specific demand as well as supply viewpoints are analysed before, the environmental social progress with its economical features is reflected next.

- *Bulgaria*

The Ministry of the Interior and Kingdom Relations (2010) analyses that Bulgaria covers an area of 110,912 km². According to the United Nations (1971), in 1970 the population density per km² was 77 persons. The urban cluster was 50.6% of the total population, while for rural areas the figure was 49.4% (United Nations, 1971). The tenure status in the base year 1965 had a high level of owner-occupiers representing 71.0% of the total; the second cluster of private renters was 17.1% (United Nations, 1974). The additional clusters are not available. In the current base year 2007 of the Ministry of the Interior and Kingdom Relations (2010), the population density per km² had fallen to 69 persons. According to Eurostat (2012d), the population was heading in a more urban direction until 2006: a high-density cluster of 35.0%, an urban cluster of 26.0% and a rural cluster of 39.0%. For Cecodhas (2012) also the tenure status changed significantly: In 2008 the share of owner-occupied housing was 95.6% with an increase of 34.6% in contrast to 1965. These processes will continue in the future. In 2050 the forecast of Geohive (2010) for population per km^2 is much lower at 46.0 persons and a high urban cluster of 83.41%. A forecast of how tenure status will develop in the future is not available.

Also the economic conditions are important to focus on. According to research by HSBC (2012), the 2010 per-capita income level in comparison to the other countries with shrinking populations in the European Union 27 is low at 2,542 USD. Corresponding to Cecodhas (2012), the share of housing costs in disposable income is 18.4%. This is a relatively low and, therefore, a positive level in comparison to other analysed countries in the European Union. For the European Commission (2012a), the number of dependent people in Bulgaria is 333,000. This is around 4.4% of the population, which is at a relatively stable level. According to HSBC (2012), for 2050 the forecast is for a higher income of 13,154 per capita, which is less significant than in other states in the European Union 27 (Figure 4.41). The European Commission researches (2012a) highlight that the number of dependent people will increase to about 6.3% of the population equating to 370,000.

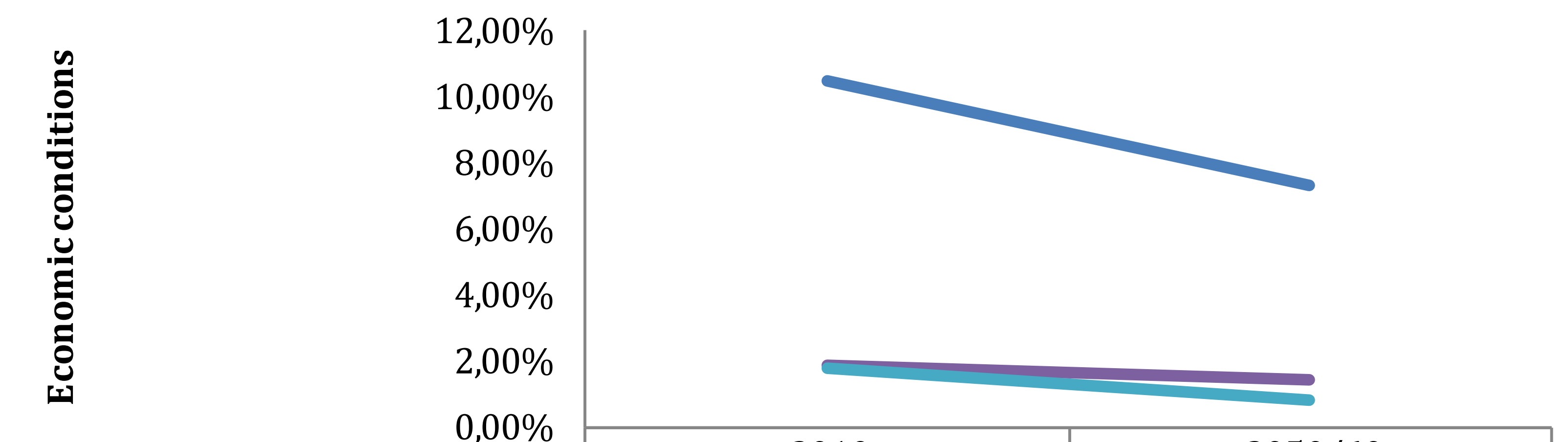
Figure 4.41 The movement of the income level in Bulgaria



Source: HSBC (2012); own representation

According to Cecodhas (2012), the total housing costs in purchasing power standards to express the volume of economic aggregates is 165.6 based on 2009, which represents a lower standard than most of the other analysed countries. The construction cost index as an indicator of the average cost movement over time of a fixed basket of representative goods and services related to the construction industry with a basis of 2005 equal to 100% is 139.9 (Cecodhas, 2012), which is one of the highest and, therefore, more adverse than the levels of the evaluated countries with shrinking populations. Estimations for the future are not available. Nevertheless, these economic conditions demonstrate contrasting relationships and could have consequences for portfolio management as will be researched and analysed later. Relating to the European Commission (2012a), the unemployment rate of the working-age population was 10.5% in 2010. For 2060 it is estimated to be 7.3% (European Commission, 2012a), which could be an indication of the demographic developments in Bulgaria. For Eurostat (2012f), the share of the population at risk of poverty, which is the percentage of persons with an equalised available income under the risk-of-poverty level of 60.0% of the national median spendable income, is at 46.2% the highest of the analysed countries. Future estimates are not available. This could become a critical area in the future economy. Referring to the European Commission (2012a), the gross domestic product rate is 1.9% per capita and is expected to have fallen by 2050 to 1.4%. The potential GDP growth rate in 2010 was 1.8%, and is expected to have fallen by a ratio of 1.0% to 0.8% in 2050 (European Commission, 2012a), which represents a reduction of the economic potential for the industry (Figure 4.42).

Figure 4.42 Economic conditions in Bulgaria



	2010	2050/60
Unemployment rate (%, 15-64))	10,50%	7,30%
GDP per capita	1,90%	1,40%
Potential GDP (growth rate)	1,80%	0,80%

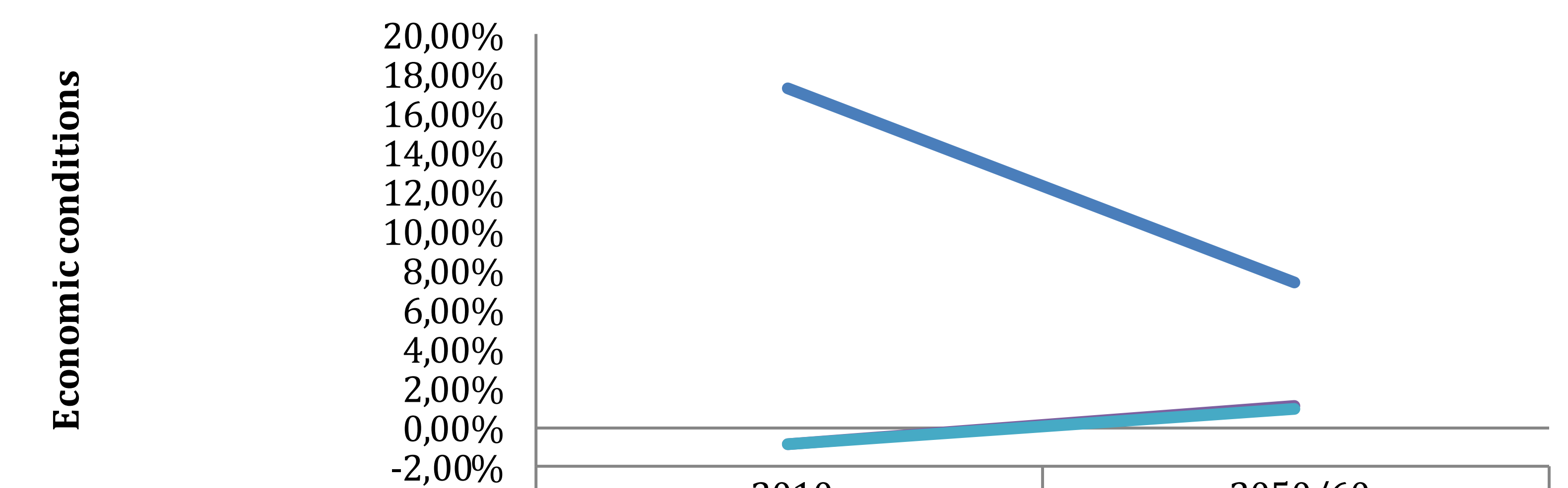
Source: European Commission (2012a); own representation

○ *Estonia*

In reference to the Ministry of the Interior and Kingdom Relations (2010), Estonia covers an area of 45,227 km². According to analyses by the United Nations (1971), in 1970 the population density per km² in the USSR was low at 11 persons with a balanced urban cluster of 56.3% of the total population, and 43.7% for rural areas. With regard to the Ministry of the Interior and Kingdom Relations (2010), in 2007 the average population density per km² had risen to 30.9 persons. The tenure status of the base year 1965 is not available. For Eurostat (2012d) the population density per km² in 2006 showed an increase of the high-density cluster to 32.0%, urban cluster 29.0%, and a decrease of the rural cluster to 39.0%. According to Cecodhas (2012), tenure data for 2008 demonstrated a high and crucial share of owner-occupied housing with 96.0%. For Geohive (2013), in 2050 the population density per km² is forecasted to have fallen to 25.0 persons with the urban cluster having increased to 80.0%.

Research by Cecodhas (2012) demonstrates the proportion of housing costs from disposable income was 15.5% in 2009. This is the lowest share of the analysed countries in the European Union and shows a positive economic tendency in the residential trade and industry. According to the European Commission (2012a), dependent people number 95,000, which equates to approximately 7.3% of the total population and is relatively high for this country. In 2050 it is predicted that the amount of dependent people will have risen to 9.42% equating to 113,000 people (European Commission, 2012a). The total housing costs in purchasing power standards is 179.0 for the base year 2009 of Cecodhas (2012); this standard is located in the middle of the analysed states. The construction cost index with a basis of 2005 equal to 100% is 115.3 (Cecodhas, 2012). Therefore, the prices for new buildings are mainly stable in the economy. According to the European Commission (2012a), the high unemployment rate of the working-age population was 17.2% in 2010. For 2060 it is estimated to have fallen to 7.3% (European Commission, 2012a) as a result of an upturn in the employment market in Estonia. For Eurostat (2012f), 23.4% of the population is at risk of poverty, which is one of the lowest levels among the selected states. Future estimates are not available. The European Commission (2012a) analyses that the gross domestic product rate in 2010 was minus 0.8% per capita, but by 2050 is expected to have increased to plus 1.1%. The potential GDP growth rate was also on a deep basis in 2010 at minus 0.8%, but is forecasted to have increased to 0.9% by 2050 (European Commission, 2012a). These figures show Estonia's poor economic situation, both today and in future, which will also have consequences for developments in the real estate sector:

Figure 4.43 Economic conditions in Estonia



	2010	2050/60
Unemployment rate (%, 15-64))	17,20%	7,30%
GDP per capita	-0,80%	1,10%
Potential GDP (growth rate)	-0,80%	0,90%

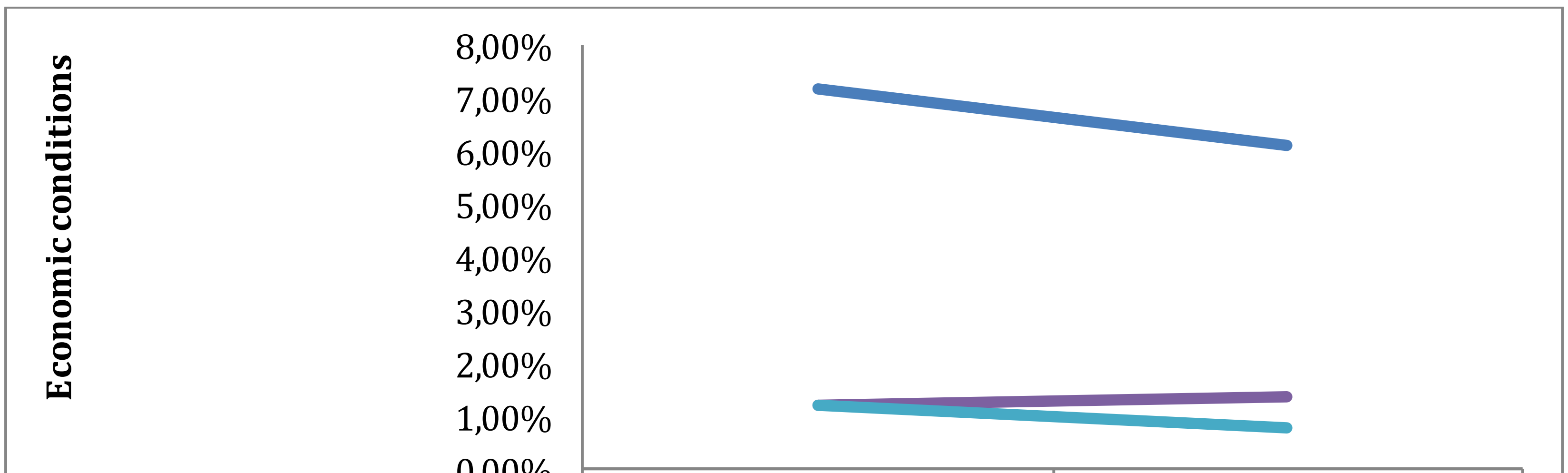
Source: European Commission (2012a); own representation

- *Germany*

Research by the Ministry of the Interior and Kingdom Relations (2010) proofs that Germany has an area of 357,031 km^2. According to the European Commission (2012a), in 1970 the population density per km^2 was 212.73 persons with a balanced urban cluster of 43.3% of the total population in 1968/ 1969; in reference to the United Nations (1971), for rural areas it was 56.7%. In the current base year 2007 of the Ministry of the Interior and Kingdom Relations (2010), the appropriate population rate per km^2 was calculated at 229.9 persons. For Eurostat (2012d), the population density per km^2 in 2006 reveals an important movement towards a high-density cluster of 31.0%, an urban cluster of 41.0%, and a low rural cluster of 28.0%. Related to Cecodhas (2012), in comparison to other researched countries the tenure level in 2008 showed a relatively low rate of owner-occupied housing at 42.0%, private housing at 53.0% and social housing at 5.0%. In 2050 it is forecasted by Geohive (2013), that the population density per km^2 will have fallen to 203.0 persons with an increased urban cluster of 83.8% and a rural cluster of 16.2% (Geohive, 2010).

Research by HSBC (2012) outlines that the income level of 2010 is in comparison to the other countries with shrinking populations in the European Union 27 on a high level with a per-capita income of 25,083.00 USD and forecasted to be 52,683.00 USD in 2050. For Cecodhas (2012), the amount of housing costs from disposable income is calculated to be high and, therefore, an adverse share of 31.0% in 2009. According to the Ministry of the Interior and Kingdom Relations (2010), in 2009 the free market rent was 4,900 euros per year and up to an area of 71.0 m^2 per habitation. Following the European Commission (2012a), there are 8,408.0 thousand dependent people in the country, representing more than 10.0% of the total population, which is deemed high. By 2050 it is predicted to have increased further to 9,810.0 thousand people (European Commission, 2012a). As this defines persons dependent on financial support, this places the real estate sector and the economy on a rather downward slope. Analyses by Cecodhas (2012) proof that the total housing costs in purchasing power standards was 771.5 in 2009. This is by far the highest of the analysed countries and limits the additional spending capacity of the population. The construction cost index in 2005 equal to 100% was at a balanced level of 111.5 (Cecodhas, 2012). Corresponding to the European Commission (2012a), the unemployment rate of the working-age population was the lowest of the evaluated states at 7.2% in 2010 (Figure 4.44). For 2060 it is expected to have fallen to 6.1% (European Commission, 2012a). For Eurostat (2012f), 20.0% of the population is deemed to be at risk of poverty, which is one of the lowest levels of the analysed states. The gross domestic product rate in 2010 was 1.2% per capita, but by 2050 is expected to have increased to 1.4% (European Commission, 2012a). In 2010 the size of the economy was calculated by HSBC (2012) at 2,058 billion USD, and is forecasted to have risen to 3,714 USD by 2050. Nevertheless, these mentioned economic conditions point to a stable and increasing tendency of Germany.

Figure 4.44 Economic conditions in Germany



	2010	2050/60
Unemployment rate (%, 15-64))	7,20%	6,10%
GDP per capita	1,20%	1,40%
Potential GDP (growth rate)	1,20%	0,80%

Source: European Commission (2012a); own representation

○ *Hungary*

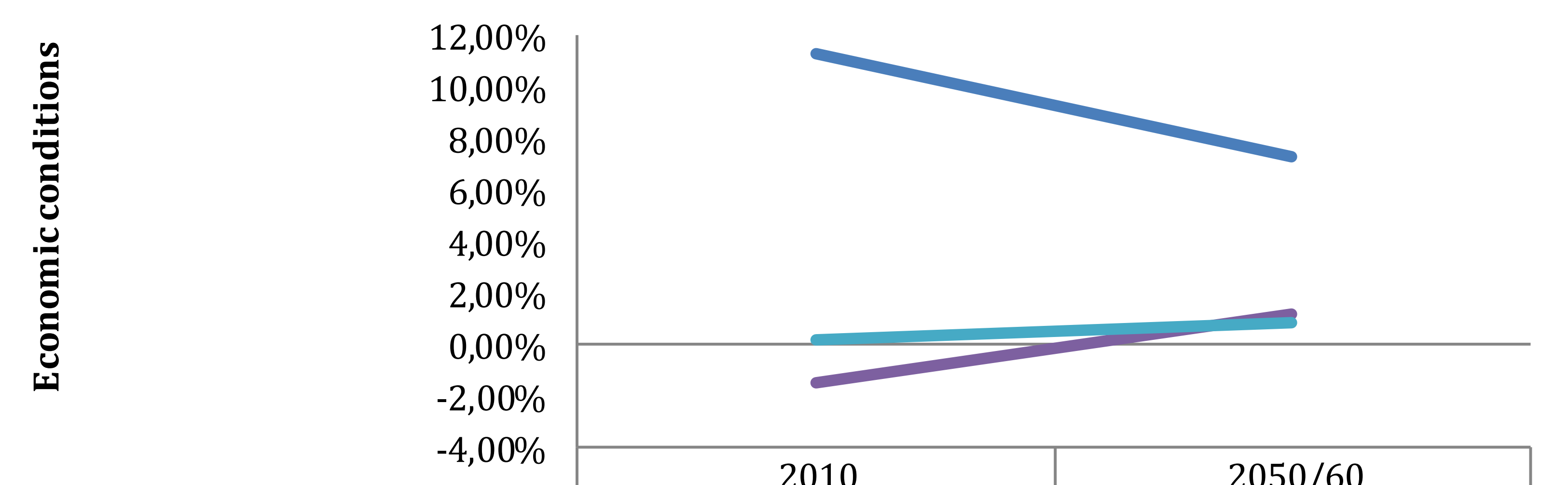
According to the Ministry of the Interior and Kingdom Relations (2010), Hungary covers an area of 93,030 km². Research by the United Nations (1971) reveals that in 1970 its population density per km² was 111.0 persons. In 1969 its urban cluster represented 44.4% of the total population and rural areas 55.6% (United Nations, 1971). According to the Ministry of the Interior and Kingdom Relations (2010), in 2007 the average population rate per km² was calculated to have fallen to 108.1 persons. The population density per km² fixed in the last base year 2006 of Eurostat

(2012d) was again at a balanced level of a high-density cluster with 24.0%, an urban cluster of 33.0% and a rural cluster of 43.0%. By 2050 the population per km^2 is expected by Geohive (2013) to have fallen to 96.0 persons with a significant share of an urban cluster of 82.1%. This tendency demonstrates a high development towards more urban areas. Research by the United Nations (1974) highlights that the tenure level in 1970 demonstrated a high proportion of owner-occupied housing with 62.9% and private housing 29.6%. According to Cecodhas (2012), in 2008 the tenure status of owner-occupied housing shifted to a crucial level of 92.0%.

There have been important changes regarding economic conditions. The income per capita calculated by the HSBC (2012) was 5,833 USD in 2010 and is forecasted to be 31,966 USD in 2050. According to Cecodhas (2012), the proportion of housing costs from disposable income are calculated with a balanced quote of 23.2% in 2009. The free market rent is analysed by the Ministry of the Interior and Kingdom Relations (2010) with 1,700 euros per year and a size of 51.0 m^2 per habitation in 2009; the level of rent in regulated markets was much lower at 400 euros per year and an average size dwelling of 48 m^2 in 2009. In reference to the European Commission (2012a), 8.1% of the population were described as being dependent on others, equating to 805.0 thousand persons. By 2050 this number is expected to have increased to 1,002.0 thousand (European Commission, 2012a). This figure is significant for the economic situation due to a reduction in the spending power of the inhabitants of Hungary. Cecodhas (2012) states that the total housing costs in purchasing power standards were 244.6 euros in 2009. This lies in the middle of the researched states of the European Union. The 2005 construction cost index equal to 100% was relatively high in comparison to the other countries and came to 123.1 (Cecodhas, 2012). According to the European Commission (2012a), the unemployment rate of the working-age population was 11.3% in 2010. By 2060 it is expected to have fallen to 7.3% (European Commission, 2012a). Eurostat (2012f) reveals that 29.6% of the population was deemed to be at risk of poverty in 2009, which is relatively high compared to the other countries analysed. For the European Commission (2012a), the gross domestic product rate in 2010 was negative at minus 1.5% per capita but by 2050 is expected to have increased to plus 1.2% (Figure 4.45). Research by

HSBC (2012) shows the size of the economy in 2010 to be 58.0 billion USD, which is expected to have increased to 295.0 USD by 2050. Therefore, this economic tendency will move in a more positive direction in the future.

Figure 4.45 Economic conditions in Hungary



	2010	2050/60
Unemployment rate (%, 15-64))	11,30%	7,30%
GDP per capita	-1,50%	1,20%
Potential GDP (growth rate)	0,20%	0,90%

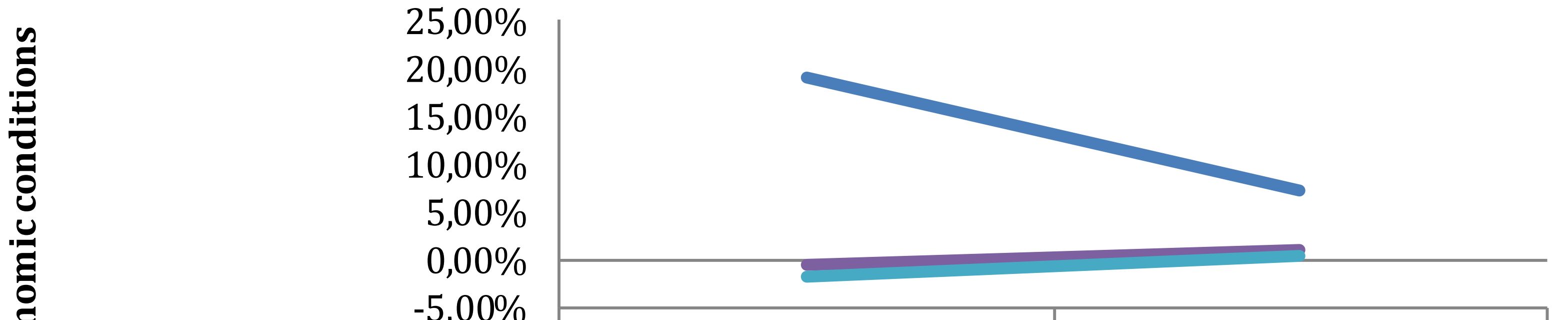
Source: European Commission (2012a); own representation

- *Latvia*

The Ministry of the Interior and Kingdom Relations (2010) states that Latvia covers an area of 64,589 km². In compliance with the United Nations (1971), in 1970 under the USSR regime the population density per km² was 11.0 persons with an urban cluster of 56.3% of the total population; rural areas according to the available base year 1959 represented 43.7% of the population. According to the Ministry of the Interior and Kingdom Relations (2010), by 2007 the average population rate per km² had increased to 36.5 persons. Also this is low growth in the USSR regime compared to the founded Latvia state. The population density per km² in the last base year 2006 of Eurostat (2012d) included a balanced share of a high-density cluster of 35.0%, an urban cluster of 25.0% and a rural cluster of 40.0%. In 2050 the population per km² is again expected to have fallen to 26.0 persons (Geohive, 2013), but with the urban cluster rising crucially to 78.1% and the rural group falling to 21.9% (Geohive, 2010). Like the countries analysed earlier this tendency again demonstrates a high development of urban areas. According to Cecodhas (2012), in 2010 the high share of owner-occupied housing was calculated at 84.9%, private housing 14.7% and a small amount of social housing at 0.4%.

Following research by HSBC (2012), the income per capita was calculated at 4,973 USD in 2010 and is estimated to have reached a more balanced level of 27,143 USD by 2050. For Cecodhas (2012), the proportion of housing costs from disposable income was found to be at the 3rd lowest level of the countries analysed at 18.0% in 2009. According to analyses by the European Commission (2012a), 6.2% of the population was calculated to be dependent people equating to 137.0 thousand. In 2050 it is expected to have increased to 157.0 thousand (European Commission, 2012a) or 8.7% of the population, which will be on a balanced level in comparison to the other analysed countries. For Cecodhas (2012), the total housing costs in purchasing power standards had fallen among the middle of the other ranked states with 186.2 in 2009. The 2005 construction cost index equal to 100% was 152.5 (Cecodhas, 2012). This is the highest of the researched countries with the result of higher prices in the new building sector. According to the European Commission (2012a), the unemployment rate of the working-age population was the 2nd highest after Spain with 19.0% in 2010; for 2060 it is expected to have fallen sharply to 7.3%. In compliance with Eurostat (2012f), the share of the population at risk of poverty in 2009 was established at the 3rd highest with 37.4%. Referred to the European Commission (2012a), the gross domestic product rate in 2010 was negative at minus 0.7% per capita and will have increased marginally by 2050 to plus 1.0% (Figure 4.46). Analyses by the HSBC (2012) demonstrate that the size of the economy was fixed in 2010 at 11.0 billion USD and is forecasted to be 52.0 billion USD for 2050. In consequence the economy focuses on difficult conditions, but will exhibit a tendency towards a more positive development in the future. For the Ministry of the Interior and Kingdom Relations (2010), the average annual rent for rental dwellings of the free market was fixed in 2009 at 85,000 euros and an average dwelling size of 48 m^2, while the rent of regulated markets was much lower at 14,000 euros per year and an average dwelling size of 51 m^2, which reveals a strong difference between free and regulated markets. The average price for one existing dwelling was 24,000 euros in 2009 (Ministry of the Interior and Kingdom Relations, 2010), which is on a relatively low level in contrast to the rents of the free market.

Figure 4.46 Economic conditions in Latvia



	2010	2050/60
Unemployment rate (%, 15-64))	19,00%	7,30%
GDP per capita	-0,70%	1,00%
Potential GDP (growth rate)	-1,90%	0,30%

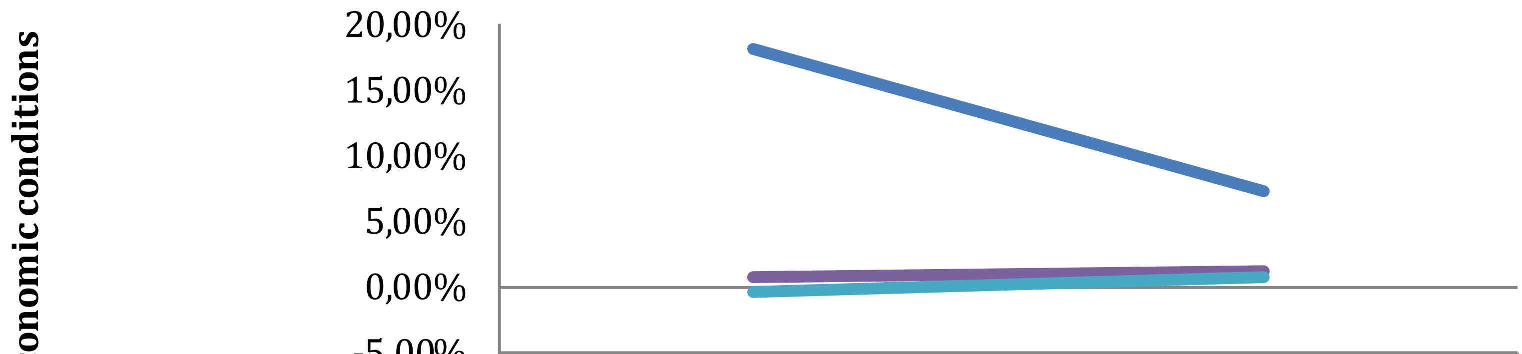
Source: European Commission (2012a); own representation

- *Lithuania*

Following the Ministry of the Interior and Kingdom Relations (2010), Lithuania covers an area of 65,300 km². Related to the United Nations (1971), in 1970 the population density in the former USSR was 11 persons per km² with an urban cluster of 56.3% of the total population; in 1959 rural areas represented 43.7%. In the current base year 2007 of the Ministry of the Interior and Kingdom Relations (2010) the population rate per km² for Lithuania itself was calculated to be a higher 53.9 persons. From a Eurostat study (2012d), the population density per km² pointed in 2006 was stable with a high-density cluster of 32.0%, an urban cluster of 12.0% and a rural cluster of 56.0%. Therefore, Lithuania includes the highest tendency towards rural living compared to the other afore-mentioned countries. In 2050 the population per km² is expected by Geohive (2013) to have fallen to 39.0 persons, with an urban cluster of 78.7% and a rural cluster of 21.3% of the population (Geohive, 2010), which points to an assimilated formation in contrast to previous decades in this country. For Cecodhas (2012), the tenure level in 2008 demonstrated a high rate of owner-occupied housing with 91.0%, private housing 4.0% and social housing 3.0% with about 2.0% being other housing constellations.

According to HSBC (2012), the income level of 2010 was low with a per-capita income of 5,154 USD that is forecasted to have increased to 20,955 USD by 2050. Analyses by Cecodhas (2012) highlight that the proportion of housing costs coming out of disposable income was 15.9% in 2009. This is one of the lowest shares of the evaluated countries in the European Union 27, which allows the possibility of growth for the real estate sector in the future. Following the Ministry of the Interior and Kingdom Relations, the free market rent was available at 1,100 euros per year and a size of 61.0 m^2 per habitation in 2008; the average rent of the regulated market was around 10% of the free market rents, which equates to 100 euros per year with a dwelling size of 44 m^2. For the European Commission (2012a), 8.5% of the population is deemed dependent on others equating to 280 thousand persons. In 2050 this is expected to have increased to 327 thousand (European Commission, 2012a) or 11.7% of the population, which is high. According to Cecodhas (2012), the total housing costs in purchasing power standards were 168.2 in 2009. This is the 3rd lowest of the researched countries and should have a positive influence on the real estate sector. The 2005 construction cost index equal to 100% came to 116.1 (Cecodhas, 2012). Also this trend is stable and ranks in the middle of the analysed countries. For the European Commission (2012a), in 2010 the unemployment rate of the working-age population was very high at 18.1% compared to the other states; for 2060 it is forecasted to have fallen sharply to 7.3% (Figure 4.47). The percentage of the population at risk of poverty, calculated by Eurostat (2012f), is relatively high at 29.5%. Following research by the European Commission (2012a), the gross domestic product rate in 2010 is low at 0.8% per capita but will increase marginally until 2050 to 1.2%. Pertaining to HSBC (2012), the size of the economy in 2010 was 17.0 billion USD and is expected to be 59.0 USD in 2050.

Figure 4.47 Economic conditions in Lithuania



	2010	2050/60
Unemployment rate (%, 15-64))	18,10%	7,30%
GDP per capita	0,80%	1,20%
Potential GDP (growth rate)	-0,30%	0,70%

Source: European Commission (2012a); own representation

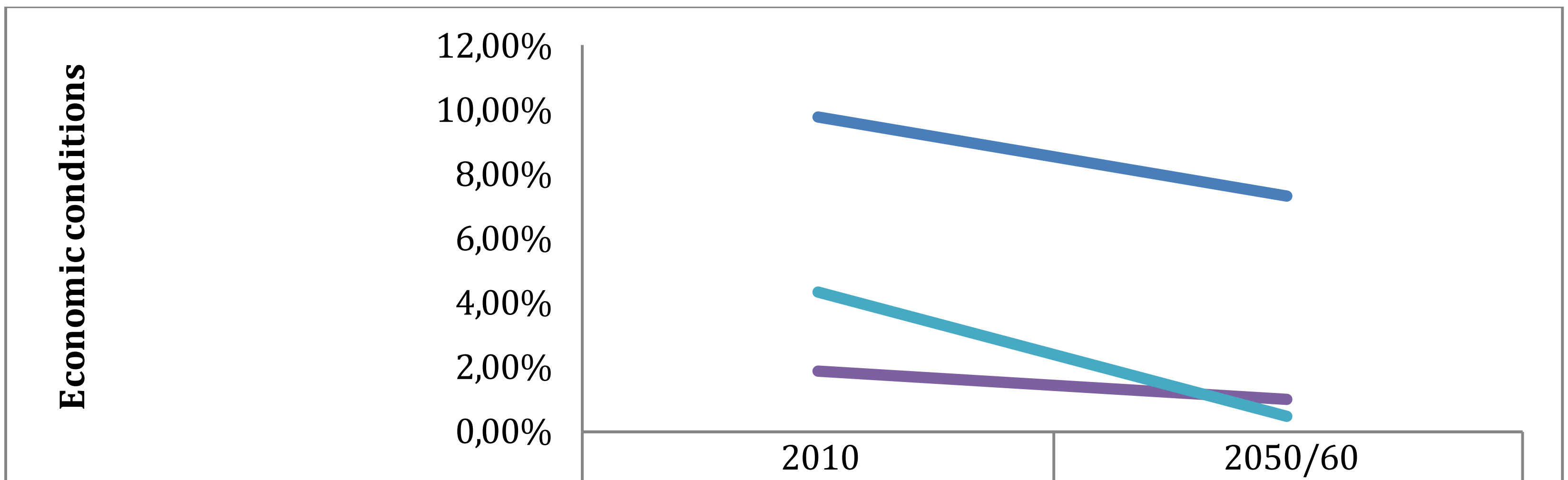
- *Poland*

According to the European Commission (2012a), Poland covers an area of 312,685 km². Adapted from the United Nations (1971), in 1970 the population density per km² was 105 persons with an urban cluster of 52.0% of the total population; rural areas represented 48.0%. The Ministry of the Interior and Kingdom Relations (2010) states that by 2000 the average population per km² had increased to 122.4 persons. Research by Eurostat (2012d) demonstrates that by 2006 the population density per km² was exhibiting a stable and balanced tendency towards urban living with a high-density cluster of 28.0%, an urban cluster of again 28.0% and a rural cluster of 44.0%. According to Cecodhas (2012), the tenure standard in 2008 demonstrated a more balanced share in comparison to the other analysed states with 62.4% of owner-occupied housing, 8.0% private rent, 10.0% social rent and other habitations with 19.6%. Following Geohive (2013), by 2050 the population per km² is forecasted to have fallen to a level similar to 1970 with 109.0 persons, but with an urban cluster of 73.6% of the population (Geohive, 2010). This tendency towards less rural living is exhibited by a significant reduction to around 40.0% in comparison to the current base year 2006.

In compliance to Cecodhas (2012), the proportion of housing costs taken from disposable income ranks in the middle of the other analysed states at 21.1% in 2009.

The European Commission (2012a) reveals that 6.3% of the population was deemed dependent on others in 2010 equating to 2,424 thousand persons. By 2050 it is forecasted to have grown to 3,349 thousand (European Commission, 2012a). Analyses by Cecodhas (2012) illustrate that the total housing costs in purchasing power standards were 250.1 for the base year 2009 and, therefore, one of the highest of the researched countries with the result of reduction in the spending power of inhabitants. Nevertheless, there is a relatively low construction cost index with a basis of 2005 equal to 100% is 115.8 (Cecodhas, 2012). Consequently new buildings are more affordable in Poland than in other states of the European Union. Relating to the European Commission (2012a), in 2010 the unemployment rate of the working-age population was comparatively low at 9.8%. By 2060 it is expected to be 7.3% (European Commission, 2012a) with the result of a boost to Poland's employment market. On the basis of Eurostat (2012f), in 2009 the percentage of the population at risk of poverty at 27.8% ranked in the middle of the analysed countries. Analysed by the European Commission (2012a), the gross domestic product rate in 2010 as low at 1.9% per capita and will decrease until 2050 to an estimated plus 1.0%. Following the European Commission (2012a), the potential GDP growth rate of 4.3% in 2010 was the highest basis, but will have fallen to 0.5% by 2050 (Figure 4.48). These databases point to a negative level and development of the economy of Poland in the future. Nevertheless, based on the databases of HSBC (2012), the size of the economy in 2010 was 250.0 billion USD and is expected to have risen to 786.0 USD by 2050, which is the 3rd highest level of the researched European Union states. Also the income level of 2010 will see a shift of per-capita income from 6,563 USD to 24,547 USD in 2050 (HSBC, 2012), which will support spending in the real estate sector.

Figure 4.48 Economic conditions in Poland



	2010	2050/60
Unemployment rate (%, 15-64))	9,80%	7,30%
GDP per capita	1,90%	1,00%
Potential GDP (growth rate)	4,30%	0,50%

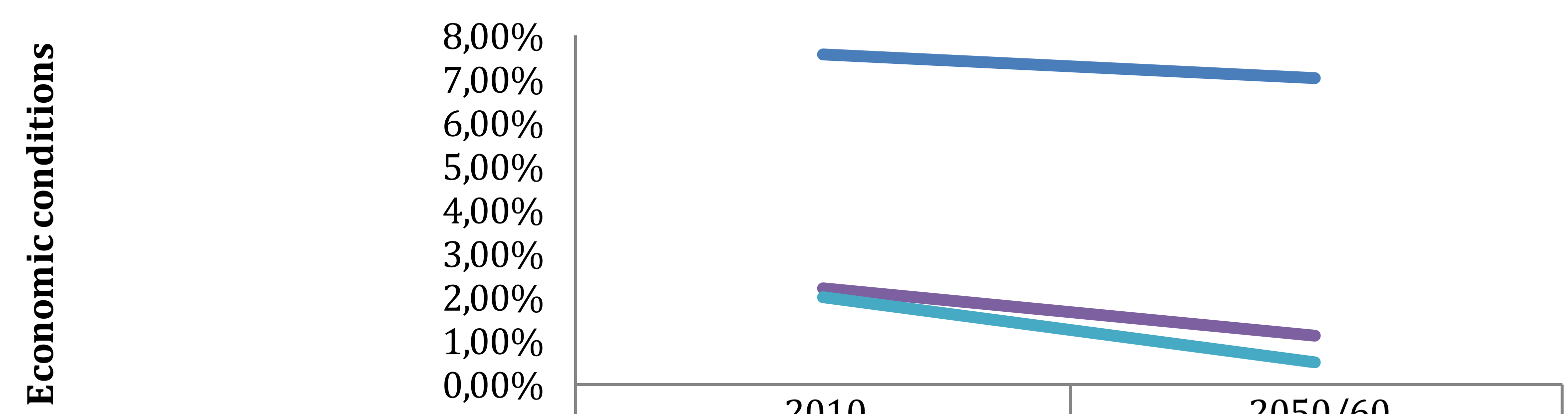
Source: European Commission (2012a); own representation

- *Romania*

Following analyses by the Ministry of the Interior and Kingdom Relations (2010), Romania covers an area of 238,391 km². According to the United Nations (1974), in 1970 the population density per km² was low at 85.0 persons with an urban cluster of 40.8% of the total population, with rural areas representing 59.2% in the base year 1970 (United Nations, 1971). Adapted from research of the Ministry of the Interior and Kingdom Relations (2010), in 2007 the average population rate per km² had risen to 93.7 persons. Referring to Eurostat (2012d), the population density per km² included in the last base year 2006 showed a high-density cluster of 30.0%, an urban cluster of 21.0% and again a balanced rural cluster of 49.0%. By 2050 the population per km² is again expected to fall to 75.0 persons (Geohive, 2013) with a high urban cluster with 77.3% and a minor rural one of 22.6% (Geohive, 2010). In total this demonstrates a very high tendency towards urban clusters. Cecodhas (2012) analyses that in 2008 the share of owner-occupied housing was high at 96.0%, private housing was 0.7%, social housing 2.3%, and 1.0% for other housing.

Economic conditions will also change in Romania. Corresponding to the HSBC (2012), the income per capita was the 2nd lowest after Bulgaria and was calculated at 2,596 USD in 2010; for the future it is again estimated to exhibit comparatively low movement before reaching 20,357 USD in 2050. For Cecodhas (2012), the proportion of housing costs coming from disposable income was 25.3% in 2009. This is the 2nd highest after Germany and retards the public's buying power in the residential trade and industry. According to the European Commission (2012a), 1,317.0 thousand persons are deemed dependent on others. This is in line with the normal standard of 6.2% in comparison to the afore-mentioned countries. By 2050 it is expected to have increased to 9.4% of the future population, equating to 1,728.0 thousand (European Commission, 2012a), which again points to a stable formation. In compliance with Cecodhas (2012), the total housing costs in purchasing power standards were 138.4 in 2009. This is the lowest level of the researched countries, which offers a competitive advantage in comparison to the other countries. The 2005 construction cost index equal to 100% was 148.2 (Cecodhas, 2012), which is the 2nd highest after Latvia and will have a negative effect on the new building sector. Based on research by the European Commission (2012a), the unemployment rate of the working-age population was low at 7.6% in 2010; by 2060 this expected to have fallen slightly to 7.0% (Figure 4.49). For Eurostat (2012f), the share of the population at risk of poverty in 2009 was one of the highest at 43.1%. The gross domestic product rate in 2010 was positive at 2.2% per capita, but will decrease until 2050 to 1.1% (European Commission, 2012a). The size of the economy in 2010 was 56.0 billion USD and is expected by the HSBC (2012) to rise to 377.0 USD by 2050. In consequence the economic will have a tendency towards more positive development in the future.

Figure 4.49 Economic conditions in Romania



	2010	2050/60
Unemployment rate (%, 15-64))	7,60%	7,00%
GDP per capita	2,20%	1,10%
Potential GDP (growth rate)	2,00%	0,50%

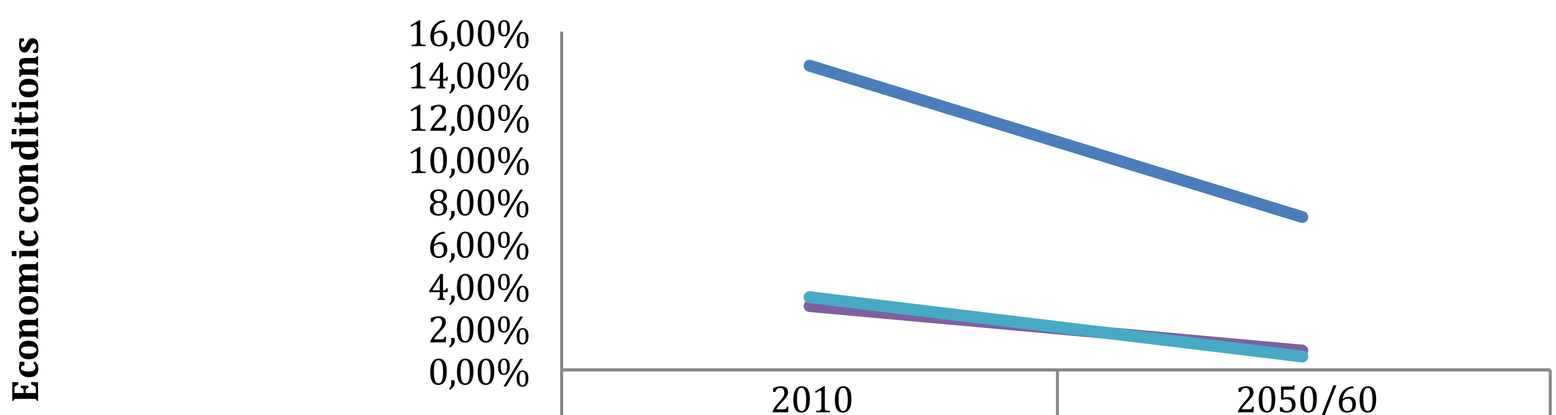
Source: European Commission (2012a); own representation

- *Slovakia*

According to the Ministry of the Interior and Kingdom Relations (2010), Slovakia covers an area of 49,035 km^2. Analyses by the United Nations (1971) show that in 1970 the population density in Czechoslovakia per km^2 was 113.0 persons with an urban cluster of 47.6% of the total population; rural areas represented 52.4%. Relating to the Ministry of the Interior and Kingdom Relations (2010), in 2007 the average population rate per km^2 had fallen to 110.1. For Eurostat (2012d), the population density per km^2 in the last base year 2006 showed a high-density cluster of 17.0%, an urban cluster of 35.0% and a rural cluster of 48.0. This rural formation is more balanced and stable in comparison to the other researched states in the European Union. By 2050 the population per km^2 is estimated to have fallen to 102.0 persons (Geohive, 2013), but with a growing urban cluster of 69.3% (Geohive, 2010). This demonstrates a high tendency towards more urban areas. Nevertheless, in comparison to the aforementioned countries it is at a relatively stable level. According to the United Nations (1974), the tenure level in 1961 in Czechoslovakia demonstrated nearly a balance between owner-occupied housing at 50.4% and private housing at 42.0%. Pertaining to Cecodhas (2012), in 2008 the tenure status of owner-occupied housing shifted to a high and significant formation of 92.0%.

The income per capita was the 3rd highest after Germany and Spain at 8,042 USD in 2010 and is expected by HSBC (2012) to have risen to 27,639 USD by 2050. The proportion of housing costs taken from disposable income was calculated by Cecodhas (2012) at 22.0% in 2009 and therefore, ranks in the middle of the other analysed countries of the European Union. Following analyses by the Ministry of the Interior and Kingdom Relations (2010), the size of a habitation in the free market was analysed with a high sum of 124.1 m^2 in average; the average size of dwellings in regulated markets is in comparison to the free market sizes on a low level of 59.8 m^2 in average in 2009. According to the European Commission (2012a), people dependent on others number a high 508.0 thousand or 9.4% of the total population; in 2050 there is assessed a number of 797.0 thousand that is a high level of 15.0% of the population and could illustrate a decreasing of the spending power of inhabitants in the real estate sector. Corresponding to Cecodhas (2012), the total housing costs in purchasing power standards count 310.3 in 2009 that is the 3rd highest standard after Germany and Spain with an economic disadvantage in contrast to other countries. The 2005 construction cost index equal to 100% sums 116.8 (Cecodhas, 2012). For the European Commission (2012a), the unemployment rate of the working-age population includes a high percentage of 14.4% in 2010; for 2060 this rate is estimated a rate with a decreasing trend of 7.3% (Figure 4.50). Eurostat (2012f) analyses that in 2009 19.6% of the population was deemed at risk of poverty, which is the lowest level and represents an advantage over the other afore-mentioned states. The gross domestic product rate in 2010 was 3.0% per capita, but will have fallen to 0.9% by 2050 (European Commission, 2012a). The HSBC (2012) highlights that in 2010 the size of the economy was 44.0 billion USD and is forecasted to be 145.0 USD in 2050, which is a positive formation in this economic field.

Figure 4.50 Economic conditions in Slovakia



	2010	2050/60
Unemployment rate (%, 15-64))	14,40%	7,30%
GDP per capita	3,00%	0,90%
Potential GDP (growth rate)	3,50%	0,60%

Source: European Commission (2012a); own representation

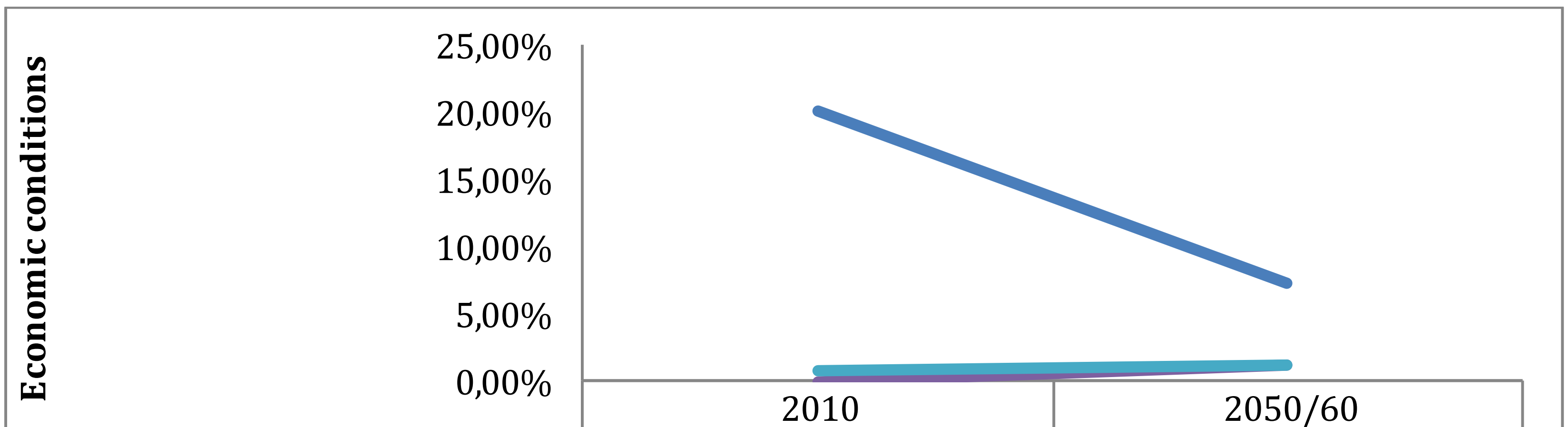
- *Spain*

The Ministry of the Interior and Kingdom Relations (2010) states that Spain covers an area of 505,124 km². Following research by the United Nations (1971), in 1970 the population density per km² was a low 66.0 persons with an urban cluster of 42.9% of the total population; rural areas represented 57.1%. Based on the Ministry of the Interior and Kingdom Relations (2010), in the current base year 2000 the population rate per km² was calculated to have grown to 79.6. According to Eurostat

(2012d), the population density per km^2 in 2006 revealed a high-density cluster of 43.0%, an urban cluster of 25.0% and a rural cluster of 32.0%, which is balanced. Analyses by the United Nations (1974) demonstrate that the tenure level shifted from 45.9% with owner-occupied status in 1950, to a high 85.0% in the base year 2008 (Cecodhas, 2012). By 2050 the population per km^2 is again expected by Geohive to have risen to 96.0 persons (Geohive, 2013) with an urban cluster of 86.5% and a rural cluster of 13.5% of the population (Geohive, 2010), which demonstrates a more unbalanced trend and a significant shift towards urban living.

The economic conditions are important for Spain. In compliance with HSBC (2012), the income level of 2010 was a high level with a per-capita income of 15,699.0 USD. This is expected to have risen to 38,111.0 USD by 2050 (HSBC, 2012), which after Germany is the 2nd highest among the analysed countries. For Cecodhas (2012), in 2009 the proportion of housing costs taken from disposable income was relatively low at 18.6%. The Ministry of the Interior and Kingdom Relations (2010) analyses that the free market rent is available at 5,100 euros per year and a size of 74.8 m^2 per habitation, the regulated market rent was 1,600 euros a year with a similar average size in comparison to the free market level of 74.9 in 2009. Relating to the European Commission (2012a), 2,485 thousand persons were deemed dependent on others, which is relatively high. By 2050 this is expected to have risen to 7.8% of the population or 4,093 thousand (European Commission, 2012a). According to Cecodhas (2012), the total housing costs in purchasing power standards were 363.3, based on 2009 and are the 2nd highest after Germany and represents an economic disadvantage in the residential trade and industry. The 2005 construction cost index equal to 100% was 122.3 (Cecodhas, 2012) and ranks in the middle of the other researched countries. For the European Commission (2012a), the unemployment rate of the working-age population was the highest of the evaluated states at 20.2% in 2010; by 2060 it is expected to have fallen sharply to 7.3% (Figure 4.51). Pertaining to research by Eurostat (2012f), the proportion of the population at risk of poverty in 2009 was 23.4%. The gross domestic product rate of the European Commission (2012a) in 2010 was 0.0% per capita, but by 2050 is expected to have increased to 1.2%. The high size of the economy in 2010 was 711 billion USD and is expected by HSBC (2012) to be 1,954 billion USD in 2050.

Figure 4.51 Economic conditions in Spain



	2010	2050/60
Unemployment rate (%, 15-64))	20,20%	7,30%
GDP per capita	0,00%	1,20%
Potential GDP (growth rate)	0,70%	1,20%

Source: European Commission (2012a); own representation

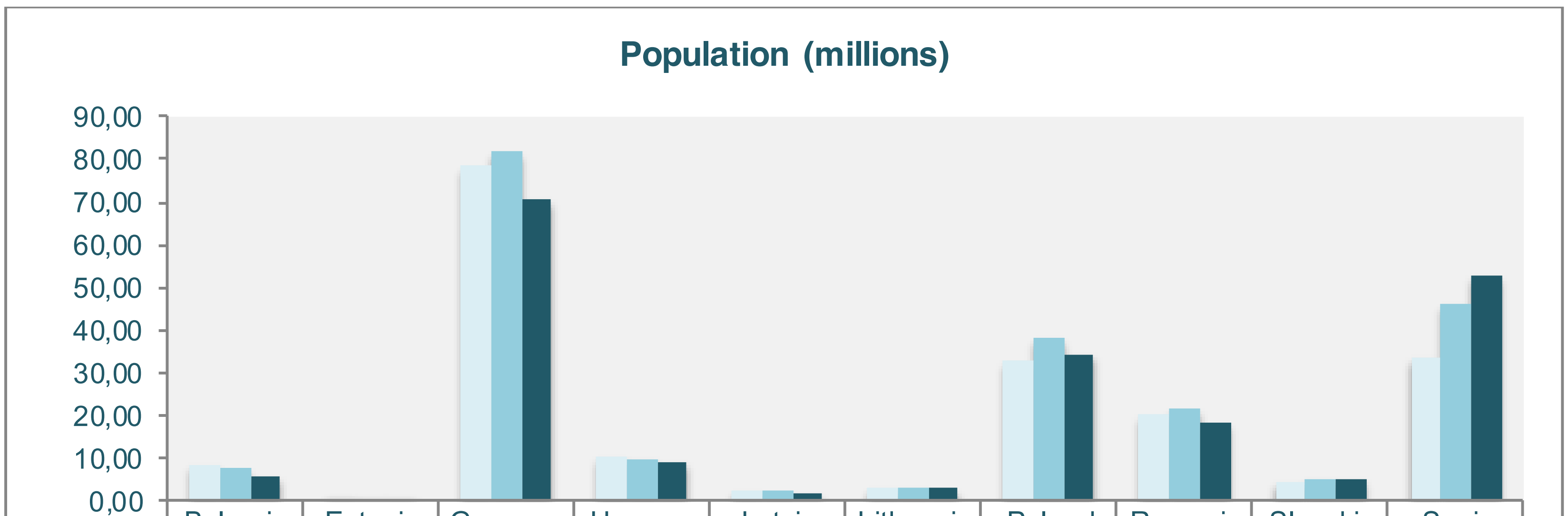
As already analysed in Chapter 2, the databases and information of literature in this milieu are mainly highly fragmented. Because the databases of the different instituts put affords on different areas, time periods and basic years, a standardised evaluation within the market and status analysis is not possible. Furthermore, sometimes data are not available or include different definitions of variables that are entitled similar. Established databases result partly in newly developed researches that hinder in parts an utilisation of innovative researched information. Nevertheless, although this before mentioned analysis handles various basic years mainly in the past and current time periods, important tendencies of demand and supply within an economical and environmental context are clear visible those affect the residential trade and industry of the European Union until 2050. Consequently, the variables are also the foundation of the empirical part, outlined in Chapter 6.

Subsequently, a decision model for realising effectual real estate portfolios has to be developed.

4.2 A decision model for effectual real estate portfolios in Europe

The afore-mentioned databases demonstrate significant trends in the European Union 27. As a result of the demographic developments, the population in 9 countries of the European Union exhibits shrinking tendencies. While half of these states – Germany, Lithuania, Poland, Romania and Slovakia – had growing formations from 1970 to 2010, the other countries – Bulgaria, Estonia, Hungary and Latvia – decreased across the whole period (Figure 4.52). In contrast to these states, Spain's population increased by a high 56.8% (European Commission, 2012a; Eurostat, 2010a). Nevertheless, these tendencies are not solely responsible for the future shifts in the residential trade and industry as analysed later.

Figure 4.52 Trends of the population development



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
1970	8,50	1,40	78,30	10,30	2,40	3,10	32,70	20,10	4,50	33,60
2010	7,50	1,30	81,70	10,00	2,20	3,30	38,20	21,40	5,40	46,10
2050	5,90	1,20	70,60	9,20	1,80	2,80	34,50	18,40	5,30	52,70

Source: European Commission (2012a); Eurostat (2010a); own representation

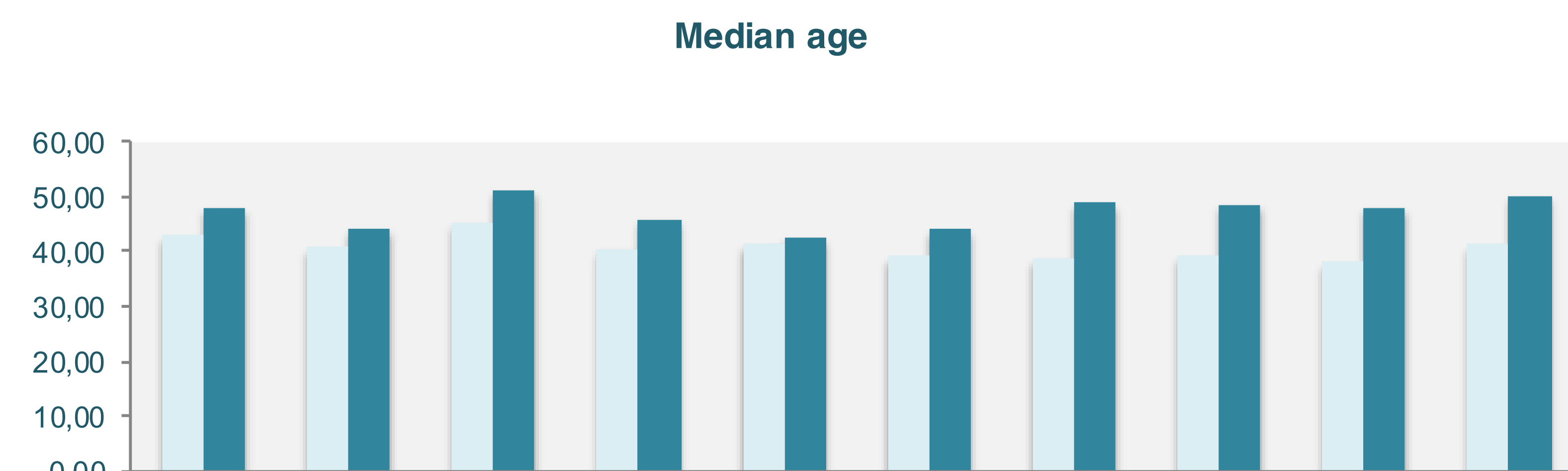
This development is a strong effect of the adjustment to the age structures, which have seen a decrease in the young generations and an increase in the older formations as analysed in Chapter 4.1.1. A crucial aspect here is that the median age has been changing and will do so in future. While the range today lies between 38.2 in Slovakia and 45.5 in Germany, the age level for 2050 will be between 42.7 in Latvia and 51.5 in Germany, which represents the oldest inhabitants currently and in the future (Figure 4.53). Consequently there will be movements in the median ages with a maximum of around plus 10 years in the next 37 years with the highest developments in Poland and Slovakia. The most balanced level will be in Latvia with an increase of

1.2 years of the median age. These tendencies of high median ages in future will change the demands of inhabitants according to habitations, which will have to be constructed in more senior-compatible manner in the future years (United Nations, 2013a).

The result is a future reduction in the number of families and an increase of the elderly population; therefore, the hypothesis is the following:

h.1: Realisation of modernized and new constructed habitations

Figure 4.53 Tendencies of the median age of the populations



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
2013	43,00	40,90	45,50	40,60	41,50	39,30	38,80	39,40	38,20	41,40
2050	48,10	44,40	51,50	46,10	42,70	44,20	48,90	48,80	48,20	50,40

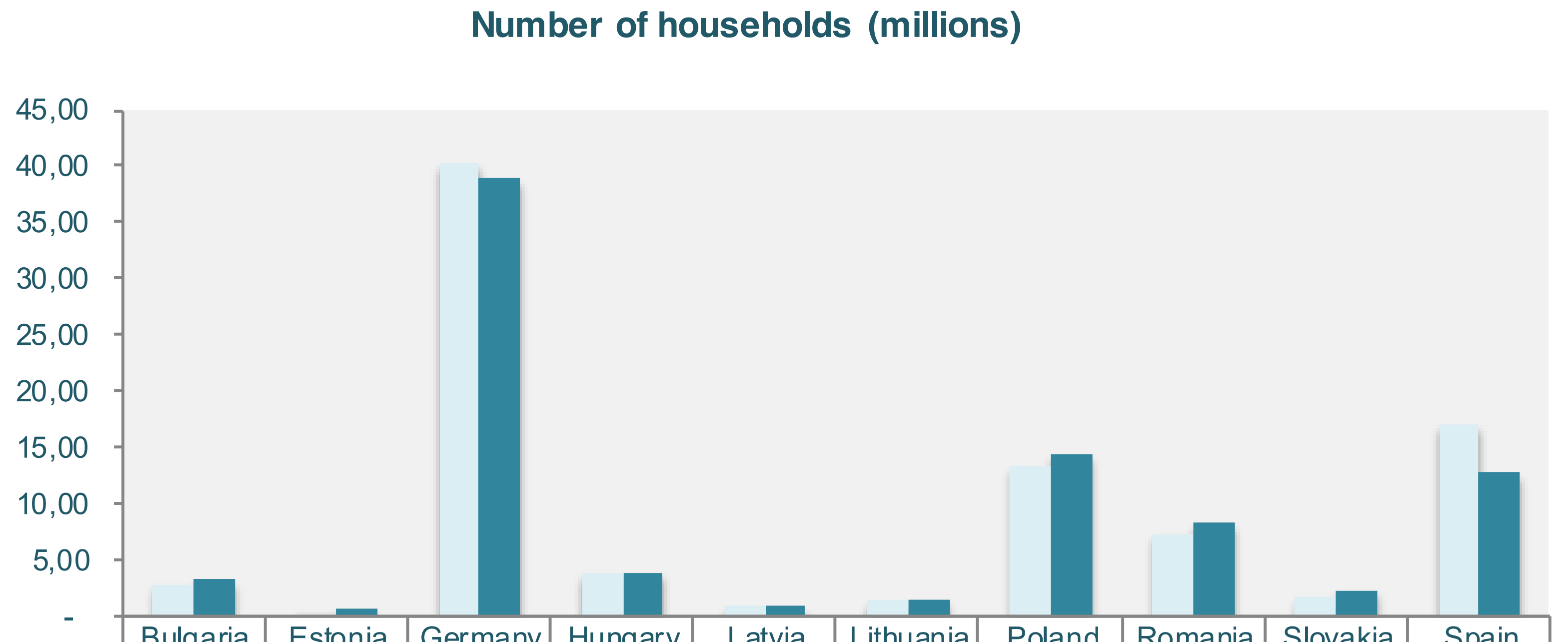
Source: United Nations (2013a); own representation

Nevertheless, the tendencies in the residential trade and industry will shift mainly in the reverse direction until 2030 (Figure 4.54). With the exceptions of Germany, Latvia and Spain, there is a growing development of households in the other countries and, therefore, an increasing tendency towards a higher demand for real estate assets (Cecodhas, 2012; United Nations, 2001).

Consequently, in the main there will be more households in future; therefore, the hypothesis is the following:

h.1: Realisation of modernized and new constructed habitations

Figure 4.54 Development of the formation of the number of households



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
2009	2,90	0,55	40,19	3,79	0,86	1,39	13,32	7,40	1,76	17,08
2030	3,24	0,61	38,82	3,95	0,84	1,53	14,36	8,29	2,40	12,71

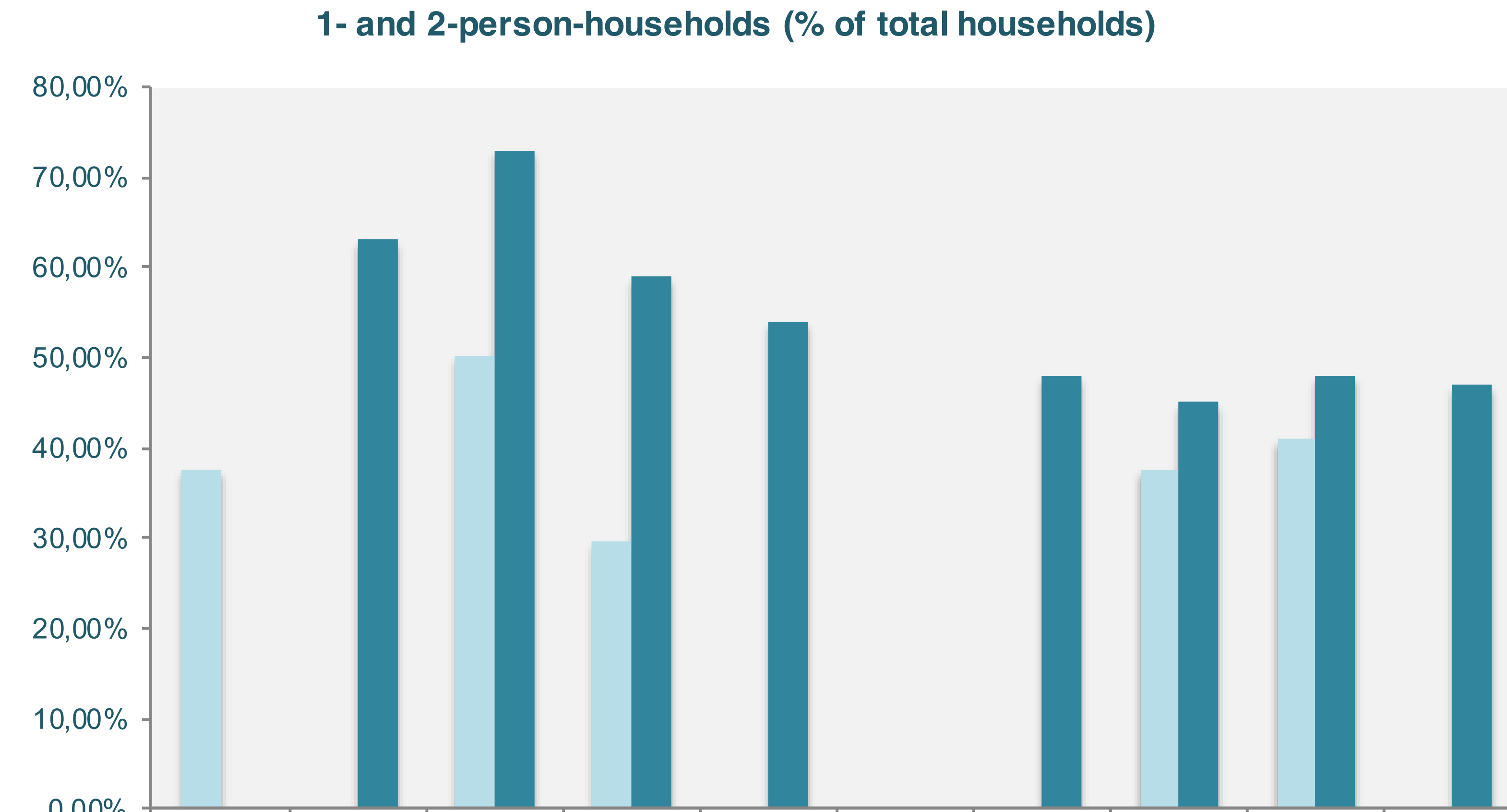
Source: Cecodhas (2012); United Nations (2001); own representation

As a consequence of the strong demographic movements and the changing of age structures, household sizes also change, which is an important factor for the real estate sector. While in the past decades there was a predominant share of 3-and-more-person households, today there is a trend towards smaller 1-and-2-person households ranging from 45.0% in Romania to 73.0% in Germany (Ministry of the Interior and Kingdom Relations, 2010; United Nations, 1974), which represents an increased demand for such habitations today that will continue to grow in the future (Figure 4.55).

Hence, there is a growing tendency towards smaller as well as more households; therefore, the hypothesis is the following:

h.1: Realisation of modernized and new constructed habitations

Figure 4.55 The growth of the smaller 1-and-2-person households



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
1961-70	37,70%	-	50,29%	29,60%	-	-	-	37,60%	41,00%	-
2004-08	-	63,00%	73,00%	59,00%	54,00%	-	48,00%	45,00%	48,00%	47,00%

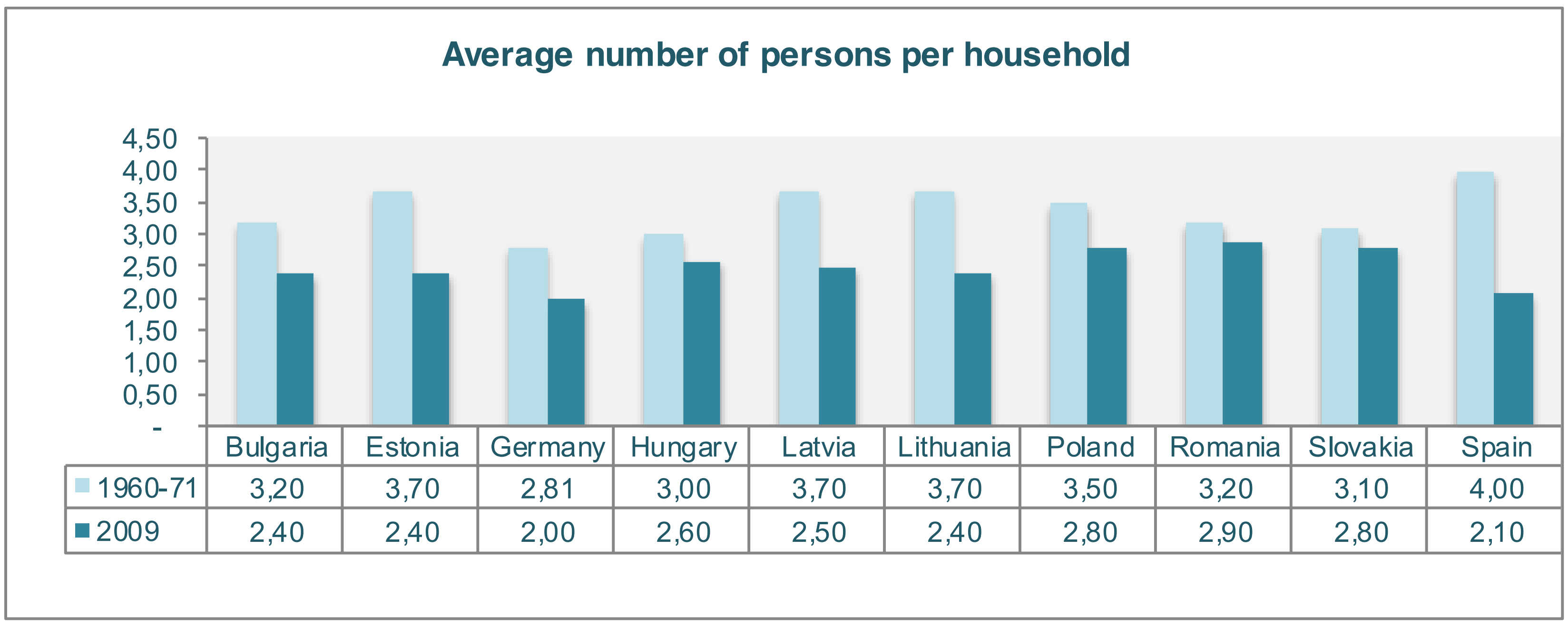
Source: Ministry of the Interior and Kingdom Relations (2010); United Nations (1974); own representation

Therefore, also the average number of persons per household is changing. In the past base years 1961/ 1971 the highest number of persons per household was to be found in Spain with 4.0 persons; the lowest was detected in Germany with 2.8. Today in the base year 2009 there has been an upward shift to a high level of 2.9 persons per household in Romania and a low quantity of 2.0 in Germany (Figure 4.56), which demonstrates significant trends in this field (Cecodhas, 2012; United Nations, 1974). Consequently there is mainly a need for higher numbers of housing and smaller dwellings in real estate assets, which has to be responded to in each country's portfolio management.

Thus, there is a reduction in the number of families and a development towards smaller households; so the hypothesis is as follows:

h.1: Realisation of modernized and new constructed habitations

Figure 4.56 Shrinkage of the average number of persons per household



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
1960-71	3,20	3,70	2,81	3,00	3,70	3,70	3,50	3,20	3,10	4,00
2009	2,40	2,40	2,00	2,60	2,50	2,40	2,80	2,90	2,80	2,10

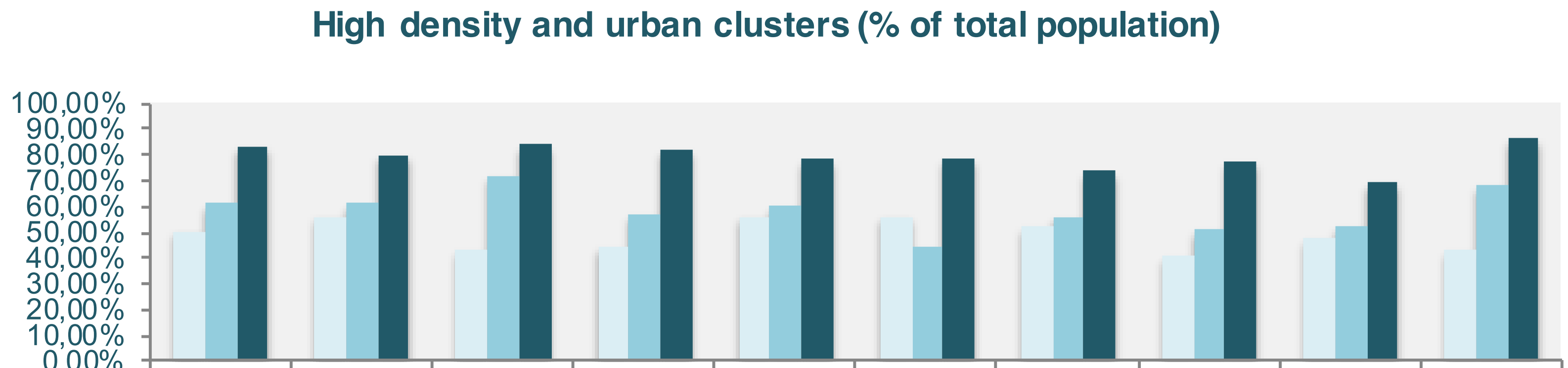
Source: Cecodhas (2012); United Nations (1974); own representation

Another area of the change in demands of population is the location of the residential trade and industry portfolios. In the past decades 1960/ 1970 there was mainly stability between urban and rural living. This changed with the consequence of a major percentage now living in high-density or urban clusters, ranging from 51.0% in Romania to 72.0% in Germany. In Lithuania there was the opposite tendency from 1960/ 70 to 2006, but this will also change and increase until 2050. In 2050 it is forecasted that the figures will range from 69.3% in Slovakia to 86.5% in Spain (Eurostat, 2012d; Geohive, 2010; United Nations, 1971) with the consequence of a focus on real estate portfolios located in more urban areas (Figure 4.57).

Therefore, a future housing displacement into urban regions has to be realised with the resulting hypothesis:

h.1: Realisation of modernized and new constructed habitations

Figure 4.57 Movement to high-density and urban clusters



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
1970	50,60%	56,30%	43,30%	44,40%	56,30%	56,30%	52,00%	40,80%	47,60%	42,90%
2006	61,00%	61,00%	72,00%	57,00%	60,00%	44,00%	56,00%	51,00%	52,00%	68,00%
2050	83,41%	80,01%	83,81%	82,14%	78,08%	78,73%	73,62%	77,37%	69,32%	86,47%

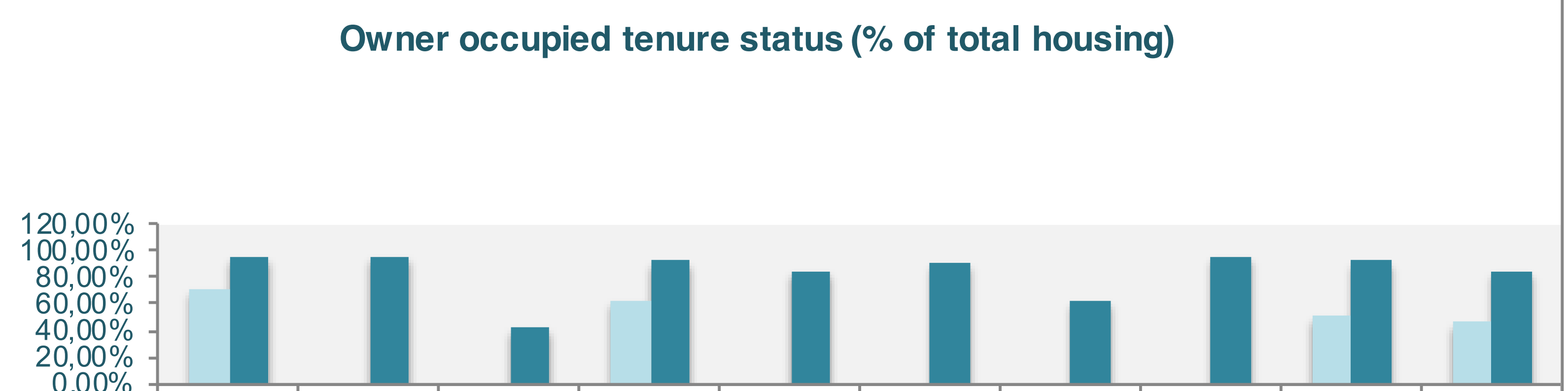
Source: Eurostat (2012d); Geohive (2010); United Nations (1971); own representation

The owner-occupied tenure also indicates a tendency towards a change in the residential trade and industry. While the available databases covering the past decades demonstrate a percentage of owner-occupied habitations represent 45.9% of the total in Spain and 71.0% in Bulgaria, there is currently a significant demand for own housing ranging from 42.0% in Germany to 96.0% in Estonia and Romania. Germany is by far the lowest in this area, followed by Poland with 62.4%; nevertheless, the other researched countries lie between 84.9% and 96.0% (Cecodhas, 2012; United Nations, 1974). Therefore, in most of these countries apartment buildings play a minor role so that the tenures are responsible for the realisation of adequate housing (Figure 4.58).

In consequence, the cost awareness and inflexibility of tenures is high thus the hypothesis is as follows:

h.2: Realisation of extrapolated and modernized habitations

Figure 4.58 Formation of owner-occupied tenure status



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
1950-70	71,00%	-	-	62,90%	-	-	-	-	50,40%	45,90%
2008-10	95,60%	96,00%	42,00%	92,00%	84,90%	91,00%	62,40%	96,00%	92,00%	85,00%

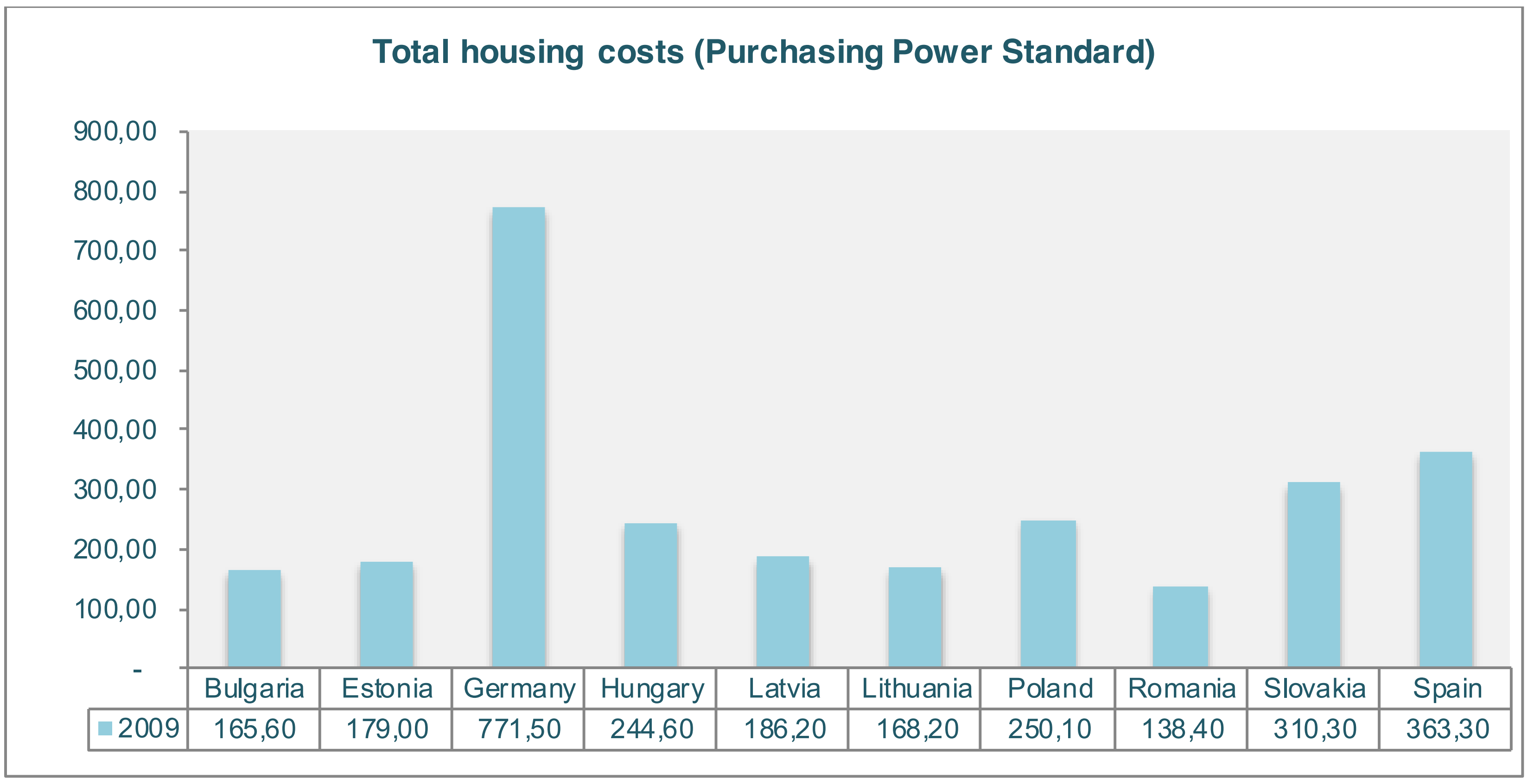
Source: Cecodhas (2012); United Nations (1974); own representation

The total housing costs in purchasing power standards, needed to realise an effective comparability between the countries, are high in Germany at 771.5. The other states of the European Union 27 are valued from a relatively low level of 138.4 in Romania to a high standard of 363.3 in Spain (Cecodhas, 2012). Because the housing costs in some countries are comparably high, it could be estimated that additional expenditure in the future for, e.g., modernizations or new buildings will be limited (Figure 4.59).

The outcome is a focus on a cost-benefit equation and the available income of individuals with the ensuing hypothesis:

h.3: Realisation of extrapolated, modernized and new constructed habitations

Figure 4.59 Exposure of total housing costs in PPS



Source: Cecodhas (2012); own representation

Also the construction cost index is at relatively high levels in the analysed states. Germany had a stable index of 111.5 in 2005 that point to a development of 11.5% over a period of 5 years (Cecodhas, 2012). Nevertheless, Bulgaria, Latvia, Romania and Spain realised high movements with the consequence of an establishment of significant prices in the new building sector (Figure 4.60). In these countries these dimensions could inhibit the realisation of custom-made housing through new constructions.

The effect is a focus on a cost-benefit equation as well as the available income of occupants with the following hypothesis:

h.3: Realisation of extrapolated, modernized and new constructed habitations

Figure 4.60 **Equation of the construction cost indexes**

	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
2010	139,90	115,30	111,50	123,10	152,50	116,10	115,80	148,20	116,80	122,30

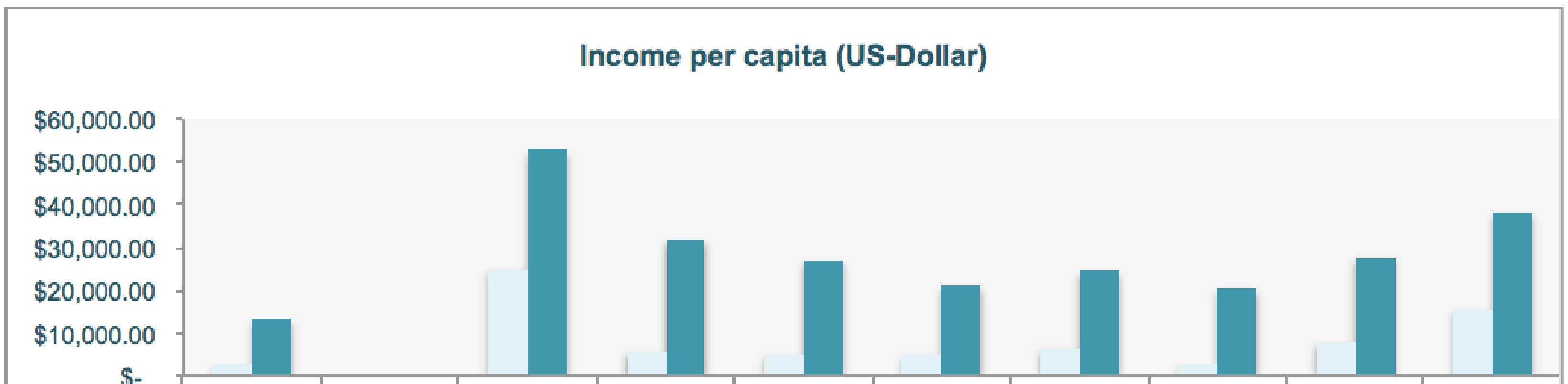
Source: Cecodhas (2012); own representation

Furthermore, the economic conditions differ between the researched countries, although they all include a growing tendency of per-capita income. The most important growth is in Romania with a projected increase of 684.2% from 2010 to 2050. The lowest is Germany with 110.0% predicted for 2050 (HSBC, 2012). For the residential trade and industry this trend could be an impulse for the growth of real estate assets if consumers invest their higher budgets in real estate assets (Figure 4.61).

Therefore, available income will rise in future; nevertheless, there will also be higher construction costs with the arising hypothesis:

h.3: Realisation of extrapolated, modernized and new constructed habitations

Figure 4.61 **Trend of the income per capita**



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
2010	$2,542.00	-	$25,083.00	$5,833.00	$4,973.00	$5,154.00	$6,563.00	$2,596.00	$8,042.00	$15,699.00
2050	$13,154.00	-	$52,683.00	$31,966.00	$27,143.00	$20,955.00	$24,547.00	$20,357.00	$27,639.00	$38,111.00

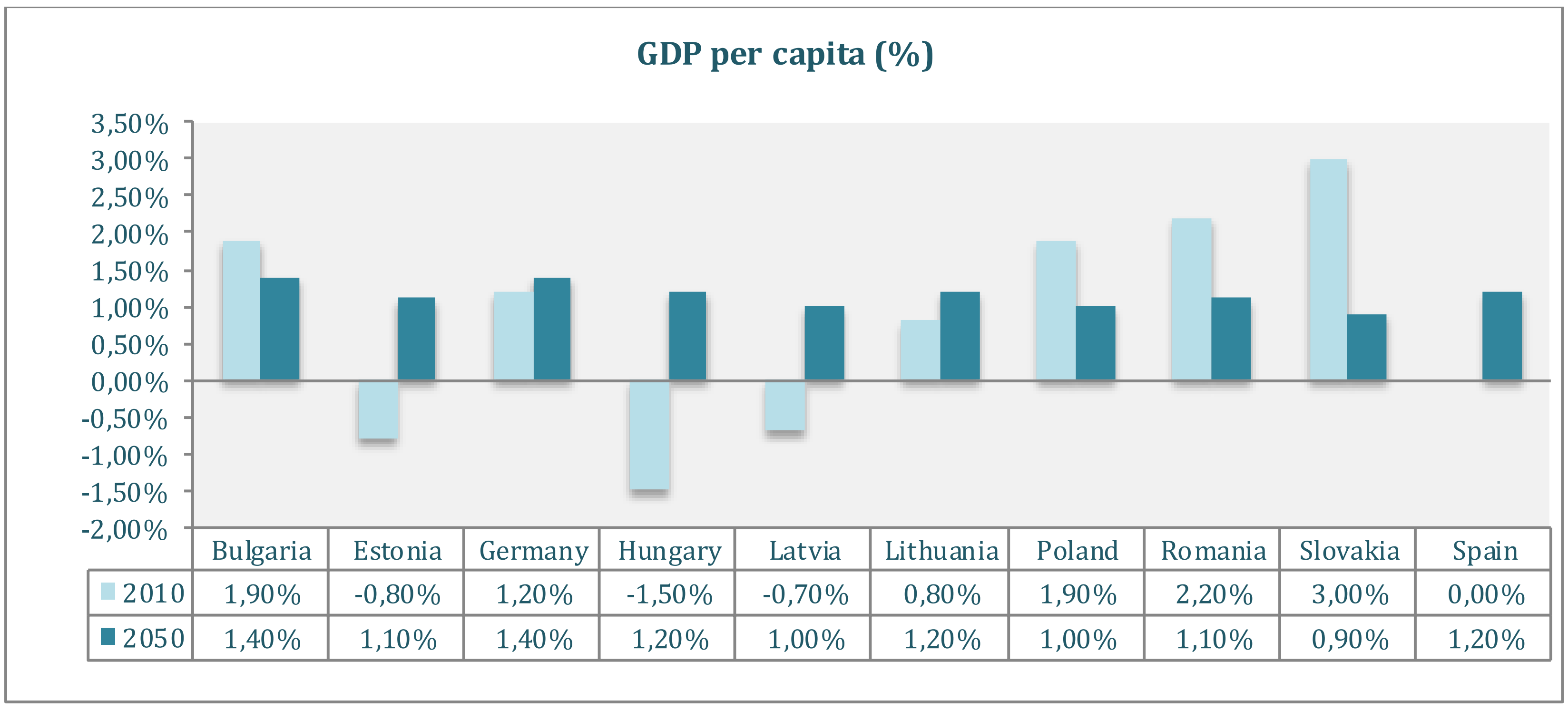
Source: HSBC (2012); own representation

The GDP per capita develops in two different ways. In Estonia, Germany, Hungary, Latvia, Lithuania and Spain the movement will be positive until 2050 (European Commission, 2012a). Consequently in these states economic growth is predicted, which can also cause growth in the residential trade and industry. The states Bulgaria, Poland, Romania and Slovakia will realise a negative economic shift. This could be disadvantageous for the fulfilment of custom-fit real estate assets (Figure 4.62).

Consequently, there will be differences in the economic developments of the countries with the following hypothesis:

h.3: Realisation of extrapolated, modernized and new constructed habitations

Figure 4.62 **Tendency of the GDP per capita**



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
2010	1,90%	-0,80%	1,20%	-1,50%	-0,70%	0,80%	1,90%	2,20%	3,00%	0,00%
2050	1,40%	1,10%	1,40%	1,20%	1,00%	1,20%	1,00%	1,10%	0,90%	1,20%

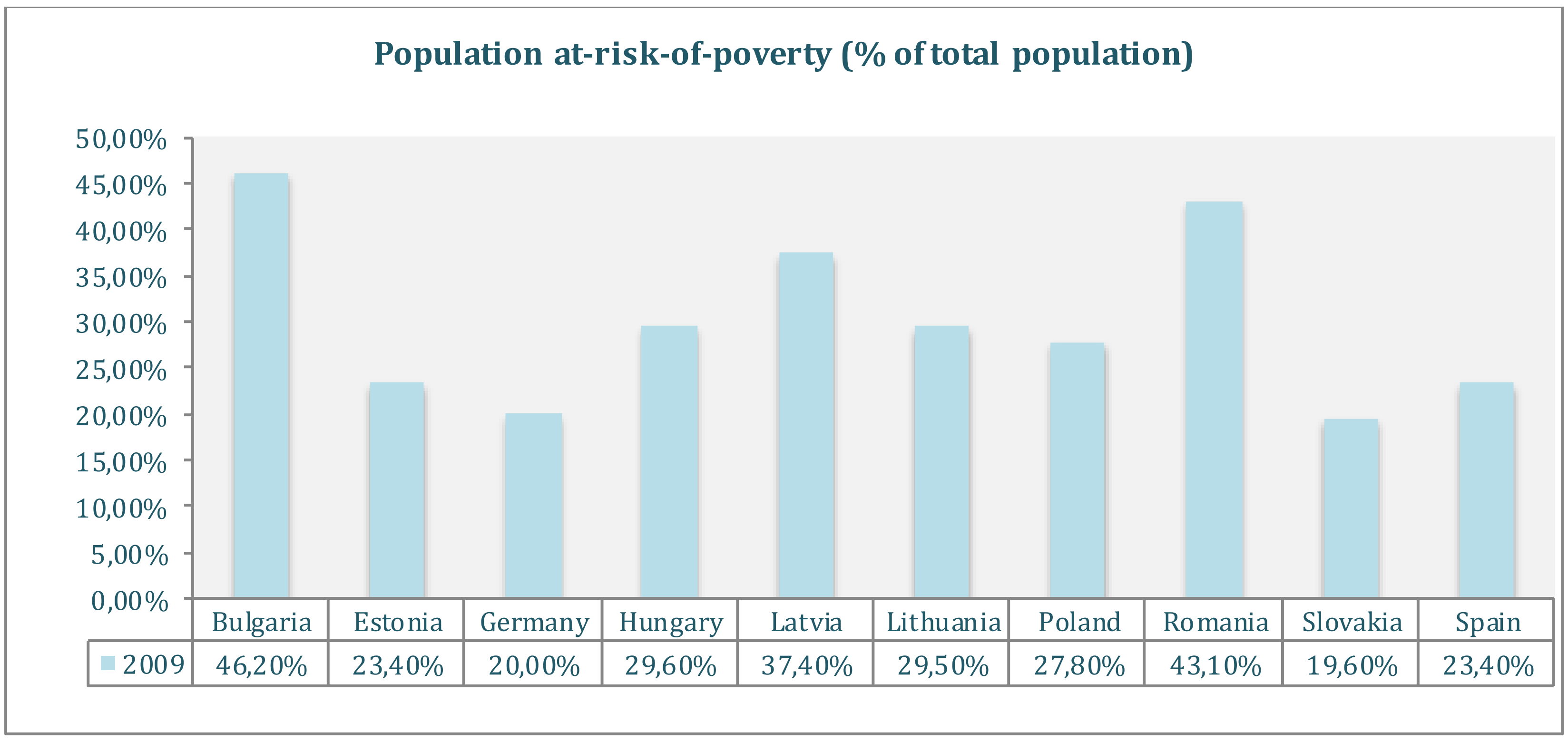
Source: European Commission (2012a); own representation

The percentage of the population at risk of poverty is a crucial area in the countries. Slovakia has the lowest at 19.6%; Bulgaria the highest at 46.2%, followed by Romania with 43.1% (Eurostat, 2012f). Consequently the self-dependent fund of consumer demand habitation assets will be a challenge in countries with high levels in this economic area, which stands in contrast to the other positive economic conditions mentioned above (Figure 4.63).

Thus, there is a focus on high poverty as well as less redistribution with the below hypothesis:

h.2: Realisation of extrapolated and modernized habitations

Figure 4.63 Formation of the population at risk of poverty



Source: Eurostat (2012f); own representation

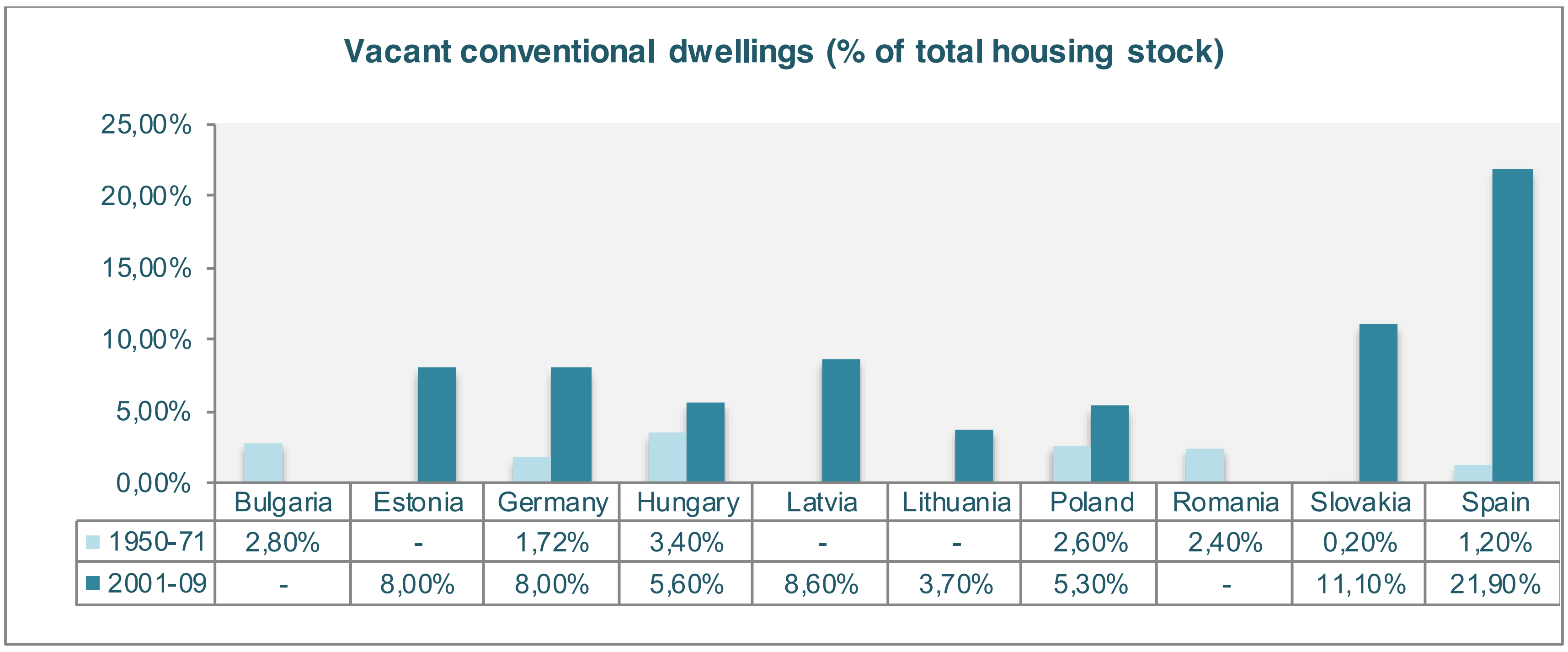
In a nutshell it can be stated that there is a higher demand for residential trade and industry assets in most of the analysed countries as a consequence of a shift towards smaller household sizes in the European Union. Consequently, a focus on smaller dwelling sizes is necessary. Additionally as a result of a strong increase of older generations and the change of the median ages across the states, real estate assets also have to respond to the needs of these growing generation clusters and focus on a higher share of senior-compatible habitations. For the claim of infrastructural surroundings as a conclusion of the shift to older generations, urban areas embrace a growing trend. Nevertheless, the high numbers of owner-occupied habitations and negative economic conditions in some fields will mean a limited willingness to pay for additional configurations of real estate assets.

However, research has revealed that today the real estate assets are not responding to the demands of the populations. While the amount of vacant habitations ranged in 1950/1971 from 0.2% in Slovakia to 3.4% in Hungary, there has been a major shift to 3.7% in Lithuania and 21.9% in Spain (Ministry of the Interior and Kingdom Relations, 2010; United Nations, 1974), which is a strong indicator of real estate assets not fitting the demands of the current population (Figure 4.64).

The effect is an absence of custom-fit habitations with the following hypothesis:

h.1: Realisation of modernized and new constructed habitations

Figure 4.64 The tendencies of vacant conventional dwellings



	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
1950-71	2,80%	-	1,72%	3,40%	-	-	2,60%	2,40%	0,20%	1,20%
2001-09	-	8,00%	8,00%	5,60%	8,60%	3,70%	5,30%	-	11,10%	21,90%

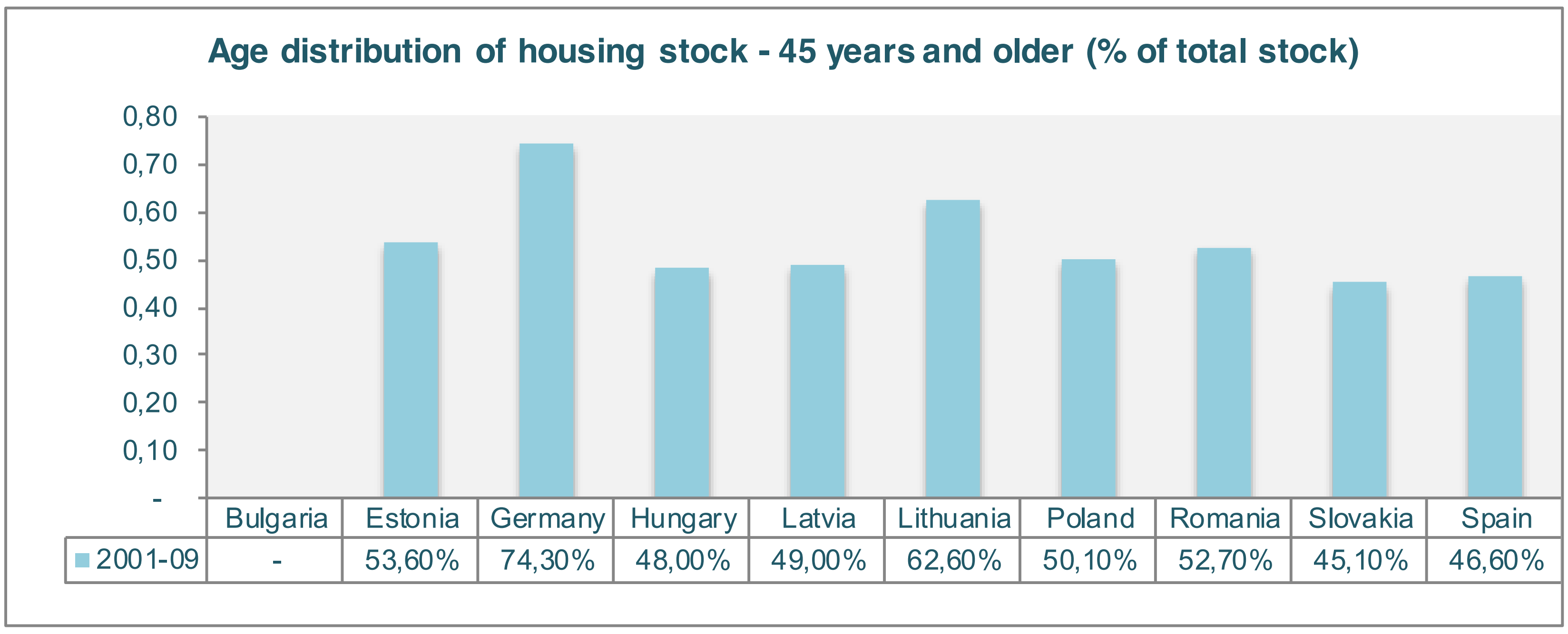
Source: Ministry of the Interior and Kingdom Relations (2010);
United Nations (1974); own representation

Certainly one of the challenges to offer custom-made residences is the high age distribution of the housing stocks in each country. Also in this field there is a clear trend towards mainly high-aged real estate assets. With the base years 2001 to 2009 the databases showed that the construction ages of the habitations falling in the period 1970 and earlier represent a high share of asset portfolios. The most significant real estate portfolios aged 45 years and older are in Germany with 74.3%; nevertheless, the lowest ratio of 45.1% is in Slovakia (Ministry of the Interior and Kingdom Relations, 2010) that demonstrates an unbalanced level of age distributions (Figure 4.65).

Consequently, a high age distribution of housing stock and a change of customer demands is evaluated with the following hypothesis:

h.1: Realisation of modernized and new constructed habitations

Figure 4.65 Trends of the age distribution of housing stock



Source: Ministry of the Interior and Kingdom Relations (2010); own representation

In summary, the core hypothesis of the afore mentioned circumstances are:

H 1: High shares of modernized and new constructed habitations for 2050

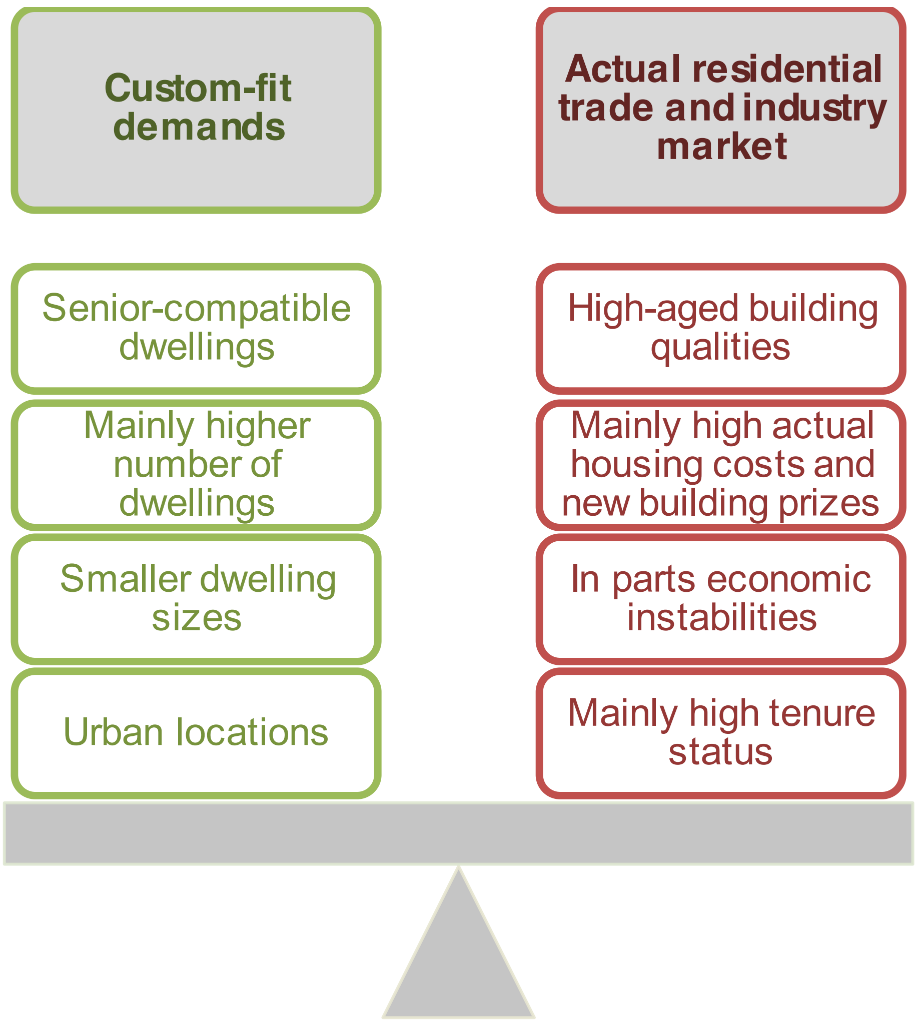
H 2: Low shares of extrapolated habitations for 2050

Therefore, approaches to secure residential trade and industry values can be deduced as follows.

4.3 Approaches to secure real estate values

As analysed in the previous chapters, there is a strong tendency towards deciding trends in the European Union 27. On the one hand, consumers are mainly demanding a higher number of smaller-sized dwellings as a result of changes in the age clusters in the different countries. Because the highest increasing group of inhabitants are the elderly, there is a necessity to realise more senior-compatible dwellings. Furthermore, the demand to live in urban locations is growing disproportionately. On the other hand, the current real estate market offers high-aged buildings with an age of a minimum of 45 years that mostly hold a tenure status. Although economic instability is evident in some areas, current housing costs remain high and the price of newly constructed habitations is also at an important level (Figure 4.66).

Figure 4.66 General trends in the European Union



Source: Own representation

Hence, there are various risks obvious in the context of future residential trade and industry portfolios as already analysed in Chapter 3. According to the above-stated general trends in the European Union, the main risk areas are as follows:

- Environmental risks – Ruin of the real estates, social requirements:

  General trends:

  - *Shift of occupancy-demand*

- Economic risks – Business cycle, unemployment, development of income and purchasing power:

General trends:

- *Formation of owner-occupied tenure status*
- *Increasing shares of total housing costs and construction cost indexes*
- *Change of GDP per capita*
- *Shift of population at risk of poverty*

- Sectorial risks – business cycle, supply and demand behaviour, vacancy, technological innovations:

General trends:

- *Rise of vacant conventional dwellings*
- *Development of age distribution of housing stock*

- Location-specific risks – Economic potential of the community, demand and supply at the location, vacancy risks in the community, location infrastructure:

General trends:

- *Movement to high-density and urban clusters*
- *Rise of vacant conventional dwellings*

- Residential trade and industry risks, along the lifecycle – Development risks, evaluation risks, utilisation risks, loss of revenue risks, exploitation risks:

General trends:

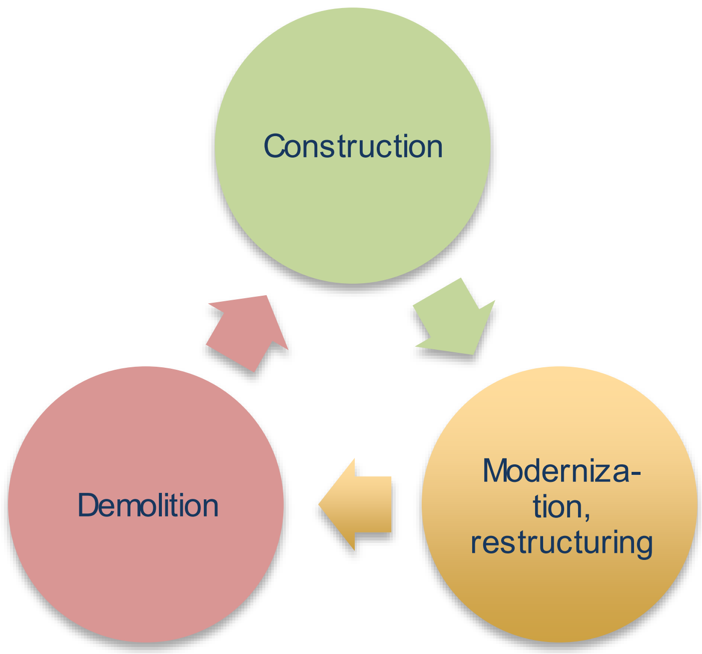
- *Development of age distribution of housing stock*
- *Higher number of households*
- *More smaller households, shrinkage of average number of persons per household*
- *Movement to high-density and urban clusters*
- *Rise of vacant conventional dwellings*

- *Change of GDP per capita*
- *Shift of population at risk of poverty*
- *Growth of median age*

To support current and future demands, there is a necessity to supply the requirements of the population. Therefore, a mix of residential trade and industry portfolios has to be adapted to meet the situation.

The combination of asset portfolios depends on the lifecycle of real estate stocks. The lifecycle varies according to the technical lifespan of components as well as the economically useful life of the buildings. Both methods of approach interact in mutual interdependencies. The technical lifespan is a core requirement of the economic lifecycle for habitation. However, if the economic conditions are not accessible, then also the technical lifespan is determined to be finished with the consequence of the demolition of real estate. For Kalusche (2004) the lifecycles contain different phases. At the establishment of the lifecycle the assets are newly constructed and thus represent a vacancy until the start of usage. After the start of usage, modernizations and restructurings are required over the period of the building's lifetime to fulfil technical and economic conditions. At the end of the lifecycle, demolition and elimination are essential because neither the technical nor the economic conditions are met. The core segments are illustrated below (Kalusche, 2004):

Figure 4.67 Real estate lifecycle



Source: Kalusche (2004); own representation

Corresponding to Kalusche (2004), the technical lifespan embraces diverse influences in the lifecycle of real estate assets; the main ones are described below:

- *Characteristics of building materials*

  Building materials are generally standardised products with technical specifications. If this requirement is not met, the technical lifespan decreases as a result of higher loss susceptibility and a faster machine fatigue.

- *Faults in the building design*

  Mainly in the implementation planning, state-of-the-art technology has to be considered along with essential norms and fundamental rules. With the usage of unsuitable building materials or if the plan is not detailed enough, a reduction of the lifespan is normally the outcome.

- *Defects in the building construction*

  If manual work by craftsmen is not carried out correctly as a consequence of absent knowhow or time and cost pressures, damage to the building stock could be a consequence with the result of an increase of the amount of repairs and a decrease of the technical life period.

- *Behaviour of the users*

  Users of habitations waste buildings. This wasting depends on the maintenance carried out by consumers. If they care for their habitation, the lifespan could be increased; if parts of the building are vandalised, life periods will be reduced.

- *Type and degree of building and land use*

  Building components have to be maintained and reconditioned by tenants. If tenants neglect to do this, early erosion could be the consequence.

- *Environmental influences*

  Building components are influenced by environmental stimuli such as water, temperature and toxic element, which also reduce the lifecycle of habitations.

In addition, the economic circumstances have influence on the lifespan of real estate assets as outlined below (Kalusche, 2004):

- *Economic targets of the builder owner*

  The cost-effectiveness as well as cash returns for preservation of the habitation impact the rise or reduction of the lifespan of a building.

- *Building location and system environment*

  The position of the building stock determines its attractiveness. Changes in utilisations in the neighbourhood, surrounding properties or nearby infrastructure can enhance or devalue the status of properties.

- *Functionality and design quality*

  Requirements in regard to functionality as well as the design characteristics can change rapidly, principally as a result of a change in tenants. The effect could be the modification of the residence to realise a longer lifecycle.

- *Population development and migration*

  Population changes alter the demand for habitations and downstream equipment with a necessity for habitations to be transformed.

- *Income development in general*

  Income levels regulate the demand for dwellings in both, free and regulated real estate markets. This income development influences rents as well as the economic feasibility and the lifespan of the building.

- *Utilisation of available income*

  The consumption of existing incomes is an individual household decision. Residential trade and industry assets compete with other investments and consumption potentials. With an emphasis on other investments and consumptions, the life expectancy of houses could decline.

In correlation with their technical and economically useful lifespan, buildings go through different stages of development. Evidence of average life expectances in combination with the earlier stated concerns and a suitable utilisation of real estate assets, the life expectancies of residences, which are properly maintained according to the rules but without modernization, range between 50 and 100 years (Kalusche, 2004).

As analysed in this chapter, there is a strong shift in the demographic development of the countries in the European Union 27. Therefore, demands are changing and will do so in future. To stabilise the real estate portfolios in these states, it is necessary to offer customised residential trade and industry assets. Nevertheless, although countries comprise analogical tendencies, it is crucial to establish real estate portfolios that conform to the demographic, space, environmental and social/ economic characteristics of each country. An optimal mixture of asset stocks has to be available in future decades with extrapolated, modernized and new-constructed real estate assets to complete a reasonable portfolio.

To identify the optimal residential trade and industry portfolio, it is necessary to apply important variables, which could have an influence on portfolio management; they are described in the above chapters. Consequently a structured technique to organise the complex decision-making process in this field has to be available. To realise this form of decision-making in the residential trade and industry, in the following chapters Thomas L. Saaty´s Analytic Hierarchy Process methodology will be used to research and analyse the decision elements of each country.

5 Transformation of the quantitative Analytic Hierarchy Process for implementation in the residential trade and industry

The methodology used in research of this study is outlined in this chapter. The mathematician Thomas L. Saaty created the Analytic Hierarchy Process in 1980. There are different key perceptions about this methodology: In Saaty's view, as a result of a complex world there is the necessity to handle more challenges than are possible for an individual to realise. Consequently, Saaty constructed an approach to reduce the complexity of decision-making. In the AHP methodology there are two basic converge approaches to explain problems: deductive and systems (Saaty, 1990). For Burney (2008), on the one hand, the deductive methodology comprises a hypothesis built on existing theories followed by research approaches intended to test these hypothesis. According to Ackoff et al. (2010), on the other hand, the system approach is a connection of considerations in the managerial area, which pressures interactive as well as the interdependence environments of outside and inside dynamics in organisations to evaluate market situations, which touch upon the business of these organisations. According to Saaty (1990), because individuals are generally not rational creatures, the AHP establishes feelings, perceptions as well as logic in a systematised method to realise decision-making.

Saaty's AHP structure forms the transformation for effective portfolios in the residential trade and industry, which were researched in detail for this study.

5.1 Valuation methodology based on AHP

" 'You can´t compare apples and oranges', so the saying goes. But is this true? Consider a hungry person who likes both apples and oranges and is offered a choice between a large, red, pungent, juicy looking Washington State apple and an even larger, old and shrivelled, pale colored orange with a soft spot. Which one is that person more likely to choose? Let us reverse the situation and offer the same person on the next day a small, deformed, unripe apple with a couple of worm holes and a fresh colored navel orange from California. Which one is he or she more likely to choose now?"(Saaty and Vargas, 2001)

Following Aznar Bellver et al. (2011a), the Analytic Hierarchy Process was created by Thomas L. Saaty in 1980 and is a technique for analysing and realising decision-making, which is established across wide-ranging fields within the business sector. For Saaty and Vargas (2001) this technique is a universal theory of measurement. The AHP is a descriptive theory, which treats individuals independently from their basic circumstances. Prior to the AHP there was no widespread amalgamated theory across all areas of social, economic, political as well as environmental and cultural factors permitting people to realise optimality codes for their performances (Saaty and Vargas, 2001). Managing the quantitative as well as qualitative variables to evaluate the best alternatives with respect to the overall target by building pairwise comparisons of all variables became an established practice (Saaty, 2005; Saaty and Vargas, 2001).

According to Saaty and Vargas (2001), in the field of AHP, the rationality concerns to realise these procedures are outlined in the four purviews as follows: "Focussing on the goal of solving the problem; knowing enough about a problem to develop a thorough structure of relations and influences; having enough knowledge and experience and access to knowledge and experience of others to assess the priority of influence and dominance (importance, preference or likelihood to the goal as appropriate) among the relations in the structure; allowing for differences in opinion with an ability to develop a best compromise."(Saaty and Vargas, 2001)

The foundation of this mathematical statistical methodology is the creation of the AHP hierarchy with the objective in the highest level, followed by the criteria as well as the subcriteria in the next levels and finally the alternatives in the last level. In the next stages the assessment of the variables by realising pairwise comparisons and the calculations of the weights in every level is substantial, followed by the calculations of the weights of the entire AHP hierarchy. If the evaluation of the consistency ratio is plausible, the examination of the outcomes as well as the decision-making process complete this approach (Saaty, 1990). The following structure demonstrates the fundamental stages of this methodology in an overview:

Figure 5.1 The basic steps of the AHP methodology

Source: pangea labs GmbH Switzerland (2012); own representation

5.1.1 AHP hierarchy

According to Saaty (1990), to reduce the complexity of decision-making and understand complicated systems in a better way, these systems have to be broken down into fundamental sections by structuring the sections using a hierarchical method. They have to be arranged based on the relative significance of the components at each level of the hierarchy into a set of total primacies (Saaty, 1990).

According to Saaty and Vargas (2001), the Analytic Hierarchy Process is used to develop ratio scales from separate and continuous pairwise comparisons in multilevel hierarchy constructions. The pairwise comparisons are established from tangible dimensions, respectively from a fundamental scale, which replicates the comparative asset of preferences as well as feelings. The AHP has a special dependence within and between the clusters of different elements of its structure. Basically, the AHP is a nonlinear pattern to fulfil the deductive and inductive view. This procedure has the potential to use numerous influences on reflection in a simultaneous way, allowing for subjection and feedback, and realising numerical trade-offs to recognise a decision. To establish the AHP for decision-making, a hierarchy or a network structure is necessary. Furthermore, pairwise comparisons are crucial to finding relations within this structure. These pairwise comparisons lead to matrices, from which ratio scales result in eigenvectors, respectively eigenfunctions. The matrices are positive as well as reciprocal, e.g., $a_{iJ} = 1/a_{ij}$. As a result of the requirement for a variation of decisions, there is the necessity to deal with the development of amalgamating group results. In the AHP structure there are four different principals: The comparison of homogeneous components, the reciprocal relationship of elements, the hierarchy dependency as well as the validity of the rank, the value of the result and their reliance on the structure (Saaty and Vargas, 2001). Analyses by Saaty (1990) highlight that to work with the AHP hierarchy, there is first the requirement to define and focus on the current situation and the circumstances, embracing as many related aspects as potential, which require complex decision-making. Dividing a hierarchy structure into different aspects is essential, where the highest level is the overall target and the lowest includes the alternative strategies, which affect in a positive or negative manner the core goal through their influence on the criteria and subcriteria (Saaty, 1990).

For Saaty (1990), in the first stage of the AHP procedure the AHP hierarchy has to be created. For the formation of this hierarchy in the first level, the overall target of decision-making has to be defined, followed by a collection of criteria, which compare the relative importance with respect to the objective. These criteria could be broken down into a next level of subcriteria, which again relay to the group of criteria. In the fourth level the alternatives are established for realising the goal; these have to be compared with the relative preference with a matter to the subcriteria. At least the relative importance of the subcriteria has to be compared with respect to the different alternatives (Saaty, 1990).

5.1.2 AHP priorities

Based on Saaty (1990), the formation of the priorities of the diverse elements of the formed hierarchy is a fundamental part of the second stage of the Analytic Hierarchy Process. Therefore, the pairwise comparisons, where the elements are compared against a given criterion, have to be executed. With the treatment of a matrix a structure is specified for analysing consistency, achieving further information as a result of fulfilling all probable comparisons as well as evaluating the sensitivity of all the priorities to changes in decisions. The matrix reflects the dominating as well as dominated characteristics of priorities (Saaty, 1990).

On the basis of research by Saaty (2001), two kinds of measurements are possible: absolute and relative dimension. In the absolute dimension, alternatives are compared with the memory and experience of professionals. In the relative measurements, alternatives are compared pairwise according to a collective characteristic. Therefore, the AHP interacts with absolute as well as relative measurement scales. In the relative measurements elements are compared in pairs with the others. In the pairwise comparison construction, elements i and j are compared with regard to a collective feature. The i element is smaller and utilised as a component, while the larger j is valued as a multiple of that component in the formula $w_1/w_2/1$, where the ratio w_1/w_2 is transferred from a fundamental scale of absolute values (Saaty, 2001).

Table 5.1 The matrix for pairwise comparisons

	A_1	A_2	A_3
A_1	1		
A_2		1	
A_3			1

Source: Saaty (1990); own representation

According to Saaty and Vargas (2001), absolute measurement or scoring is related to ranking the alternatives in terms of the criteria, respectively the rankings of the criteria, for instance excellent, very good, good, and average, below average, poor or very poor. After the measurement of priorities, for the criteria and, if applicable, sub-criteria the comparisons in pairs are also realised between the ratings themselves to establish primacies for them under each criterion and dividing each of their primacies by the most important valued intensity to get the ideal intensity (Saaty and Vargas, 2001).

Finally, alternatives are focussed on by evaluating their respective rankings under each criterion and summarising these rankings for all the criteria. The result is a ratio scale score for the alternatives. At the end, these scores can by normalised by dividing each by their sum (Saaty and Vargas, 2001).

5.1.3 The Fundamental Scale

By operating with personnel reviews instead of ratios, a valuation of the ratios as numbers of the Fundamental Scale of Saaty's AHP is required.

A valuation is a pair of elements with respect to a common characteristic. The smaller component is considered to be the unit and the specialists evaluate how many times more central, respectively more dominant the other element is by utilising one of the specified numbers from the Fundamental Scale (Saaty, 2009).

Table 5.2 The Fundamental Scale of absolute numbers

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
Reciprocals of about	If activity *a* has one of the above non-zero numbers assigned to it when compared with activity *b*, then *b* has the reciprocal value when compared with *a*	A reasonable assumption
Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining n numerical values to span the matrix

Source: Saaty (2009); own representation

Saaty´s researches (2009) demonstrate that a dominant element is often interpreted as more important than another element. The pairwise compared sections have to be homogeneous. If sections differ in their characteristics, they have to be clustered into homogeneous sets. If measurements from an existing scale are used, they can be normalised without respect to similarity (Saaty, 2009).

Because trade-offs have to be realised between diverse criteria, rankings often become complex. Therefore, the numbers for evaluating the potency have to be selected conscientious with which every element possesses to the criterion, respectively sub-criterion in question. Therefore, at the end there has to be an outcome that considers all trade-offs and fulfils the correct total priorities for the elements (Saaty, 1990).

5.1.4 The synthesis

To achieve the complete priorities for the conclusion, it is in the opinion of Saaty (1990) essential to harmonise, respectively synthesise the decisions of the pairwise comparisons. Therefore, there has to be an adding to realise a single number to specify the priority of every element. To fulfil a total estimate of the relative priorities from one level to the next level up in the AHP hierarchy, an achievement is crucial to synthesise the judgements (Saaty, 1990).

Table 5.3 Example of the synthesis of the judgements

	A_1	A_2	A_3
A_1	1	1/2	1/4
A_2	2	1	1/2
A_3	4	2	1
Column total	**7**	**3.5**	**1.75**

Source: Saaty (1990); own representation

Consequently, an adding of the values in every column has to be accomplished. Following a division of every entry in every column by the entire of the column has to be executed to get a normalised matrix that provides reasonable comparisons between the elements (Saaty, 1990). Therefore, the outcomes of Table 5.4 are based on Table 5.3, where the results derived from dividing each value of column 1 by 7 – total value of column 1, each value of column 2 by 3.5 – total value of column 2 - and each value of column 3 by 1.75 – total value of column 3 of Table 5.3.

Table 5.4 Example of a normalised matrix

	A_1	A_2	A_3
A_1	0.14286=1/7	0.5/3.5=1/7	0.25/1.75=1/7
A_2	0.28571=2/7	1/3.5=2/7	0.5/1.75=2/7
A_3	0.57143=4/7	2/3.5=4/7	1/1.75=4/7

Source: Saaty (1990); own representation

Conclusively, an average over the rows by addition of the values in every row of the normalised matrix as well as dividing the rows by the number of the entries has to be carried out. The synthesis ends in the percentages of the total relative priorities (Saaty, 1990).

$$\frac{1/7+1/7+1/7}{3} = 1/7 = 0.14 = \mathbf{14\%}$$

$$\frac{2/7+2/7+2/7}{3} = 2/7 = 0.29 = \mathbf{29\%}$$

$$\frac{4/7+4/7+4/7}{3} = 4/7 = 0.57 = \mathbf{57\%}$$

(5.1)

5.1.5 The consistency

According to Saaty (1990), in the field of decision-making it is fundamental to recognise the quality of consistency to ensure that the decision is not substantiated on a low consistency with the consequence of a random result. Nevertheless, also a perfect consistency is not realistic, because in real life judgements are influenced by varying situations, which often influence preferences: "If apples are preferred to oranges, for example, and oranges are preferred to bananas, then in a perfectly consistent relationship apples must be preferred to bananas. But the same individual may sometimes like bananas better than apples, depending on the time of day, the season, and other circumstances." (Saaty, 1990) When there is sufficient consistency to keep coherence between the experiences of individuals, consistency does not have to be perfect. The knowledge of individuals has to be realised in a slight sphere of an acceptance of inconsistency and complete consistency. The AHP measures the complete consistency of decisions by using a consistency ratio. The value of the consistency ratio has to be no higher than 10%. If the consistency rate exceeds this tolerance level, the decisions could be random with the result of a revising procedure (Saaty, 1990).

For varying the consistency of the model mentioned above, the value in the second row in the third column has to be replaced as well as the reciprocal in the third row in the second column (Saaty, 1990):

Table 5.5 Example of an inconsistent matrix

	A_1	A_2	A_3
A_1	1	1/2	1/4
A_2	2	1	1/4
A_3	4	4	1
Column total	**7**	**5.5**	**1.5**

Source: Saaty (1990); own representation

Also in this illustration it is important to realise the normalised matrix as follows:

Table 5.6 Example of a normalised matrix, row sums, total priorities

	A_1	A_2	A_3	Row sums	Average row sum
A_1	1/7	1/11	1/6	0.40	0.40/3 = 0.13
A_2	2/7	2/11	1/6	0.63	0.63/3 = 0.21
A_3	4/7	8/11	4/6	1.97	1.97/3 = 0.66

Source: Saaty (1990); own representation

Because all the values are transformed with an inconsistency, an analysis has to focus on the importance of this transformation. Therefore, a comparison of the inconsistency with the value has to check whether the decisions of the specialists are random. Hence a multiplication of the first column of the inconsistent matrix has to be executed with a transition into a decimal form, by the relative priority of the second column and the third column with a result of a total row of the entries (Saaty, 1990):

Table 5.7 Example of totalling the entries

	$A_{1\ (0.13)}$	$A_{2\ (0.21)}$	$A_{3\ (0.66)}$
A_1	1	0.5	0.25
A_2	2	1	0.25
A_3	4	4	1

	A_1	A_2	A_3	Row total
A_1	0.13	0.11	0.17	0.41
A_2	0.26	0.21	0.17	0.64
A_3	0.52	0.84	0.66	2.02

Source: Saaty (1990); own representation

Following the column of the row in total has to be divided each of its entries by the conforming entry from the priority vector. The average of the three afore-mentioned entries is the ensuing identification of lambda maximum ($\lambda\, max$) (Saaty, 1990):

$$\begin{bmatrix} 0.41 \\ 0.64 \\ 2.02 \end{bmatrix} \div \begin{bmatrix} 0.13 \\ 0.21 \\ 0.66 \end{bmatrix} = \begin{bmatrix} 3.15 \\ 3.05 \\ 3.06 \end{bmatrix} \tag{5.2}$$

The outcome calculation is therefore as follows (Saaty, 1990):

$$\frac{3.15 + 3.05 + 3.06}{3} = \frac{9.26}{3} \approx 3.09 \tag{5.3}$$

This number is the $\lambda\, max$. Additionally, the consistency index (CI) is the following (Saaty, 1990):

$$\frac{3.09 - 3}{2} = \frac{0.09}{2} = 0.045 \tag{5.4}$$

To identify the random consistency in the case of numerical decisions taken from the Fundamental Scale mentioned before, the following average consistencies could be taken from the Average Random Consistency Index (R.I.) (Saaty and Vargas, 2001):

Table 5.8 Average Random Consistency Index

N	Random Consistency Index (R.I.)
1	0.00
2	0.00
3	0.52
4	0.89
5	1.11
6	1.25
7	1.35
8	1.40
9	1.45
10	1.49

Source: Saaty and Vargas (2001); own representation

Thus, the random value of the CI in the earlier declared example for n, which is the size of the matrix, is 0.52 with a consistency ratio of 0.045/0.52 = 0.09, which indicates a good result of the consistency (Saaty and Vargas, 2001).

Nevertheless, there is also criticism of this methodology. One important criticism relates to the ambiguity of the quality of questions, which the interviewee has to answer. Economists such as Watson and Freeling (1983), for example, argued: "What sort of question needs to be asked to elicit the numbers in this matrix (of pairwise comparisons)? It would seem that they have to be of the form: 'Which is more significant, purchase price or maintenance cost per year?' …. If this question is asked without further explanation, it is, we maintain, meaningless" (Watson and Freeling, 1983). Related to McCaffrey (2005), another disadvantage is seen in the subjective scales of variables in the different levels, because it is subject to individual error. Furthermore the AHP scales measure the individual psychology of the interviewed decision-makers that can also end in human error. Additionally, the quantity of comparison benches can become very extensive if there is an utilisation of various comparisons attributes with the difficulty of the manageability of the calculations (McCaffrey, 2005).

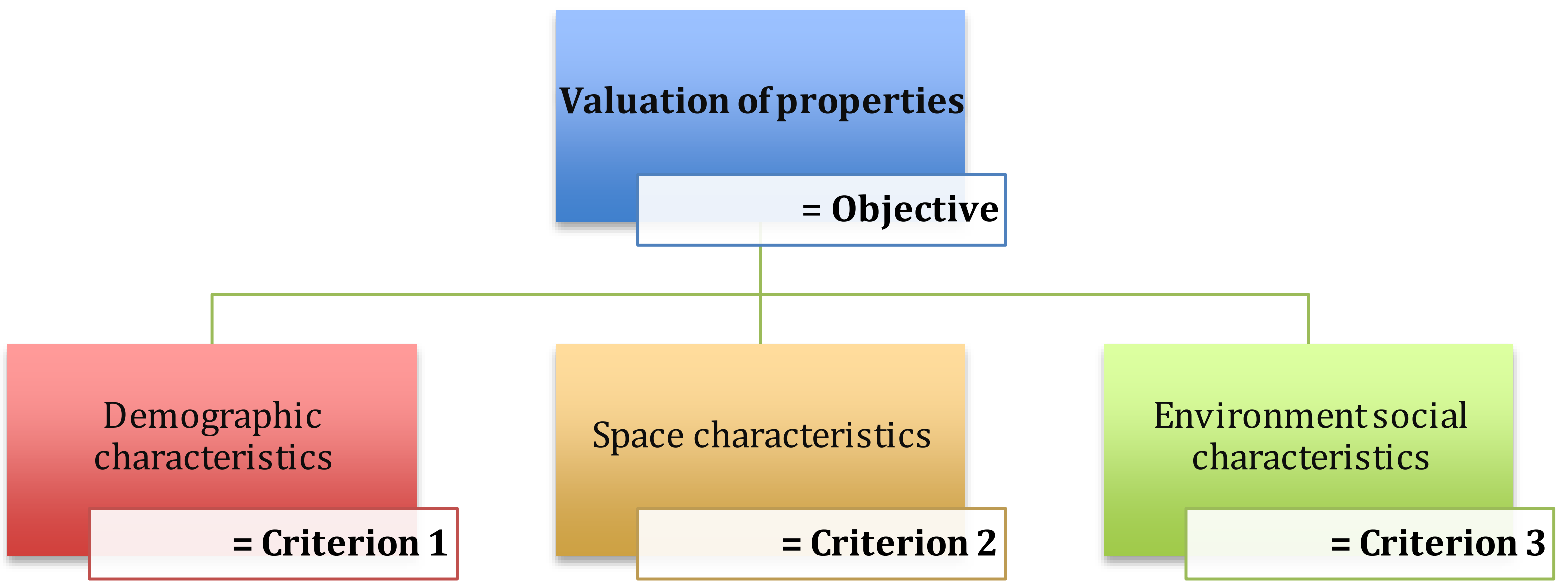
5.2 Transformation of the AHP for effective portfolios in the residential trade and industry

As analysed in the Chapters 3 and 4, it is of vital importance to successfully manage the future demographic situation of the real estate assets. Therefore, it is necessary to invest a great deal of attention on diverse fields such as demographic, space and environmental social areas in order to gain the most ideal real estate portfolios in countries with shrinking populations until 2050. For an assessment of an effective portfolio management in the field of the AHP methodology, in the first stage the AHP hierarchy with various variables is essential. The statistical data analysis mentioned in Chapter 4 demonstrates significant trends over a period of approximately 80 years with the generally analysed beginning in 1970 and the core end of this analysis in

2050. Hence these variables comprise the focus of the AHP hierarchy for the potential residential trade and industry portfolio.

The overall objective of the portfolio analysis is the *valuation of properties, respectively the establishment of the most optimal residential trade and industry portfolio for countries with shrinking populations and in addition for Spain until 2050*. For realising this target a widespread range of criteria is positioned in the second level of the hierarchy:

Figure 5.2 Objective and criteria for real estate assets



Source: Own analyses

The first criterion is the area of *demographic characteristics*, which reflects the trends in the following areas:

- Demographic developments of the individuals
- Demographic alterations of populations
- Changes in the real estate stocks.

The second criterion is the area of *space characteristics* with a focus on the following:

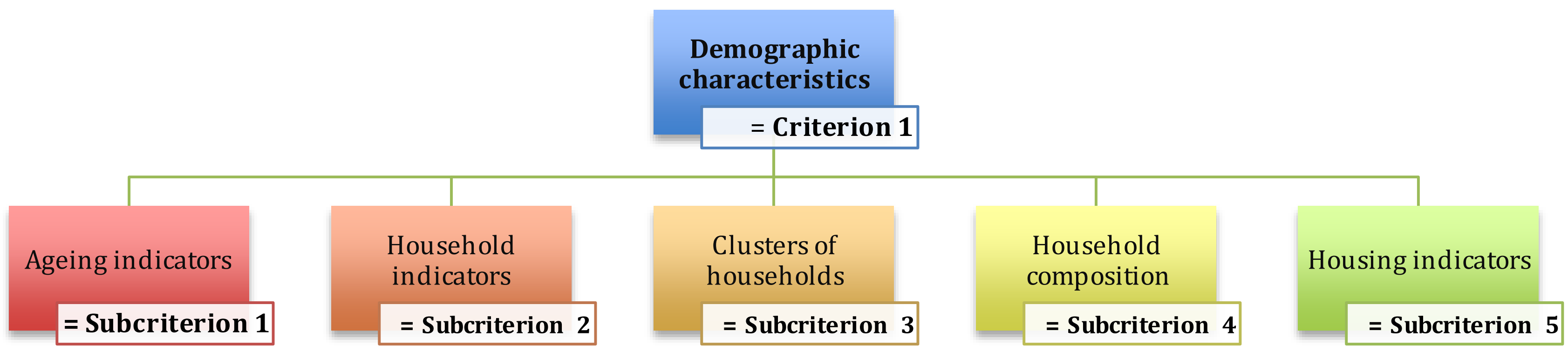
- Building equipment
- Building lifecycles.

The third criterion is the *environmental social characteristics*, which covers the following:

- Real estate environments
- Price conditions
- Economic situations of individuals and states.

The criterion demographic characteristics is split across the third level of subcriteria.

Figure 5.3 Demographic criterion and subcriteria for real estate assets



Source: Own analyses

These subcriteria comprise mainly the following:

- *Ageing indicators*
  - Share of the children population, age 0-14
  - Share of the working age population, age 15-64
  - Share of the elderly population, age 65 plus
  - Share of the very elderly population, age 80 plus
  - Medium age in years

- *Household indicators*
  - Number of households
  - Average number of persons per household

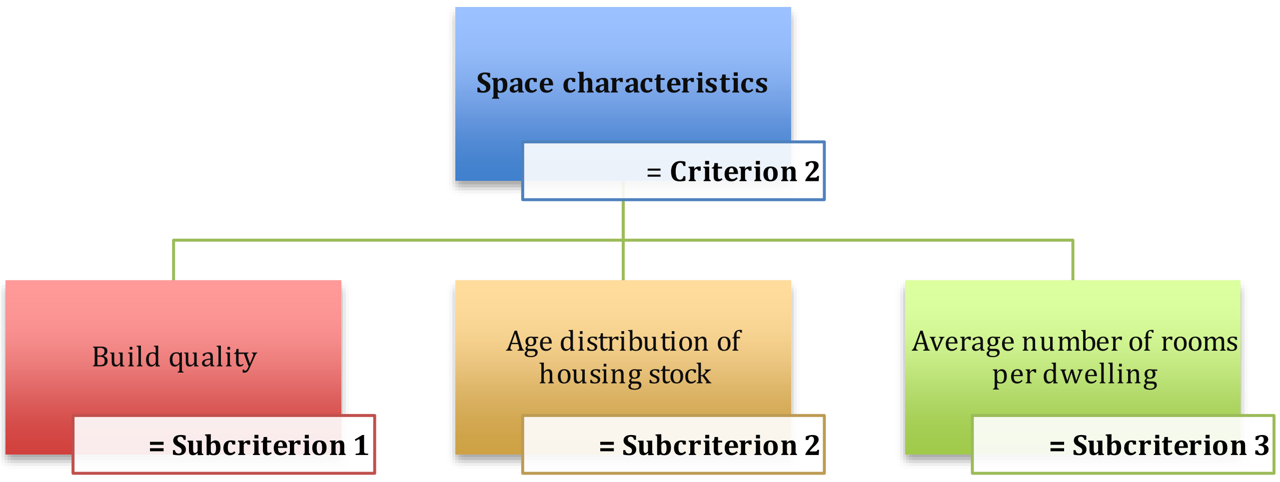
- *Clusters of households*
  - Share of 1-person households
  - Share of 2-person households
  - Share of 3-person households
  - Share of 4-and-more-person households

- *Household composition*
  - Share of single adults under 65 years
  - Share of single adults aged 65 years plus
  - Share of couples with both partners under 65 years
  - Share of couples, at least one partner aged 65 years plus
  - Share of others, no one under 18 years
  - Share of single adults with children
  - Share of 2 or more adults with children

- *Housing indicators*
  - Housing stock
  - Vacant conventional dwellings
  - Occupied dwelling stock in square metres per person

In the second area, the space characteristics are split into the following subcriteria:

Figure 5.4 Space criterion and subcriteria for real estate assets



Source: Own analyses

The subcriteria are defined as follows:

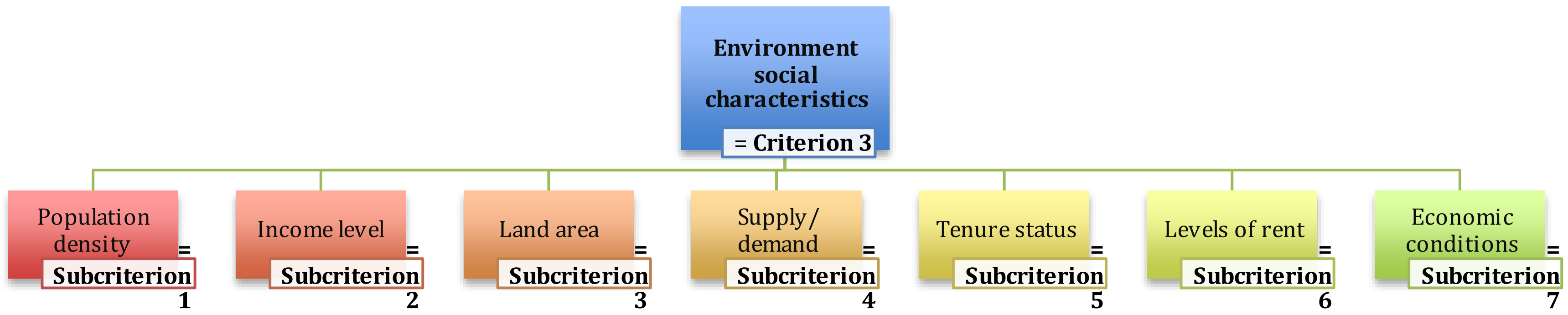
- *Build quality*
  - Piped water inside the dwelling
  - Flush toilet inside the dwelling
  - Electric lighting inside the dwelling
  - Fixed bath or shower inside the dwelling

- *Age distribution of housing stock*
  - Construction year older than 1919
  - Construction year 1919-1945
  - Construction year 1946-1970
  - Construction year 1971-1980
  - Construction year 1981-1990
  - Construction year 1991-2000
  - Construction year after 2000

- *Average number of rooms per dwelling*

In the third criterion seven subcriteria are illustrated:

Figure 5.5 Environmental social criterion and subcriteria for real estate assets



Source: Own analyses

These subcriteria comprises the subsequent issues:

- *Population density*
  - High-density clusters
  - Urban clusters
  - Rural grid cells

- *Income level*
  - Share of housing costs in disposable income
  - Income per capita
  - Number of dependent people

- *Land area*
  - Land area in km^2
  - Population per km^2

- *Supply/ demand*
  - Total housing costs in Purchasing Power Standard
  - Construction cost index
  - Average price for one existing dwelling

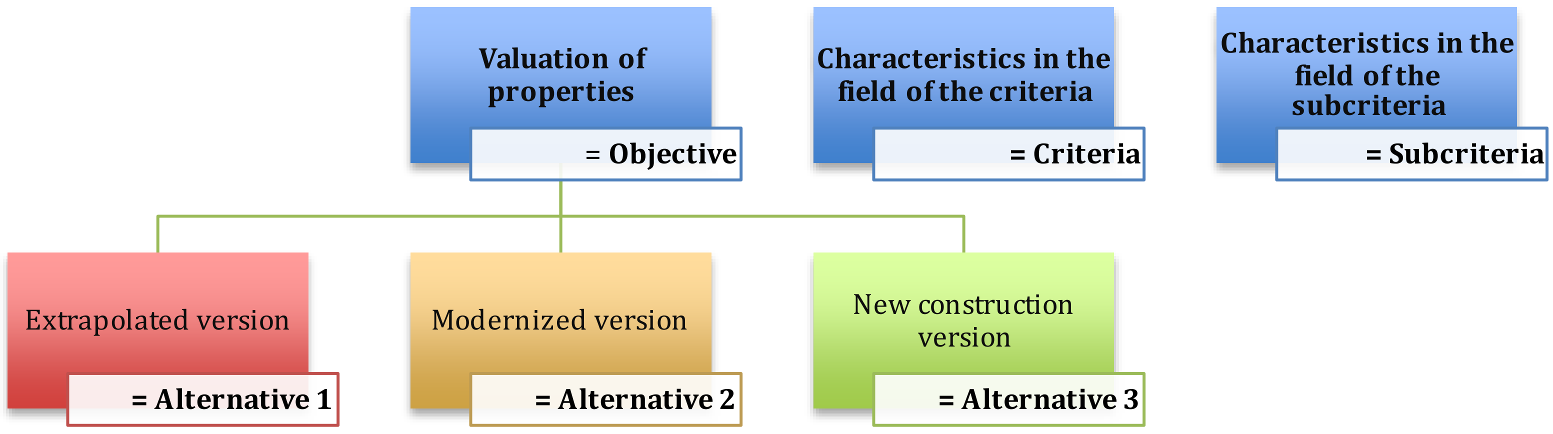
- *Tenure status*
  - Owner occupied status
  - Private rent status
  - Social rent status

- *Levels of rents in free and regulated market*
  - Average annual rent for rental dwellings
  - Average size in square metres for rental dwellings

- *Economic conditions*
  - Unemployment rate
  - Population at risk of poverty
  - Size of the economy
  - GDP per capita
  - Potential GDP, growth rate

The fourth level of the AHP hierarchy includes the different alternatives for achieving the overall target:

Figure 5.6 Objective and alternatives for real estate assets



Source: Own analyses

As analysed in Chapter 4, there are mainly three options as a consequence of the real estate lifecycles, which infers the following alternatives with respect to the overall target.

The extrapolated real estate portfolio includes the current portfolio of each country and the forecast for future years, in which just the planned routine repairs and maintenance will be realised in order to achieve the lifecycle of the assets. Corresponding to EPA (2013), furthermore, replacement and modernization of home components after the average life expectancies has to be conducted, e.g., kitchens have to be renewed after a lifecycle of 38 years and water heaters after 10 years. At the end of the lifecycle, the real estate asset has to be demolished (EPA, 2013). For apartment buildings with private or social rents the rents will be extrapolated with a modification based on economic conditions such as the cost-of-living index. Strengths in the tenure area are no additional homemade leverages and in the private and social sector rents on a stable level and an absence of a relocation of tenants. Weaknesses include in parts an absence of customised dwellings and partially an absence of senior-compatible dwellings. An opportunity is the natural regulation of the housing stock after the end of the lifecycles, while a strong risk is the housing stock being of no use as a consequence of the absence of customised dwellings.

Modernized real estate portfolios also refer to the current dwelling stock with an extrapolation of the age distributions to future years as described above. Besides the planned routine repairs and maintenance to realise the lifecycle of the assets, there is also a strong focus on restructuring and modernization of dwellings and home components where customised residences are necessary, such as the need for senior-compatible living conditions. Also with this alternative, demolition of the assets comes at the end of the lifecycle (EPA, 2013). In the case of rented assets, an extrapolated rent equal to the extrapolated real estate portfolio will be desired, but with an additional modernization fee to finance the rebuilding and modernizations. Strengths are customised dwellings and the absence of a relocation of tenants if the assets are rented. A weakness is that assets are again dated and high-aged, but are in parts modernized. An important opportunity is useable residences with a reduction of the number of vacant dwellings that will increase real estate assets again. A risk is the disparity of the age distribution of the stocks and the newly modernized components, which do not reduce the construction ages of the stock assets. Another risk is the impracticality of modernizations, e.g., elevator integration in housing with old or poor-quality construction. In cases of rented stock an additional risk could be the higher levels of rents.

New-construction real estate portfolios are newly constructed housing stocks where there is a demand for customised dwellings. A major strength in this field is customised dwellings. Major weaknesses are possible debt overloads if habitations include owner-occupied status; in the case of apartment buildings there are weaknesses of a relocation of tenants and high rents. Important opportunities could be the advancement of real estate assets and a life-long living of the owners and renters.

Nevertheless, a risk could be the possibility of an unpayability of residences because of a high level of construction costs.

As outlined in this chapter, the AHP methodology compromises systems to minimise complicated decision-making structures. Therefore, it is essential to apply this theory to the multifaceted residential trade and industry, which is realised for this study to reduce complexity in the field of demographic challenges in the future portfolio management. This AHP transformation for the macroeconomic real estate decision-making is the foundation for the expert surveys analysed in the following chapter.

6 Empirical valuations of future real estate portfolios

In Chapter 4 in-depth and widespread analyses of real estate data and market data of research institutes such as United Nations, Eurostat and Cecodhas were realised with the objective of establishing past and future tendencies for the evaluated countries. The resulting deducted hypotheses aiming at formulating future portfolio investment targets illustrate a high preference for a forthcoming customisation of residential trade and industry assets with modernized and new-constructed portfolios and a minor share of extrapolated asset options. To confirm, respectively contradict these hypotheses, this empirical chapter will reflect on the decision-making of different branch specialists from specialist real estate divisions of theoretical, research, practical, political and overriding branch fields of activities with the result of a portfolio management in the fields of strategy planning, portfolio construction and the establishment of a future performance analysis.

6.1 Framework of the empirical survey

As stated in the previous chapter, Saaty's Analytic Hierarchy Process is designed for the complex world to handle more challenges than possible for an individual to realise and reduce the complexity of decision-making. There are different advantages of this methodology that are crucial factors in establishing this method for the empirical valuations of future real estate portfolios (Saaty, 1990):

- Unity: The AHP is a flexible methodology with the possibility to structure a widespread variety of different matters.
- Complexity: The method enables deductive reasoning and powers by understanding complicated challenges.
- Interdependence: The AHP structure transacts with interdependencies of variables in a hierarchy and is therefore not related to linear thinking.
- Hierarchic structuring: The AHP hierarchy mirrors the tendency of the human mind to categorise variables into diverse levels and evaluate them on every level.

- Measurement: The AHP embraces a Fundamental Scale for weighting tangible and intangible variables and to establish priorities of the variables.
- Consistency: The methodology handles the consistency of decisions by forming a consistency ratio to analyse the reliability of the pairwise comparisons on each hierarchy level.
- Synthesis: The AHP puts the decision-maker in a position to evaluate the overall attractiveness of each alternative.
- Trade-offs: The AHP qualifies the individual to structure the relative priorities of variables in the hierarchy and choose the best alternative with a preference for the overall target.
- Decision and accordance: The methodology does not require full consistency; nevertheless, the process amalgamates a representative result from various judgements.
- Process repetition: The AHP allows individuals to improve their problem definition and judgements.

Furthermore, the methodology of the Analytic Hierarchy Process enables the establishment of an overall objective supported by key data of the ideal future residential trade and industry portfolio mix. Hence, the diverse decision-making results are standardised and analysable, which is important for the real estate portfolio, as the portfolio shares of countries are simple to perceive. However, the process allows reflection on the weightings and pairwise comparisons by the influence of individual feelings, decision-making and experience that analyses a future expert estimation of the development of real estate assets, risks and portfolio management and consequently mirrors the partial valuation of the residential trade and industry.

As the afore-mentioned advantages are significant for portfolio interpretability, the AHP methodology is used for the definition of the future real estate portfolios of the analysed countries. As evaluated in the last chapter, the methodology is based on the assessment of dissimilar variables in different levels of the AHP hierarchy with the aid of experience and knowledge. Consequently, there is a high preference for realising the survey using experts of the different social, residential trade and industry and economic areas. The methodology is standardised, but with individual pairwise comparisons with numbers from 1 to 9 and reciprocals from 1/2 to 1/9 of Saaty's Fundamental Scale as illustrated in the previous chapter; therefore, according to other researchers, the surveys are verified as complex standardised interviews (Gibney and Shang, 2007; Tahriri et al., 2008) in a quantitative milieu.

For realising a widespread perception of expert options, various specialists were requested for these interviews, especially in the following branch areas:

- Theoreticians with international knowledge of economic and managerial purposes
- Residential trade and industry economists and researchers
- Residential trade and industry professionals of property and asset management
- Personalities of the residential trade and industry branch alliances
- Real estate brokers
- Consuls of the analysed countries
- Politicians of the European Parliament

The requisitions were realised by email and telephone calls from 24th November 2014 until 17th March 2015. In total 35 people from approved and international-accepted organisations with years of experience and a high degree of knowledge in the specialist interview fields were invited. 42.86% of the branch experts were willing to be interviewed. The other experts did not respond to the inquiry as they were busy or indifference. None of the other specialists replied. In total, interviews with 15 experts were realised, generally covering the above-described requested expert fields. As various researchers of the AHP methodology carried out expert interviews with a maximum of 10 interviewees (e.g., Aznar Bellver et al., 2011a; Khumpaisal et al., 2012; Perera and Sutrisna, 2010; Yu et al., 2010), the number of experts in this research lies in a good and acceptable range. These specialist knowledge areas are clustered as follows:

- Academics
- Practical professionals
- Branch alliances
- Special market professionals

Those interested in being interviewed received further information by email (Appendix 9-10). The information contained the interview guidelines, an introduction to the topic, the motivation behind the research and also details about the author of this study and the AHP methodology. Additional information included the current demographic, space and environmental social variables of the created AHP hierarchy for the residential trade and industry portfolio. To hinder manipulation of the already evaluated and analysed past and future trends as illustrated in Chapter 4, the interviewees only received information containing the different variables, but without the historical and future data.

The interviews were conducted from 15th December 2014 until 7th April 2015 in Hamburg, Stuttgart and Berlin in Germany, Sofia in Bulgaria and Brussels in Belgium. 40.0% were female and 60.0% male interview partners. The interviews were mainly carried out in person. Nevertheless, there are also some exceptions as some of the interview partners had a time challenge to validate all the pairwise comparisons within the appointment time. Thus, parts of the analyses were executed later. The interview with the Bulgarian expert was conducted over Skype.

The experts realised the pairwise comparisons through the different levels of the AHP hierarchy. The first focus was the criteria level with the three variables of demographic, space and environmental social characteristics with preference for the overall target. The second concentration was in the subcriteria level, with 15 variables highlighted in the last chapter, again weighted against each other with preference for the criteria. The last level of the pairwise comparisons was the area of the three alternatives of extrapolated, modernized and new-construction versions, weighted against the different subcriteria. In total, the interviewees clarified 82 pairwise comparisons per country (Appendix 11-71). The detailed comparisons are described in this chapter. Most of the interviews embraced all 10 countries with the exception of the interviewee cluster of the special market professionals; these specialists realised interviews for one, respectively two countries. The consultations lasted between two and four hours. The basis for the interviews was the information sent prior to the interview as explained above. The interviewer answered questions to aid the interviewees' understanding of the interview process. Other issues were not mentioned to avoid manipulating the interviewees and tarnishing the results. The applicants basically clustered different countries as they evaluate similar future trends for different countries.

The pairwise comparisons for the different country clusters in the AHP hierarchy were directly transferred to the AHP software package. This software was created by using Microsoft Excel as a basis. The AHP software is adapted to Saaty's "Expert Choice 11.5" software from Expert Choice Inc. The test of this licence ensures the equality to the self-created software.

During the interviews, the interviewees did not receive information about the eigenvector rankings, consistency ratios or overall outcomes also with the target in order to avoid influencing the experts. At the end, the specialists declared their key knowledge of one or more countries to detect if the interviewee is generally or highly specialised in this area. After the appointment each interviewee received the complete AHP evaluation of the interview and the denoted special country knowledge per email to avoid misunderstandings of their pairwise comparisons and special knowledge. All confirmed the accuracy of the issues (Appendix 72-85). Therefore, an utilisation of their outcomes is probable in the correct manner.

In total, the following experts underwent the interviews as described and analysed following:

Table 6.1 Interview partners

Name	Interviewee-group	Special knowledge Bulgaria	Special knowledge Estonia	Special knowledge Germany	Special knowledge Hungary	Special knowledge Latvia	Special knowledge Lithuania	Special knowledge Poland	Special knowledge Romania	Special knowledge Slovakia	Special knowledge Spain
Prof. Dr. Matthias Ross	Academics	x	x	x		x	x		x		x
Dipl.-Phys. Axel Detz	Academics			x							x
Prof. Dr. Frank Borrmann	Academics			x							
Ass.-jur. Mara Meinel	Practical professionals			x	x				x	x	x
Michael Wulf, M.A.	Practical professionals			x							x
Dipl.-Betr. Berit Jalas	Practical professionals			x							
Dipl.-Oec. Richard Winter	Practical professionals			x				x			x
Susanne Gentz	Practical professionals			x							
Dr. Özgür Öner	Branch alliances			x				x	x		
Alice Pittini, M.A.	Branch alliances		x			x	x			x	x
Dipl.-Ing. Michael Pistorius	Branch alliances			x							
Dipl.-Betr. Klaus Schrader	Branch alliances		x	x		x	x	x			x
Dipl.-Päd. Petra Gaugisch	Special professionals of a market			x							x
Ass.-Jur. Klaus Kirchhoff	Special professionals of a market								x		
Polina Stoykova, M.A.	Special professionals of a market	x									
Total		2	3	12	1	3	3	3	4	2	8

Source: Own analyses

6.2 Instrumentation of the study

As stated above, various interviews were carried out with branch specialists in different activity fields. The outcomes of the expert pairwise comparisons, arranged in expert groups and interview appointments, are highlighted following.

a. Interviewee group of academics

Prof. Dr. Matthias Ross

This interviewee is a professor at the FOM – Hochschule für Oekonomie und Management, Hamburg, Germany. His core profession is European economic policy and statistics and mathematics (FOM, 2015a). Ross' publications include e.g. "Transfers, agglomeration and German unification" (Ross, 2001) and "The impact of optimal tariffs and taxes on agglomeration" (Ross, 2002).

The interview was conducted on 15th December 2014 from 9:00 to 11:30 a.m. in the FOM – Hochschule für Oekonomie und Management (Appendix 11-15, 72). Because Ross interprets similar developments in some of these countries until 2050, he clustered the different states as follows:

- Cluster 1: Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia
- Cluster 2: Germany
- Cluster 3: Hungary, Poland
- Cluster 4: Spain

His special core fields are Bulgaria, Estonia, Germany, Latvia, Lithuania, Romania and Spain.

- *Cluster 1: Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia*

For Ross in the criteria-level with respect to the overall goal of the valuation of properties the variables demographic, space as well as environmental social characteristics are equally important because in the interviewee´s view they all of them play a significant role in the future. Therefore, the consistency ratio lies at 0.0%, which is a consistent result.

In the following subcriteria level in the field of demographic characteristics, the interviewee decided to evaluate the ageing indicators (e.g., children generation, elderly generation) as much more significant than household indicators (e.g., number of households), clusters of households (e.g., 1- and 2-person households) and household composition (e.g., single adult aged 65+, 2+ adults with children). Ageing indicators and housing indicators (e.g., vacant dwellings) are in his view of equal importance. Therefore, the variables ageing indicators and housing indicators comprise an eigenvector of 38.46% per variable, which are by far the most important eigenvectors of this subcriteria cluster. The pairwise comparisons correlate to the outcomes with the result of a consistency ratio of 0.0%, which indicates total consistency.

In the area of space subcriteria, Ross interprets build quality as much more important than the age distribution of housing stock. The variable average number of rooms per dwelling is evaluated as equal to the subcriteria build quality. Hence, these basic variables comprise a total eigenvector ratio of 94.12%. The pairwise comparisons were evaluated as totally consistent.

In the subcriteria level of environmental social variables, the applicant analyses the levels of rent and the economic conditions as more important than the other variables. The consistency ratio is 8.33%, which also indicates a good result as the maximum rate is fixed lower than 10% with a structure of seven variables in correspondence to Saaty (1990).

In the alternatives level that compares relative preference with respect to each demographic subcriterion, Ross indicates that the different alternatives for the subcriteria are mainly equal and therefore, consistent in the results.

In the region of alternatives for the space subcriteria this context behaves in a different manner, because for Ross the modernized and new-construction versions are more significant than the extrapolated alternative. Also these pairwise comparisons demonstrate a high reliability.

Moreover, in the level of environmental social subcriteria the interviewee mainly validates the modernized and new-construction versions as in parts much more central than the extrapolated option with consistency ratios between 0.0% and 0.15%.

The alternatives, compared with the relative importance of the subcriteria in the field of demographic characteristics, demonstrate a very balanced alternative ranking with 33.85% for the extrapolated and the new-construction version and 32.31% for the modernized selection as a consequence of the mainly balanced pairwise comparisons of the alternatives in correspondence to each subcriterion. Nevertheless, as a result of the most similar evaluation of the alternatives per subcriterion, the aforementioned high-ranked subcriteria ageing indicators and housing indicators do not represent a crucial factor in the area of the total alternative ranking. This outcome changes in the space and environmental social milieus. The alternative rankings for the space characteristics finish with an effect of 42.30%, equal to the modernized and new-construction alternative and a much lower share of 15.41% for the extrapolated real estate portfolio. It could be analysed that the most important subcriteria build quality and average number of rooms per dwelling influences this total effect in a relevant manner as Ross indicates for this purpose a significant relevance of customised real estate assets; for the less important subcriteria age distribution of housing stock the interviewee interprets a more balanced asset structure. The environmental social criterion differs more with ratios of 43.76% for new-construction, 34.85% for modernized and 21.39% for the extrapolated option. Ross evaluates most of the subcriteria with a low level of the extrapolated version. Nevertheless, because the key subcriterion levels of rent result in a high eigenvector of 38.16%, the end effect of this version is also more significant. Since all criteria, especially demographic, space and environmental social features are fixed with the same eigenvector ratio according to the overall target, the criteria ranking ensures an equal effect on the alternative ranking. Consequently, the overall alternative ranking demonstrates a harmonisation of the deviations of the different alternative levels in each criterion. The combination of these criteria outcomes is a ranking with a high significance of 39.97% for new-construction, followed by 36.48% for modernized and 23.55% for the extrapolated version.

Hence, the real estate portfolio mix in 2050 has a core focus on new-constructed and modernized real estate assets as Ross analysed high future dependencies of the space and environmental social features in these fields, which indicates a necessity for more custom-fit residences.

- *Cluster 2: Germany*

This cluster mainly differs in contrast to the other country clusters mentioned above. For Ross in the criteria level with respect to the overall target the variables demographic, space and environmental social characteristics are also identical, corresponding to Cluster 1 with a total consistency.

In the demographic subcriteria level, the applicant indicates in contrast to Cluster 1 a significant more balanced structure with moderate weightings of the pairwise comparisons. The core variable ageing indicators has an eigenvector share of 29.83%, followed by the subcriteria household indicators, clusters of households and household composition with 18.83% of each of these variables and 13.68% for the housing indicators. The pairwise comparisons achieve a consistency ratio of 5.55%, which points to a good reliability.

The subcriteria level space demonstrates a strong preference for build quality with a high eigenvector of 72.73%. The consistency embraces an outcome of total consistency.

The subcriteria level of environmental social features demonstrates for the interviewee a mainly balanced structure of variables with a priority of the variables levels of rent with a percentage of 27.54% and supply/ demand with 16.94%. The consistency is calculated in the acceptable range of 9.39%.

In the alternatives level relating to the relative preference with respect to each demographic subcriterion, Ross views the alternatives modernized and new-construction for the subcriteria as mainly more important than the extrapolated version, which stands in contrast to Cluster 1. These tendencies of strong focuses on the customisation of habitations with modernized and new-constructed assets continue in the alternatives level for the space and environmental social subcriteria. The consistency ratios lie between 0.00% and 2.81%, which fulfils the requirements of a maximum of 5.0% when using matrixes with 3 variables.

As a consequence of the balanced weightings and Ross' preference for the modernized and new-constructed version in the area of demographic development, the alternatives, compared with the relative importance of the subcriteria of demographic characteristics, confirm a prevalence of customisation with a share of 36.88% for modernized and 34.96% for new-constructed portfolio assets in 2050; the ratio of the extrapolated version comprises a balanced level of 28.15%. In the space centralisation, the most important determining criterion build quality, which comprises a different alternatives weighting than the other variables, strongly influences the overall result. Consequently, the first rank is the modernization option with 48.57%, followed by the new-construction version with 34.81% and the extrapolated set with 16.62%. In the third area of environmental social conclusions, the alternative ranking changes. Basically, most of the subcriteria variables mentioned earlier show a tendency towards customisation. Nevertheless, the variables with a high eigenvector share, especially levels of rent and economic conditions, highlight the extrapolated version. Therefore, this option is more important than in the other fields with a percentage of 32.96%. The first rank comprises the modernized version with 38.62%, followed by the new assets variant with 28.42%, which is the third rank in this context. The overall outcome for Germany is a mixture of 41.36% for modernizations, 32.73% for new constructions and 25.91% for extrapolations, which demonstrates a relatively balanced future portfolio mix.

- *Cluster 3: Hungary, Poland*

Ross interprets in the criteria level with respect to the overall target the variables demographic, space and environmental social characteristics equal central, equivalent to the Clusters 1 and 2. The consistency ratio remains again by 0.0%, which demonstrates total consistency.

In the subcriteria level of demographic appearances, the interviewee estimate, comparable to Cluster 1, the ageing indicators and the housing indicators in contrast to the other subcriteria high relevant with eigenvectors of 40.34% respectively 30.83%. The pairwise comparisons realise a consistency ratio of 7.66%, which indicates a good consistency.

In the field of space subcriteria, Ross fulfils the same pairwise comparisons than in Cluster 1 with the outcome of the most significant subcriteria build quality and average number of rooms per dwelling with an eigenvector percentage of 47.06% per variable. The consistency embraces an outcome of a total consistency.

In the subcriteria level of environmental social variables, the interviewee examines more balanced eigenvectors than in Cluster 1 but also interprets the levels of rent and economic conditions as more important than the other variables with a share of 22.16% and 22.30%. The consistency ratio finishes with 9.68% that denotes also an acceptable result.

In the alternatives level that relates to the relative preference with respect to each demographic subcriterion, Ross interprets the dissimilar alternatives for the subcriteria also mainly equal analogue to Cluster 1 and is therefore, again consistent in the effects.

In the region of alternatives for the space subcriteria this context behaves in a different manner, because for Ross the modernized and new-construction versions are more significant than the extrapolated alternative. Also these pairwise comparisons demonstrate a high reliability.

In the level of environmental social subcriteria Ross mainly confirms the modernized and the new-construction versions as in parts much more dominate than the extrapolated option with consistency ratios between 0% and 2.81%.

In this country cluster the alternatives, compared with the relative importance of the subcriteria of demographic characteristics, validate a significant stability between the alternative ranking with 33.87% for the extrapolated and the new-construction version and 32.26% for the modernized assets as a result of the strong equalized pairwise comparisons of the alternatives in similarity to each subcriterion. As a consequence of the most equal assessment of the alternatives per subcriterion, the high ranking of the subcriteria ageing indicators and housing indicators do not clarify a central aspect of the entire alternative ranking. The conclusion in the space and environmental social milieus are near the results of Cluster 1: The alternative rankings for the space characteristics finish slightly differentiated with 44.82% for the modernized option and with 40.07% in the new-construction alternative; the extrapolated version has again a minor level of 15.11%. The core subcriteria build quality and average number of rooms per dwelling direct again to a customisation of habitations. As a result of the more balanced eigenvectors of the environmental social subcriteria, the total alternative ranking differs more than in Cluster 1 with ratios of 48.17% for the new-construction, 36.19% for modernized and 15.64% for the extrapolated option, as the core subcriteria with high eigenvector levels supply/ demand, tenure status and economic conditions, reduce the total outcome of the extrapolated alternative ranking. As all criteria, particularly demographic, space and environmental social structures are stable with the same eigenvector ratio according to the overall target, the criteria ranking safeguard an identical influence on the alternative ranking. Therefore, the overall alternative ranking demonstrates a compensation of the strong divergences of the diverse alternative levels in each criterion. The result is an overall alternative ranking of 40.71% for the new-construction version, 37.76% for the modernized option and 21.54% for the extrapolated portfolio. Consequently also in this cluster Ross identifies a minor significance for the extrapolated real estate portfolios.

- Cluster 4: Spain

In contrast to all the country clusters described and analysed above, for Spain Ross interprets a high significance for the demographic characteristics with respect to the overall goal with an eigenvector quote of 53.96%. The consistency ratio of this matrix of pairwise comparisons is calculated at 0.89%, which highlights a high degree of consistency.

In the next AHP hierarchy level of subcriteria in the demographic context, the eigenvectors are very balanced with ratios between 27.33% for household compositions and 9.91% for the clusters of household. Because this 5-variable matrix finishes with a consistency ratio of 6.43%, the maximum of smaller than 10.0% is positive. The subcriteria level of space characteristics is interpreted by the interviewee with a high significance of the variables build quality and age distribution of housing stock with eigenvectors of 40.0% in each case with full consistency. In the field of subcriteria of the environmental social characteristics, the interviewee prefers a high responsibility of tenure status with a share of 31.19%. The land area with 5.25% is the lowest eigenvector. The consistency ratio is located on the maximum possible field with a ratio of 9.85%, but demonstrates an acceptable pairwise comparison.

For Ross the extrapolated alternative with respect to the subcriteria of the demographic developments are mainly much more important than the other alternatives, which shows a new direction in contrast to the other country clusters. This trend proceeds mainly also in the subcriteria levels space and environment social subcriteria with consistency ratios between 0.0% and 1.76%.

As a result of the strong extrapolated preferences, the alternative rankings highlight these main shares with 56.03% and 42.92% in the demographic and space alternative ranking. As a consequence of the basic eigenvector of the subcriteria tenure status, the overall alternative ranking of the environmental social criterion is a significant share of 36.99% of the new-constructed option, followed in second by the extrapolated version with 34.04% and modernized assets with 28.97%.

Because for Ross the criterion demographic characteristics embraces the most important eigenvector with 53.96%, the total alternatives ranking is high in the field of extrapolated real estate assets with a ratio of 48.54%, second is the new-constructed variant with 27.17% and in third place the modernized version with 24.29%.

In total the real estate portfolio mix of the different countries is according to Ross the following:

Table 6.2 Real estate portfolio combinations Matthias Ross

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	23.55%	36.48%	39.97%
Estonia	23.55%	36.48%	39.97%
Germany	25.91%	41.36%	32.73%
Hungary	21.54%	37.76%	40.71%
Latvia	23.55%	36.48%	39.97%
Lithuania	23.55%	36.48%	39.97%
Poland	21.54%	37.76%	40.71%
Romania	23.55%	36.48%	39.97%
Slovakia	23.55%	36.48%	39.97%
Spain	48.54%	24.29%	27.17%

Source: Own analyses

Axel Detz

The interviewee is an academic at different universities including FOM Hochschule für Oekonomie und Management, Hamburg, Fresenius Hochschule, Hamburg, Fachhochschule Lübeck in Germany. His special fields are international and intercultural management (Fresenius, 2015).

The interview was held on 15th December 2014 from 6:30 to 8:30 p.m. The location was a public place in Hamburg (Appendix 16-18, 73). Detz interprets similar future tendencies for most of the countries; therefore, the clustering is the following:

- Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia
- Cluster 2: Germany, Spain

In his opinion, the interviewee's special core fields are Germany and Spain.

- *Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia*

For Detz in this cluster the demographic development and the environmental social variable play an important role. Therefore, in the field of the criteria ranking with relative importance to the overall goal the demographic characteristics and environmental social features realise a major eigenvector ratio of 42.86% per variable. Consequently the space criterion is less significant with a share of 14.29%. The consistency ratio lies at 0.0%.

In the following demographic subcriteria level, the variables are mainly very balanced with eigenvector ratios between 29.31% for the household indicators and 8.91% for the ageing indicators with a consistency rate of 5.94%, which indicates good results. The importance of the eigenvector values changes in the area of space. The subcriteria build quality highlight a main share of 53.96%, which indicates a high relevance for the interviewee. Also the age distribution of housing stock comprises a crucial weight of 29.70%. Furthermore, the consistency demonstrates a good outcome with 0.89%. The environmental social variables are also very balanced with the highest indicator income level having an eigenvector of 21.73% and a consistency ratio of 8.65%, which is within the limit of the standard smaller 10.0%.

For Detz the alternatives, compared with the relative preference with respect to the subcriteria of demographic, space and environmental social characteristics illustrate mainly a significant position of the modernized and new-constructed portfolio versions with a good reliability of 0.0% to 2.37%.

The alternatives, compared with the relative importance of the subcriteria with respect to the alternatives in the field of demographic criteria, demonstrate balanced effects with the exception of the subcriterion ageing indicators. Nevertheless, as this variable embraces a minor eigenvector share, it does not have a relevant impact on the alternative ranking. Therefore, the modernized version is the most vital option with 44.99%, followed by the new-construction variant with 36.65% and the extrapolated alternative with 18.36%. In the area of space characteristics this ranking changes. Because the variables build quality and age distribution of housing stock comprise high eigenvector ratios, their outcomes strongly influence the end result; the different portfolio mixture of the subcriterion average number of rooms per dwelling is not relevant for the effect. Consequently, the end result is a key share of 43.79% for the new-construction version, 40.30% for the modernized option and 15.91% for the extrapolated assets. In the environment social level, the subcriteria and the results are very balanced, so the outcome with respect to the alternatives illustrate almost the arithmetic mean with 47.31% for new-construction, 38.67% for modernized and a minimal share of 14.02% for the extrapolated alternative.

In the overall ranking, the high criteria shares of the demographic and environmental social structures play an inconsiderable role, because the ranking results of all subcriteria are very close together with the total end result of 42.24% for new-constructed, 41.61% for modernized and 16.15% for extrapolated portfolio mixes.

- *Cluster 2: Germany, Spain*

Also for this second cluster Detz interprets the demographic characteristics as the most important with an eigenvector ratio of 54.99%. Nevertheless, the other variables space and environmental social criteria are more balanced in contrast to Cluster

1 with 20.98% and 24.02%. The consistency ratio demonstrates a positive outcome of 1.76%.

The subcriteria level with respect to the criterion demographic characteristics validates a high balance of the eigenvector ratios with a most important share of the subcriterion household indicators. In the area of space characteristics the build quality is the key variable with an eigenvector of 50.0%. Also the environment social field is primary stable with eigenvector shares of 20.01% of the income level variable to 8.25% of the population density. The consistency ratios in this hierarchy level range from 0.0% to 9.2%, which suggests a good explanatory power of the interviewee.

In the following hierarchy level of the alternatives, compared with the relative preference with respect to the subcriteria of demographic, space and environment social characteristics, the interviewee’s preference is strongly towards the modernized and new-construction alternatives with consistency ratios between 0.0% and 1.76%.

The result of the overall alternative ranking of the demographic subcriteria shows a high balance as the alternative weights of the subcriteria and the weights of the alternatives are very close together with an outcome of an arithmetic mean. Hence, the outcome is a high percentage of 46.0% for the new-constructed, 34.70% for the modernized and 19.30% for the extrapolated alternatives. This purpose differs in the space level. Because build quality comprises the main subcriteria eigenvectors, the alternative ranking is strongly shaped by these variables with a result of 46.59% for modernized, 33.70% for new-construction and 19.71% for extrapolated real estate assets. The environmental social level is mainly identical to the demographic structure with arithmetic means of 44.66% for new buildings, 42.36% for modernized real estate assets and 12.97% for extrapolated options.

The end result is influenced by the demographic characteristics, as Detz identifies this criterion as the most important. Therefore, the total alternative ranking finishes with a major share of 43.10% for the new-constructed, 39.04% for the modernized and 17.86% for the extrapolated portfolio alternatives.

In total, the country results comprise the following:

Table 6.3 Real estate portfolio combinations Axel Detz

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	16.15%	41.61%	42.24%
Estonia	16.15%	41.61%	42.24%
Germany	17.86%	39.04%	43.10%
Hungary	16.15%	41.61%	42.24%
Latvia	16.15%	41.61%	42.24%
Lithuania	16.15%	41.61%	42.24%
Poland	16.15%	41.61%	42.24%
Romania	16.15%	41.61%	42.24%
Slovakia	16.15%	41.61%	42.24%
Spain	17.86%	39.04%	43.10%

Source: Own analyses

Prof. Dr. Frank Borrmann

This interviewee is a professor at the FOM Hochschule für Oekonomie und Management, Hamburg, Germany. He is a specialist in the fields of international management and entrepreneurship (FOM, 2015b). Borrmann has had diverse financial articles published such as “Wie man ETFs in den Schatten stellen kann – Plädoyer für einen aktiven Investmentansatz” (Borrmann, 2009) or “VILICO Investment: Anlegen am Risiko-Minimum” (Borrmann, 2010). The interview took place on 26th January 2015 from 7:00 to 9:00 p.m. at the FOM Hochschule für Oekonomie und Management (Appendix 19-22, 74).

For the interviewee three different country clusters are significant:

- Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia
- Cluster 2: Germany
- Cluster 3: Spain

The interviewee considers his expertise to lie mainly in Cluster 2 – Germany.

- *Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia*

For Borrmann the criteria, compared with the relative importance with respect to the overall goal, have a significant relevance in the field of space and environmental social characteristics with an eigenvector share of 46.15% per variable and a low percentage of 7.69% for the demographic development, which is different to the aforementioned weightings of the other interviewees. The consistency ratio is a perfect quota.

The demographic subcriteria with a relative importance with respect to the criterion demographic characteristics demonstrate balanced shares of the eigenvectors with main relevance of the household indicators and the clusters of households with shares of 52.46% in total. In the space variables segment, build quality is interpreted by Borrmann as the basic subcriterion with an eigenvector of 66.67%. The eigenvectors of the environmental social subcriteria are basically balanced with the highest percentage of 21.51% in the area of economic conditions. The consistencies show positive results with values between 0.0% and 7.0%.

The alternatives with a relative preference with respect to the demographic subcriteria are generally weighted equally, but in the space and environmental social context the crucial factors are the customised options modernized and new-constructed with significant eigenvectors in parts. The highest consistency rate is 2.8%, which indicates a good outcome.

Because the demographic outcomes are validated as very stable by the interviewee, also the alternative ranking ends with results that are close together, especially 35.08% per new-constructed and modernized version and 29.84% for the extrapolated option. The space result differs more. Because build quality comprises the important eigenvector of 66.67%, the end result is strongly influenced by this variable with a share of 49.13% for the modernized, 38.25% for the new-construction and 12.62% for the extrapolated version. Because the hierarchy levels of the environmental social features are basically balanced, the total result is near the arithmetic mean with a similar tendency in relation to the space level that embraces 52.52% for the new-constructed option, 32.56% for the modernized version and 14.93% for the extrapolated alternative.

The overall result is strongly influenced by the criteria space and environmental social characteristics as they cover the most crucial eigenvector shares. The overall alternative ranking finishes with 44.59% for the new-construction, 40.40% for the modernized and 15.01% for the extrapolated version, which indicates a resilient preference for customised future real estate assets according to Borrmann.

- *Cluster 2: Germany*

This cluster shows meaningful differences in contrast to Cluster 1. The interviewee interprets the criterion demographic development and environmental social characteristics as much more important than the space criterion with eigenvector values of 46.15% per variable. The consistency is on a perfect level of 0.0%.

In the subcriteria level of demographic variables the structure is essentially balanced with an advance of the variables ageing indicators and housing indicators. The subcriteria age distribution of housing stock and average number of rooms per dwelling are the key variables in the field of space criterion with an eigenvector percentage of 80.0% in total. Also the subcriteria of environmental social variables demonstrate balanced eigenvector outcomes with a small preference for the interviewee for the economic conditions with an eigenvector of 20.40%. In this hierarchy level the consistency ratio has a maximum of 6.20%, which confirms a high weighting plausibility.

The alternatives, compared to the subcriteria of the demographic, space and environmental characterisations, are in total analysed by the interviewee with a high preference for the modernized and new-construction versions with a maximum consistency ratio of 3.37%. Therefore, also the relative importance of the subcriteria with respect to the alternatives is highly influenced by these weightings. The demographic area finished with 46.87% for the modernized, 41.02% for the new-construction and 12.11% for the extrapolated version. The space segment is more balanced with alternative rankings of 45.52% for modernized, 34.10% for new-construction and 20.38% for extrapolated portfolio mixtures. The portfolio mix of the environmental social level is again more significant with 51.24% for new-constructed, 36.48% for modernized and just a minor share of 12.28% for the extrapolated version.

Because the criteria demographic and environmental social characteristics are evaluated by Borrmann with a high percentage of 46.15% with respect to the overall target, these criteria flow into the overall alternative ranking with a significant portion. Hence, the total alternative ranking embraces the major preferences for the new-constructed and modernized versions with 45.21% and 41.97%, the extrapolated version with a marginal ratio of 12.83%.

- *Cluster 3: Spain*

For Spain, Borrmann identifies a main preference for the environmental social characteristics with an eigenvector share of 78.38% and a consistency ratio of 3.39%, which is a good result.

The demographic subcriteria with a relative importance with respect to the criterion demographic characteristics demonstrate highly balanced eigenvector shares of the subcriteria with a small preference for the ageing indicators with 28.32% and a positive consistency ratio of 8.78%. The space subcriteria highlight a key component of build quality that is weighted by the interviewee with an eigenvector of 60.0% and perfect consistency of the pairwise comparisons. Also, the level of environmental social subcriteria has a good result in the consistency ratio of 2.44% and outlines also mainly balanced eigenvectors with a small preference for economic conditions with a share of 25.73%.

The alternatives that are compared with preference with respect to the demographic subcriteria are evaluated by the interviewee with primary equal importance and perfect consistency. This trend also continues in the field of space characteristics, but changes in the environmental social segment with an important weighing of the modernized and new-construction versions and a positive consistency result of a maximum of 2.8%.

As a consequence of the high-balanced subcriteria shares and the basically equal eigenvectors of the alternatives, also the alternative rankings of the demographic development are very close together with 35.22% for the new-construction and the extrapolated version and 29.56% for the modernized option. The space characteristics highlight another outcome, as build quality is the most important variable with a high effect on the end result. Therefore, the new-constructed and extrapolated versions finish with minor shares of 23.33% per option and 53.33% for the modernized version. As a result of more balanced shares in the environmental social section, the alternative ranking is near the arithmetic mean and ends with 46.92% for the new-construction, 41.34% for the modernized and 11.74% for the extrapolated version, which demonstrates a high relevance for a customisation in this area.

Because Borrmann identifies the environment social characteristics as the most important criterion, its weight influences the alternative ranking in total in a significant manner with a high importance for the new-constructed and modernized real estate assets with shares of 43.42% respectively 40.72% and a minor percentage of 15.85% for the extrapolated portfolio.

The results of an ideal portfolio mix for 2050 are the following:

Table 6.4 Real estate portfolio combinations Frank Borrmann

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	15.01%	40.40%	44.59%
Estonia	15.01%	40.40%	44.59%
Germany	12.83%	41.97%	45.21%
Hungary	15.01%	40.40%	44.59%
Latvia	15.01%	40.40%	44.59%
Lithuania	15.01%	40.40%	44.59%
Poland	15.01%	40.40%	44.59%
Romania	15.01%	40.40%	44.59%
Slovakia	15.01%	40.40%	44.59%
Spain	15.85%	40.72%	43.42%

Source: Own analyses

b. Interviewee group of professionals

Mara Meinel

This interviewee is CEO at the company Becken Verwaltungs GmbH in Hamburg, Germany, and responsible for the property and mainly asset management in the international context of Europe and the USA (Becken, 2014). The interview took place on 6th January 2015 on the company's premises in from 3:30 to 7:30 p.m. (Appendix 23-26, 75).

Because the interviewee evaluate comparable tendencies in different countries, she clustered them as follows:

- Cluster 1: Bulgaria, Romania
- Cluster 2: Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Spain
- Cluster 3: Germany

Her specialised knowledge is in her opinion in the fields of Germany, Hungary, Romania, Slovakia and Spain.

- *Cluster 1: Bulgaria, Romania*

The interviewee evaluates the space and environmental social characteristics as much more important than the demographic development with eigenvector weights of 56.95%, respectively 33.31%. The consistency ratio lies at 2.37% in a positive range.

In the next hierarchy level of subcriteria these variables are compared to their relative importance with respect to the criterion demographic characteristics, the most important subcriteria are the ageing indicators with an eigenvector of 40.23% followed by the household composition with 20.12%. The other variables are mainly balanced. The consistency is high with a ratio of 1.33%. Also in the field of space features there is a strong preference for the variable build quality with 68.33% and a good consistency percentage of 2.38%. The environmental social subcriteria embrace an important validity with 0.53% and basically focus on the variables income level with an eigenvector of 29.46%, levels of rent and economic conditions with each 21.83%.

The alternatives, compared to the relative preference with respect to the subcriteria of the demographic development, space and environmental social criteria show mainly high preferences for the interviewee in the customisation of real estate assets, especially the modernized and the new-constructed option. Primary the space subcriteria highlight the importance with 45.45% and 47.06%. The consistency ratios are nearly at the ideal level and hence very reliable.

In the following stages, which compare the relative importance of the subcriteria with respect to the demographic alternatives, the outcome of the different subcriteria is identical and, therefore, also the total alternative ranking with 45.45% of new-construction and modernized variants and 9.09% for the minor option of extrapolated real estate assets. In the area of space characteristics, the structure is also very analogical with an end result of 46.74% for the new-construction and also the modernized versions, followed by the much less significant extrapolated variable with 6.52%. This development changes in the environmental social field with more balanced percentages and a ranking of 41.41% for modernized, 38.50% for new-constructed and 20.09% for extrapolated portfolio mixes.

Because the environmental social characteristics include a share of 33.31% with respect to the overall target, this structure influences the total alternative ranking and balances the shares with 44.84% for the modernization, 43.87% for the new-construction and 11.29% for the extrapolated version.

- *Cluster 2: Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Spain*

Also in this country cluster Meinel interprets a strong preference for the space and environmental social characteristics with shares of 42.86% per variable and an ideal consistency.

In the level of demographic subcriteria the ageing indicators have significant importance with an eigenvector of 42.86%; the additional variables are balanced with 14.29% per subcriteria and again ideal reliability. For the space subcriteria the interviewee evaluates the age distribution of housing stock as highly important with a ratio of 60.0%. The environmental social area involves generally stable eigenvectors; nevertheless, the income level has a little more significance with 18.81%. The consistency ratio is a maximum 2.65% with a reliable result.

Meinel interprets the alternatives with preference with respect to the demographic and space subcriteria with significance to the customisation of real estate assets, specially modernized and new-construction version. This shifts in the environmental social field, which is in the main weighted equally. Again the consistency ratios demonstrate high reliabilities of the pairwise comparisons.

The following stage that compares the relative importance of the subcriteria with respect to the demographic and space alternatives highlights a similar trend with identical shares of new-construction and modernized assets with a ratio of 40.0%, respectively 42.51% and 20.0% or 14.98% for the extrapolated version. The alternative ranking of the environmental social criterion is more equal with 35.51% for the customisations and 28.98% for the extrapolated option.

Because the criteria space and environmental social characteristics are weighted as more significant with respect to the overall target, they comprise the basic influence for the total alternative ranking with 39.15% for the new-constructed and the modernized version and 21.70% for the extrapolated portfolio.

- Cluster 3: Germany

Also for this cluster Meinel sees minor relevance in the field of demographic development for Germany. The space and the environment social characteristics are much more important from her point of view, with an eigenvector share of 58.16% for the space and 30.90% for the environmental social criterion. The consistency is high with 0.36%, which indicates a good result.

In the demographic subcriteria the interviewee gives high relevance to ageing indicators with an eigenvector of 50.0%; the other variables are fully stable with percentages of 12.50% per variable and an ideal consistency ratio. In the space level the subcriterion age distribution of housing stock is of high relevance with 66.67% and again a full consistency rate. The eigenvectors of the environmental social subcriteria are mainly stable with a major preference for the economic conditions with a ratio of 27.13%. The consistency ratio is in the maximum limit of smaller 10% with 9.74%.

The alternatives with respect to the subcriteria generally demonstrate high partialities towards the modernized and new-constructed versions, but also highlight the equal weights especially in the field of space characteristics. The consistencies are again stable with maximum rates of 1.76%.

The comparison with respect to the relative importance of the alternative subcriteria finish with equal results in the fields of subcriteria, hence the alternative ranking embraces an important share for the modernized real estate assets with 70.10%, a relatively low percentage for the new-construction option with 19.29% and a minimum ratio of 10.61% for the extrapolated version. Because Meinel interprets the age distribution of housing stock as much more significant than build quality and average number of rooms per dwelling, this variable influences the space alternative ranking much more. Therefore, the modernized future version comprises rank one with 47.77%, followed by the new-construction version with 27.13% and the extrapolated variant with 25.10%. Because the subcriteria and the alternatives are more balanced in the environmental social version, the alternative ranking is closer together with 42.24% for the new-construction, 37.58% for the modernized and 20.17% for the extrapolated option. Nevertheless, because the space characteristics finish with an eigenvector of 58.16% in the criteria ranking, this criterion affects the overall alternative ranking with a ratio of 47.07% for the modernized, 30.94% for the new-construction and 21.99% for the extrapolated alternative with respect to the target of the ideal portfolio in 2050. In total, the results for the analysed countries are as follows:

Table 6.5 Real estate portfolio combinations Mara Meinel

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	11.29%	44.84%	43.87%
Estonia	21.70%	39.15%	39.15%
Germany	21.99%	47.07%	30.94%
Hungary	21.70%	39.15%	39.15%
Latvia	21.70%	39.15%	39.15%
Lithuania	21.70%	39.15%	39.15%
Poland	21.70%	39.15%	39.15%
Romania	11.29%	44.84%	43.87%
Slovakia	21.70%	39.15%	39.15%
Spain	21.70%	39.15%	39.15%

Source: Own analyses

Michael Wulf

The interviewee is CEO in one of the biggest real estate companies in Germany, Bauverein der Elbgemeinden eG, Hamburg, Germany. Wulf's core competencies are in the field of property and asset management and strategic management (BVE, 2015). The interview took place on 12th January 2015 from 8:30 until 10:00 a.m. at a public place in Hamburg (Appendix 27-32, 76).

Wulf interprets the developments of different countries similar for the future; therefore, he clustered the countries as follows:

- Cluster 1: Bulgaria, Hungary, Romania, Slovakia
- Cluster 2: Estonia, Latvia, Lithuania
- Cluster 3: Germany
- Cluster 4: Poland
- Cluster 5: Spain

In the view of the interviewee the core country fields are Germany and Spain.

- *Cluster 1: Bulgaria, Hungary, Romania, Slovakia*

For Wulf the demographic criterion plays an important role with a major eigenvector quote of 70.96% and a consistency ratio of 1.77%, which indicates a good consistency of the pairwise comparisons.

The subcriteria that compare the relative importance with respect to the criterion demographic characteristics evaluate high preferences of the subcriteria household indicators and clusters of households with an eigenvector percentage of 39.24% per variable. The consistency ratio is in the limit of smaller 10.0% with a quote of 9.52% and therefore, indicates acceptable outcomes. In the space area the main important variable is the age distribution of housing stock with a high eigenvector of 71.71% and a good consistency of 3.58%. The interviewee validates the income level as highly significant in the environmental social level with a quote of 48.32%. Also in this level the consistency ratio at 9.62% is in a balanced area of variable comparisons.

The alternatives with respect to the demographic subcriteria demonstrate different preferences with slightly higher preferences for the modernized version and a maximum consistency ratio of 3.58%. In the field of space subcriteria, the customised alternatives are selected by the interviewee, especially the modernized and the new-construction version. Also in this matrix the consistency ratio ends with good results as the quotation is a maximum 1.76%. The alternatives in the environmental social context are, like for the demographic one, more balanced with high shares in all alternatives as a result of dissimilar weights in different subcriteria areas. Also these comparisons are very consistent with percentages between 0.0% and 0.89%.

The variables, compared with a relative importance of the demographic subcriteria with respect to the alternatives, show a strong trend towards the modernized version with 60.11%, 21.53% for the new-constructed and 18.36% for the extrapolated alternative. The alternative ranking of the space and the environmental social criteria highlights a different result. Ranked first here is the extrapolated version with 51.96% respectively 59.17%, while the modernized and new-construction versions are close together with 24.11% and 20.54% for the modernized and 23.93% and 20.29% for the new-construction version.

Because the demographic criteria ranking is more significant than the other criteria, the overall outcome is influenced by the demographic development. Nevertheless, the other criteria with a total share of 29.04% realise a small balance of the alternative ranking with a result of 49.11% for the modernized, 29.23% for the extrapolated and 21.66% for the new-construction version.

- *Cluster 2: Estonia, Latvia, Lithuania*

Also in this cluster for Wulf the demographic characteristics comprise the most important criteria share with an eigenvector of 73.24% and a consistency ratio of 0.36%.

In the subcriteria area the variables household indicators and clusters of households are interpreted as the strongest components with a ratio of 38.37%, respectively 33.08%. The other variables embrace mainly a minor share. The consistency ratio is at the maximum level of 9.29% and, therefore, still at an acceptable level. For the space characteristics build quality plays an important role for the interviewee with an eigenvector of 69.08% and a consistency ratio of 0.53%, which indicates a near ideal value. The income level with a percentage of 42.69% is the most significant in the environmental social field. Similar to the demographic subcriteria, also in this area the consistency ratio is relatively high with 9.77%, but indicates a satisfactory result as the maximum value for matrixes with seven variables is fewer than 10.0%.

The alternatives, compared with the demographic and space subcriteria, demonstrate high preferences for a customisation of the real estate portfolios with significant percentages for the modernized and new-constructed option. This context shifts into another direction as the interviewee mainly highlights in the environmental social area the extrapolated real estate portfolio. The consistency ratio describes in all fields good results, because the highest ratio is 1.76%; therefore, the pairwise comparisons are very reliable.

The variables, compared with the relative importance of the demographic subcriteria with respect to the alternatives show high influences of the most significant subcriteria household indicators and clusters of households; nevertheless, the variable ageing indicators with an eigenvector of 15.35% balance the shares. The alternative ranking is 40.48% for the modernized, 40.31% for the new-construction and 19.21% for the extrapolated portfolio. The identical trend is viewable in the space level. Build quality has the most important effect on the result, but the variable age distribution of housing stock with 16.03% eigenvector equals the alternative ranking with a total result of 42.70% for new-construction, 40.74% for modernized and 16.57% for extrapolated assets. Although the income level is most basic for the environmental social focus, also the other variables with a total percentage of 57.31% affect the alternative ranking that changes in contrast to the other results with a key component of the extrapolated version of 57.20%, new-constructed option of 23.00% and the modernized variant of 19.79%. Because the demographic criterion is the most crucial variable, the overall alternative ranking is interpreted mainly by this area with 38.24% for the new-construction, 37.66% for the modernized and 24.10% for the extrapolated alternative.

- *Cluster 3: Germany*

The demographic criterion is for Germany much more important from the interviewee's point of view with an eigenvector of 63.37% and a consistency ratio of 0.89%.

The demographic subcriteria are mainly very balanced with a near-perfect consistency of 0.42%. This weighing differs in the space subcriteria level with a significant importance of build quality with 78.91%. Also in this field the ratio of the consistency is very low at 0.19%, which indicates a good result. Moreover, the environmental social matrix indicates, similar to the demographic subcriteria, very balanced eigenvectors with a good reliability of 6.59%.

The alternatives with respect to the demographic subcriteria mainly demonstrate a preference for customised real estates, but also highlight strongly extrapolated eigenvector shares by the ageing indicators and clusters of households. This tendency is also important in the space level for the age distribution is weighted with a preference for the extrapolated portfolio. Furthermore, also the environmental social subcriteria income level and levels of rent are interpreted as key variables for the extrapolated real estate version. The consistency ratio with a maximum value of 3.58% indicates good and plausible results.

The relative importance of the subcriteria, compared to the alternatives, are interpreted by Wulf in the area of demographic and environmental social characteristic as more balanced than the space components with alternative rankings of 53.7% for modernized, 37.0% for extrapolated and 9.30% for new-constructed alternatives for the demographic and 41.69% for extrapolated, 32.80% for new-construction and 25.51% for modernized options in the environmental social area. Because the criterion build quality embraces a crucial eigenvector share of 78.91%, these results mainly influence the alternative ranking. Nevertheless, the other subcriteria with 21.09%

smoothly balance out this ranking. Consequently, the modernized alternative accounts for 58.88%, the extrapolated 27.48% and the new-construction option 13.65%. The total alternative ranking comprises high shares of the key criterion demographic characteristics, but is also balanced by the other criteria with a quote of 36.63% and ends with 49.20% for the modernized, 36.24% for the extrapolated and 14.57% for the new-construction version.

- *Cluster 4: Poland*

In the criteria level the demographic characteristics embrace an eigenvector share of 73.24% and is, therefore, the most important key criterion with a consistency ratio of 0.36%.

The demographic subcriteria area demonstrates mostly balanced eigenvectors with a reliability ratio of 1.49%, which ensures very consistent pairwise comparisons. The space subcriteria highlight the importance of build quality with 73.24% and again a consistent ratio of 0.36%. In the environmental space subcriteria area, similar to demographic development, the eigenvectors are rather balanced with a consistency ratio of 9.93%, which is in the maximum range of acceptance.

For Wulf the demographic and space alternatives are mainly positioned in the modernized and new-construction area. The environmental social subcriteria shift primary to the extrapolated real estate assets. Also in this area, the pairwise comparisons demonstrate high reliabilities with quotes of maximum 1.76%.

Although the alternative outcome of the demographic subcriterion ageing indicators differentiate from the other subcriteria with a share of 4.6%, there is a marginal influence for the alternative ranking that directs into the future customisation with shares of 45.83% for the new-construction, 43.01% for the modernized version and 11.16% for the extrapolated option. Although build quality subcriterion of the space characteristics contain the most important effect on the alternative ranking, the additional variables balance the end result with 43.74% for the new-construction, 39.27% for the modernized and 16.99% for the extrapolated portfolio. The environmental social section ends with outcomes that are more directed to the arithmetic mean as a result of a more balanced criteria ranking with a high share for the extrapolated version with 63.95%, new-construction portfolio with 20.85% and modernized option with 15.20%. As the demographic development is interpreted as highly significant, the overall alternative ranking reproduces strongly this criterion outcome with 42.12% for new-constructed, 38.69% for modernized and 19.19% for extrapolated real estates.

- *Cluster 5: Spain*

Also for Spain the interviewee shows high preferences for the demographic criterion of 75.0% and an ideal consistency.

The demographic subcriteria are validated with the most balanced eigenvector shares and a consistency ratio of 3.73%. In the space segment, again similar to the analysis of other clusters, build quality is much more important than the other variables with an eigenvector of 73.24% and consistency rate near the ideal of 0.36%. The environmental social subcriteria are mainly balanced but indicate one crucial subcriterion of economic conditions with 44.89%. The consistency ratio is still in the maximum range with 9.91% and, therefore, acceptable.

The alternatives, compared to the demographic and space subcriteria highlight an interviewee preference for modernized and new-construction assets, but interprets more significance for extrapolated habitations in the environmental social spectrum. The consistency ratios finish with a maximum quotation of 1.77% and hence the pairwise comparisons are highly reliable.

The subcriteria that compare the relative importance with respect to the alternatives flow in a very balanced alternative ranking with 39.96% for the new-construction, 36.54% for the modernized and 23.50% for the extrapolated version. In the space level the differences between the alternatives are bigger with a focus on the customized assets with 42.35% for modernized, 40.50% for new-construction and a low percentage of 17.15% for extrapolated alternatives. In contrast to this outcome, the environmental social alternative ranking highlights the extrapolated portfolio with 58.24%, the new-construction version with 22.55% and the modernized option with 19.21%. As a consequence of a high demographic criterion ranking, the results of this criterion reflect the overall effect with 37.85% for the new-construction, 35.10% for the modernized and 27.05% for the extrapolated portfolio.

In total, Wulf interprets the future portfolio mixes as follows:

Table 6.6 Real estate portfolio combinations Michael Wulf

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	29.23%	49.11%	21.66%
Estonia	24.10%	37.66%	38.24%
Germany	36.24%	49.20%	14.57%
Hungary	29.23%	49.11%	21.66%
Latvia	24.10%	37.66%	38.24%
Lithuania	24.10%	37.66%	38.24%
Poland	19.19%	38.69%	42.12%
Romania	29.23%	49.11%	21.66%
Slovakia	29.23%	49.11%	21.66%
Spain	27.05%	35.10%	37.85%

Source: Own analyses

Berit Jalas

The interviewee is the general manager at the Becken Verwaltungs GmbH in Hamburg, Germany. She is responsible for the international asset and property management in the residential trade and industry (Becken, 2014). The interview with her was on 13th January 2015 from 9:00 to 11:30 a.m. in the company offices (Appendix 33-38, 77).

Also this interviewee realises a clustering of the countries as she interprets the same future developments for different countries:

- Cluster 1: Bulgaria, Romania
- Cluster 2: Estonia, Latvia, Lithuania
- Cluster 3: Germany
- Cluster 4: Hungary, Poland, Slovakia
- Cluster 5: Spain

The special core country field is in her opinion Germany.

- *Cluster 1: Bulgaria, Romania*

For Jalas the demographic development plays a minor role in this cluster. Therefore, the space and environmental social characteristics are much more crucial criteria with eigenvectors of 46.15% per variable and an ideal consistency quotation of 0.0%.

In the area of demographic and space subcriteria the interviewee subscribes equal pairwise comparison weightings with the effect of equal eigenvector shares and ideal reliability. This procedure changes in the environmental social subcriteria level. The weightings are close together with a slight preference for the economic conditions with an eigenvector of 24.71%. The consistency ratio is at the maximum limit with a percentage of 9.57% and demonstrates an acceptable result.

The alternatives, compared to the demographic, space and environment social subcriteria, highlight high preferences for the customised real estate portfolios, especially the modernized and new-construction version. The consistency ratios are low with a maximum consistency ratio of 0.89%, which indicates high stability of the pairwise comparisons.

The interviewee compares the relative importance of the subcriteria with respect to the alternative in all criteria fields as nearly similar with high quotas for the customised residential trade and industry assets. In the demographic and space level the percentages are equal with eigenvector shares of 46.67% for the modernized and new-construction versions and 6.67% for the extrapolated option. These results differ marginally in the environmental social level with 46.19% for the new-construction, 45.94% for the modernized and 7.87% for the extrapolated outcome. These tendencies also reflect the overall alternative ranking with 46.45% for the new-construction, 46.33% for the modernized and 7.22% for the extrapolated alternative. Although the demographic criterion embraces a minor eigenvector share in relation to the other criteria, this effect is marginal because the alternative rankings of the different criteria are close together.

- *Cluster 2: Estonia, Latvia, Lithuania*

Also in the criteria level of this country cluster, the space and environmental social characteristics are more important with eigenvectors of 42.86% per variable and a perfect consistency.

Again the weightings of the subcriteria of the demographic and the space features are equal with consistency ratios of 0.0% that demonstrate high reliabilities of the pairwise comparisons. The environmental social segment demonstrates preferences for the income and land area subcriteria with eigenvector shares of 21.92% per subcriterion. The consistency ratio is at the maximum level of 9.98%, which is still an acceptable outcome.

The alternatives with respect to the subcriteria demographic, space and environmental social characteristics highlight mainly high preferences for the modernized and new-construction alternatives with good consistency rates of maximum 0.89%.

The afore-mentioned weightings reflect the alternative ranking of alternatives with outcomes of 46.15% for the modernized and new-construction versions and 7.69% for the extrapolated assets in the field of demographic characteristics. Very similar are also the end result of the space alternative ranking with 46.67% for the customised options modernized and new-construction and 6.67% for the extrapolated variant. The environmental social level demonstrates slight differences between the different alternatives with 46.19% for the new-construction, 45.86% for the modernized and 7.95% for the extrapolated alternative. Because the outcomes of the alternative rankings of the different criteria are close together, the criteria rankings play a minor role for the overall ranking and end at 46.39% for the new-construction option, 46.25% for the modernized variant and 7.36% for the extrapolated alternative.

- *Cluster 3: Germany*

In contrast to the other afore-mentioned country clusters, Jalas interprets the demographic development for Germany as important in that it embraces an eigenvector share of 45.45% equal to the environmental social criterion. The consistency ratio is 0.0%, which demonstrates an ideal reliability of the pairwise comparisons.

The weightings of the demographic subcriteria are equal with a similar effect on the eigenvector quotes and an ideal consistency ratio. The interviewee analyses in the space subcriteria build quality and average number of rooms per dwelling as most substantial with eigenvectors of 46.15% per variable and a consistency rate of 0.0%. In the environment social subcriteria level, the most crucial subcriterion is the land area with a share of 26.36% and a consistency ratio of 5.0%, which is a good result for matrixes of seven variables.

The alternatives compared with a relative preference with respect to the subcriteria of the demographic, space and environmental social criteria, highlight high eigenvectors up to 75.0% for the modernized alternative and good outcomes of the consistency rates with a maximum value of 3.72%.

The subcriteria of the demographic level, compared to the alternatives, demonstrate equal weightings in all subcriteria with a similar outcome in the alternatives ranking with a major preference for the modernized version with 75.0% and minor shares of the new-construction and extrapolated alternative with 12.5% per variable. The same effect is also apparent in the space level with an outcome of 71.43% for the modernized and 14.29% for the new-construction and extrapolated future portfolio. The environmental social effect differs as the criteria ranking and the alternative ranking of the subcriteria differ with a total alternative ranking of 67.32% for the modernized, 20.23% for the new-construction and 12.44% for the extrapolated real estate assets. These results are more differentiated, but also highlight the preference for the modernized version. Because the criteria ranking of the demographic and the environmental social criteria are weighted higher than the space criterion, these results embrace the effects of the total ranking with 71.18% for the modernized, 16.18% for the new-construction and 12.64% for the extrapolated version.

- *Cluster 4: Hungary, Poland, Slovakia*

In this cluster the criteria space and environmental social characteristics play the main role with a total share of 85.71% and perfect consistency ratio.

In the following level of demographic and space subcriteria the pairwise comparisons of Jalas are equal with similar eigenvector weights and an ideal consistency ratio. The environmental social area demonstrates different results to the subcriteria with the highest preference by the economic conditions with an eigenvector of 31.94%. The consistency ratio lays at 9.94%, which is still in the range of the maximum possible value for matrixes with seven variables and is, therefore, an acceptable result.

The alternatives, compared with a relative preference for the demographic, space and environmental social subcriteria, demonstrate strong preferences for the modernized and new-construction versions with key eigenvector shares and good results of the consistency ratio of maximum 0.89%.

These outcomes also reflect to the alternative rankings of the criteria with core shares of the customised future real estate shares. The demographic and space alternative rankings finish with a total share of 92.31% for the modernized and new-construction version and 7.69% for the extrapolated portfolio. The same trend is also apparent in the environmental social criterion levels with a customisation share of 92.01% and 7.99% for the extrapolated alternative. Therefore, also the total ranking demonstrates the same tendency, whereas the different criteria rankings play a minor role because the outcomes in each subcriteria level are nearly the same. Hence, the most important share is with the new-construction option with 46.17%, followed by the modernized version with 46.02% and with an important distance with 7.82% the extrapolated alternative.

- *Cluster 5: Spain*

For Spain the interviewee evaluates the demographic and the environmental social criteria again, with a similar trend to Germany, as the most important variables with 40.0% eigenvector share per variable. The consistency ratio is 0.0% and, therefore, the pairwise comparisons are at an ideal level.

In the demographic subcriteria level the pairwise comparisons are equal with an ideal reliability of 0.0%. For the space characteristics, Jalas interprets build quality and average number of rooms per dwelling as the most important subcriteria with eigenvectors of 42.86% per variable, again with a consistency ratio of 0.0%. In the environmental social section, the subcriteria land area with an eigenvector of 21.6%, economic conditions with 19.98% and supply and demand with 19.54% are the most crucial preferences with a good consistency result of 4.08%.

The alternatives, compared with the relative preference with respect to the demographic, space and environmental social subcriteria, highlight strong preferences for the modernization with eigenvector shares up to 60.0% and ideal consistency ratios of 0.0%.

These tendencies emanate also to the alternative rankings with effects in the demographic and space criteria levels of 60.0% for the modernized and 20.0% for the extrapolated and new-construction version per variable. Also in the environmental social level this trend continues with 59.03% for the modernized and 20.48% for the extrapolated and new-construction version. Hence, the overall alternative ranking ends with 59.61% for the modernization and 20.19% for the extrapolated and the new-construction version.

The overview of the effects of the alternative rankings for the different countries are illustrated as follows:

Table 6.7 Real estate portfolio combinations Berit Jalas

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	7.22%	46.33%	46.45%
Estonia	7.36%	46.25%	46.39%
Germany	12.64%	71.18%	16.18%
Hungary	7.82%	46.02%	46.17%
Latvia	7.36%	46.25%	46.39%
Lithuania	7.36%	46.25%	46.39%
Poland	7.82%	46.02%	46.17%
Romania	7.22%	46.33%	46.45%
Slovakia	7.82%	46.02%	46.17%
Spain	20.19%	59.61%	20.19%

Source: Own analyses

Richard Winter, Susanne Gentz

The interviewees are employees of the multinational real estate management and research company Jones Lang Lasalle in Hamburg, Germany. Richard Winter is the director of the office in Hamburg; Susanne Gentz is the associate director of the residential trade and industry. The core business fields of Winter are the restructuring and development of European real estate assets (Jones Lang LaSalle, 2015). Gentz' core field is the German residential trade and industry market (Jones Lang LaSalle, 2014). The pairwise comparisons for Germany Winter and Gentz realised together, while Winter fulfilled the interviews for all of the analysed ten countries. The interview was conducted on 7th April 2015 in the offices of Jones Lang Lasalle and lasted from 11:00 until 13:00 (Appendix 39-43, 78).

Because Winter interprets the same development for different countries, he analyses the following country clusters:

- Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Romania, Slovakia
- Cluster 2: Germany
- Cluster 3: Poland
- Cluster 4: Spain

The core fields of Winter are Poland and Spain; for Gentz it is Germany.

- *Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Romania, Slovakia*

For Winter, in the criteria field the environmental social characteristics are the most important variable with an eigenvector of 66.12%, followed by demographic development with 27.18%. The consistency ratio is at an acceptable level with 4.27%.

The demographic subcriteria mainly demonstrate very balanced eigenvectors. Also the consistency ratio is at a low level with 0.67%, which indicates reliable pairwise comparisons. The space subcriteria demonstrate a high preference for build quality with an eigenvector of 60.0% and an ideal consistency ratio. The environmental social subcriteria evaluate a strong significance for the income level with an eigenvector of 22.25%. The lowest preference is the variable land area with a share of 4.04%. The consistency ratio with 8.91% is at a tolerable level.

The demographic alternatives compared with the relative preference with respect to the subcriteria demonstrate a high ranking of the new-construction alternative with eigenvectors of 55.84%, followed by the extrapolated option with 31.96% and a minor share for the modernized version of 12.2%. The consistency ratio is 1.76% for every subcriterion and is, therefore, a good result. In the level of space alternatives, the major eigenvectors are illustrated for the modernized and new-construction alternatives with a good maximum of consistency ratio of 1.76%. The environmental social alternative level demonstrates again, similar to the demographic development, mainly high shares for the extrapolated and the new-construction variants and plausible consistency ratios of a maximum 3.72%, which are good and reliable outcomes.

Because the demographic criteria ranking is generally balanced and the alternatives of the subcriteria are all equal, also the alternative ranking comprises an equivalent portfolio of 55.84% for the new-construction, 31.96% for the extrapolated and 12.2% for the modernized future real estate assets. Although build quality within the space characteristics embraces the highest criteria-ranking share with 60.0%, the additional criteria balance the total alternative ranking with an outcome of 51.17% for the new-construction, 24.98% for the modernized and 23.85% for the extrapolated alternatives. The environmental social subcriteria, compared with the relative importance of the alternatives, reflect a balanced alternative ranking with an arithmetic mean of 58.41% for the new-construction, 23.53% for the modernized and 18.06% for the extrapolated real estate portfolio. As the environmental social characteristics highlight the most important criteria-ranking with an eigenvector of 66.12%, this criterion basically influence the overall alternative ranking in an important way with an outcome of 57.23% for the new-construction, 22.23% for the extrapolated and 20.55% for the modernized version.

- *Cluster 2: Germany*

For the interviewees the environmental social characteristics with 46.65% and the space criterion with 43.3% are the most significant variables within the criterion level. The consistency ratio of 0.53% is a good result of the pairwise comparisons of the interviewees.

The demographic subcriteria evaluate a high preference of 40.58% for the variable household composition. The minor importance is illustrated with 8.42% for the clusters of households. The consistency ratio with 6.49% highlights a good reliability of the pairwise assessments. In the hierarchy level of space subcriteria, build quality plays the most important role with an eigenvector of 69.08%. The low consistency ratio lies with 0.53% on a good level near the ideal value. The highest ranked subcriterion in the environmental social area is the income level with 31.76%. The consistency ratio with 9.36% is on the maximum acceptable level and still indicates good results.

In the following hierarchy level of the alternatives that compares the relative preference with respect to the demographic subcriteria, basically the customisation of real estate assets, especially the modernized and the new-construction versions, generally comprise the highest preferences. Also in the environmental social area, similar to the demographic development, the modernized and new-construction residential trade and industry portfolios highlight the major eigenvector shares. The consistency ratios illustrate a maximum quote of 3.58% and realise good and reliable results.

The subcriteria, compared to the demographic alternatives, outline an alternative ranking that is near the arithmetic mean with 47.06% for the modernized, 42.32% for the new-construction and a minor share of 10.62% for the extrapolated asset portfolio. Although the subcriterion build quality in the space field has a high eigenvector ranking of 69.08%, the other subcriteria balance the total alternative ranking. Therefore, the basic share comprises 57.66% for the modernized, 22.64% for the new-construction and 19.7% for the extrapolated alternative. In the environmental social level, the total alternative ranking is more balanced with basically an arithmetic mean of the subcriteria and the alternatives comprise an outcome of 43.27% for the new-construction, 42.43% for the modernized and 14.3% for the extrapolated version. Also the overall alternative ranking is an arithmetic mean and balances the outcome with 49.49% for the modernized, 34.24% for the new-construction and 16.27% for the extrapolated portfolio.

- *Cluster 3: Poland*

For the interviewee, the environmental social and the demographic characteristics with eigenvectors of 57.69% and 34.2% are the major variables with a consistency ratio of 2.8%, which indicates a good and reliable result.

The demographic subcriteria are very balanced with a minor variable of 5.7% for the ageing indicators. The consistency ratio of 0.64% is near the ideal value and, therefore, it comprises a good reliability. Build quality and average number of rooms per dwelling validate significant eigenvector shares of 63.7% respectively 25.83% and a good consistency ratio of 3.72%. The eigenvectors of the environmental social level are mainly stable with a consistency ratio of 6.02%, which is a good outcome as the maximum consistency is under 10.0% for matrixes with seven variables.

The alternatives compared to the demographic, space and environmental social subcriteria outlines Winter's high preference for a future customisation with basically significant eigenvector shares for the modernized and new-construction versions. The consistency ratios are with a maximum of 1.76% on a good level.

The demographic subcriteria, compared with a relative importance to the alternatives, are balanced with an arithmetic mean for the total alternative ranking. Hence, the outcome comprises a main share for the modernized version with 42.43%, a slightly lower share of 40.1% for the new-construction option and a minor share of 17.48% for the extrapolated real estate alternative. Because the space subcriteria alternatives are close together, the subcriteria ranking plays a minor role with a total alternative ranking of 44.69% for the modernized, 41.97% for the new-construction and 13.34% for the extrapolated portfolio. The environmental social area is generally balanced with an arithmetic mean of the total alternative ranking that comprises 46.1% for the modernized, 31.62% for the new-construction and 22.28% for the extrapolated alternative. Although the environmental social criterion highlights the most important criteria percentage with 57.69%, the other criteria balance the overall result with an outcome of 44.73% for the modernized, 35.36% for the new-construction and 19.91% for the extrapolated alternatives.

- *Cluster 4: Spain*

For Winter, within the criteria level with respect to the overall goal, the space criterion is the most significant variable with 75.14% with a good consistency ratio of 2.82%.

The demographic subcriteria are mainly balanced with a consistency percentage of 9.32%, which is still within an acceptable limit. In the space level, build quality plays the most important role with an eigenvector of 60.0% and an ideal consistency ratio. The environmental social subcriteria illustrate a high preference for the economic conditions with an eigenvector of 23.05% and a low percentage for the supply/ demand with 5.06%. The consistency rate lies with 8.5% at an acceptable level of pairwise comparisons.

The alternatives, compared to the demographic, space and environmental social subcriteria, indicate high preferences of the interviewee for the extrapolated and modernized versions with significant eigenvectors and good consistency percentages with a maximum value of 3.72%.

The variables that compare the relative importance of the subcriteria with respect to the demographic alternatives mainly reflect the alternative results of the key subcriteria clusters of households and household composition with a total eigenvector of 62.37%. Thus, the total alternative ranking comprises 53.8% for the modernized, 34.16% for the extrapolated and 12.04% for the new-construction versions. Although build quality is the main variable in the space criteria ranking with an eigenvector of 60.0%, the other variables age distribution of housing stock and average number of rooms per dwelling with a percentage of 40.0% in total stable the total alternative ranking with an outcome of 54.22% for the modernized, 32.5% for the extrapolated and 13.28% for the new-construction version. The portfolios and eigenvector rankings of the environmental social subcriteria are mainly stable. Therefore, the total alternative ranking generally reflects the arithmetic mean with an outcome of 39.0% for the modernized, 36.67% for the extrapolated and 24.32% for the new-construction option. As the space characteristics cover a major eigenvector share of 75.14% within the criteria ranking, this portfolio basically reflects the overall alternative ranking with 53.08% for the modernized, 33.09% for the extrapolated and a minor share of 13.84% for the new-construction version.

In total, the real estate portfolio mixes for the future assets are the following:

Table 6.8 Real estate portfolio combinations Richard Winter, Susanne Gentz

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	22.23%	20.55%	57.23%
Estonia	22.23%	20.55%	57.23%
Germany	16.27%	49.49%	34.24%
Hungary	22.23%	20.55%	57.23%
Latvia	22.23%	20.55%	57.23%
Lithuania	22.23%	20.55%	57.23%
Poland	19.91%	44.73%	35.36%
Romania	22.23%	20.55%	57.23%
Slovakia	22.23%	20.55%	57.23%
Spain	33.09%	53.08%	13.84%

Source: Own analyses

c. Interviewee group of branch alliances

Dr. Özgür Öner

This interviewee is the manager of the office of the branch alliances GdW - Bundesverband deutscher Wohnungs- und Immobilienunternehmen, Germany, located in Brussels, Belgium. The GdW is the umbrella organisation of the residential trade and industry in Germany with 3000 member companies of the residential trade and industry (GdW, 2015b). Öner is busy in the international fields of sustainable urban development, structural and regional policy and consumer policy and member of different international European organisations to establish residential trade and industry future developments and tendencies (GdW, 2015c).

The interview was conducted on 16th January 2015 from 10.30 until 1:00 a.m. in the office of the company in Brussels (Appendix 44-47, 79). Öner clusters the countries, because he interprets very similar future trends in various countries. Therefore, the country clusters are as follows:

- Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia
- Cluster 2: Germany
- Cluster 3: Spain

In the interviewee's opinion, his special core fields are Germany, Poland and Romania.

- *Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia*

In this cluster the demographic development plays in the criteria ranking the main role with an eigenvector percentage of 71.43% and perfect consistency ratio of 0.0%.

In the area of the demographic subcriteria level, the most significant variable is the housing indicators with 50.84%, followed by the ageing indicators with 28.61%. The other subcriteria comprise just marginal eigenvectors. The consistency ratio indicates a good result of the pairwise comparisons with a quotation of 6.09%. Also in the area of space characteristics, there are identified high subcriteria preferences, especially for build quality with a key eigenvector ranking of 75.0% and an ideal consistency ratio of 0.0%. The environmental social subcriteria are weighted in a more balanced way with a slight preference for the economic conditions with an eigenvector of 21.09% and a good consistency that ends with 8.76%, which is in the range of smaller 10.0% for matrixes with seven variables.

The alternatives, compared with relative preference with respect to the demographic, space and environmental social subcriteria, primary demonstrate very high preferences for the future customisation of real estate assets with key eigenvectors of maximum 91.64% and consistent pairwise comparisons of a maximum of 0.36%.

These results also reflect the alternative rankings. In the level of the demographic development, the effect is a modernization share of 45.75%, followed by the new-construction alternative with 44.95% and a marginally extrapolated percentage of 9.30%. This trend also continues in the space criterion level with 45.33%, equal to the new-construction and modernized version and 9.34% for the extrapolated option. The result of the environmental social alternative ranking is more balanced with 38.27%, again equal to the new-construction and the modernized version and 23.46% for the extrapolated variant. Because the demographic criterion embraces the most important share in the criteria ranking with an eigenvector of 71.43%, this makes it significant in the overall alternative ranking with 44.62% for the modernized, 44.05% for the new-construction and 11.33% for the extrapolated version.

- *Cluster 2: Germany*

For this country Öner analyses the environmental social criterion as the most crucial variable with an eigenvector of 67.16%, followed by the demographic development with 26.54%. The consistency ratio is in a good range with 2.81%.

In the subcriteria level of the demographic characteristics, the applicant highlights a basic importance for the ageing indicators with an eigenvector of 45.09%. The reliance is on a good level with a ratio of 8.63%. The basic variable of the subcriteria in the space level is the age distribution of housing stock with 53.96% and an almost ideal consistency rate of 0.89%. Also in the environmental social area a strong preference is evaluated with 40.57% in the population density subcriterion and a good result of the reliance with 5.98%.

The alternatives, compared with the relative preference with respect to the subcriteria demographic, space and environment social developments, basically highlight strong eigenvectors of the modernized version. Nevertheless, in the environmental social level also the extrapolated version plays a significant role in the subcriteria tenure status, levels of rent and economic conditions. The consistency ratio outlines the high reliance of the pairwise comparisons with a maximum quote of 3.39%.

In the following hierarchy level that compares the relative importance of the subcriteria with respect to the demographic alternatives, the criterion ageing indicators realises in the criteria ranking with a key subcriteria share of 45.09% the most crucial effect on the alternative ranking. Nevertheless, the other subcriteria balance the result with an outcome of 62.53% for the modernized, 21.95% for the new-construction and 15.52% for the extrapolated version. In the space level the portfolio mixes of all subcriteria are identical; therefore, the different weightings of the criteria ranking do not determine the total space alternative ranking. The outcome is a future portfolio mix of 44.34% for the modernized, 38.74% for the new-construction and 16.92% for the extrapolated version. Although the population density is in the environmental social context the most important variable, the end result reflects also the different portfolios of the subcriteria tenure status, levels of rent and economic conditions, which include a total subcriteria eigenvector of 27.38%. Therefore, the alternative ranking comprises 36.44% for the modernized, 32.81% for the extrapolated and 30.74% for the new-construction version. The overall alternative ranking is influenced by the key criterion environmental social characteristics that embrace an eigenvector of 67.16%. However, the other variables flat the end result with an outcome of 43.87% for the modernized, 28.91% for the new-construction and 27.22% for the extrapolated version.

- *Cluster 3: Spain*

The demographic development is in the criteria level interpreted as the most important variable with an eigenvector of 66.67% and an ideal consistency ratio of 0.0%.

In the demographic subcriteria level, the housing indicators with an eigenvector of 39.29% play the most important role; the other variables are mostly more balanced. The consistency ration comprises 7.72% and indicates a good result of the pairwise comparisons of the interviewee. In the level of space criterion, the subcriteria age distribution of housing stock and average number of rooms per dwelling are the key components with eigenvectors of 42.86% per variable and an ideal consistency. The subcriteria of the environmental social level are very balanced and comprise a consistency ratio of 7.73%, which still indicates a good and reliable outcome.

The alternatives that compare the relative preference with respect to the demographic, space and environmental space subcriteria basically highlight a strong significance for the customisation of real estate assets, especially the modernized and new-construction versions with a maximum consistency ratio of 1.76% and hence a good result.

These outcomes are also reflected on the next hierarchy level with the demographic alternative ranking of 44.82% for the modernized, 41.01% for the new-construction and 14.17% for the extrapolated future portfolio mix. In the space level, the high eigenvector of the age distribution of housing stock with 42.86% eigenvector share modify the alternative ranking with 34.8% for the modernized and new-construction alternative and 30.41% for the extrapolated version. As a result of highly balanced subcriteria and alternative eigenvectors, also the end result of the environmental social characteristics is more balanced with an alternative ranking near the arithmetic mean of 37.45% for the modernized, 34.0% for the new-construction and 28.55% for the extrapolated version. The total ranking is basically influenced by the demographic characteristics as a consequence of the relevant eigenvector share of 66.67%. Therefore, the overall alternative ranking finishes with 41.92% for the modernized, 38.81% for the new-construction and 19.27% for the extrapolated alternative.

For Öner, the future residential trade and industry portfolios are the following:

Table 6.9 Real estate portfolio combinations Özgür Öner

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	11.33%	44.62%	44.05%
Estonia	11.33%	44.62%	44.05%
Germany	27.22%	43.87%	28.91%
Hungary	11.33%	44.62%	44.05%
Latvia	11.33%	44.62%	44.05%
Lithuania	11.33%	44.62%	44.05%
Poland	11.33%	44.62%	44.05%
Romania	11.33%	44.62%	44.05%
Slovakia	11.33%	44.62%	44.05%
Spain	19.27%	41.92%	38.81%

Source: Own analyses

Alice Pittini

The interviewee is the research coordinator of the branch alliance Cecodhas Housing Europe, Brussels, Belgium. Her functions are mainly research for the residential trade and industry, comparative studies, thematic briefings and the publishing of articles (Housing Europe, 2015). Pittini's publications include e.g. "Housing Europe 2007 – Review of Social, co-operative and public housing in the 27 EU member states" (Cecodhas, 2007) and "Housing Europe Review 2012 – The nuts and bolts of European social housing systems" (Cecodhas, 2011). The meeting was on 17th January 2015 between 2:00 and 4:00 p.m. in the offices of the company in Brussels. However, as a consequence of Pittini being short on time, she fulfilled parts of the pairwise comparisons by herself. Therefore, parts of the analysis for Hungary, Poland and Slovakia were sent by email on 3rd February 2015 (Appendix 48-54, 80).

Because she interprets similar developments for different countries, the country clusters are the following:

- Cluster 1: Bulgaria, Romania
- Cluster 2: Estonia, Latvia, Lithuania
- Cluster 3: Hungary
- Cluster 4: Poland
- Cluster 5: Slovakia
- Cluster 6: Spain

As a result of the minor knowledge of Germany, this evaluation is absent. Pittini believes her special core fields to be Estonia, Latvia, Lithuania, Slovakia and Spain.

- *Cluster 1: Bulgaria, Romania*

For the interviewee the demographic development plays a minor role with a high eigenvector percentage of 83.08% for the space and the environmental social characteristics. The consistency rate is with a value of 1.76% a good and consistent result.

The eigenvector ratios of the demographic subcriteria are very balanced with a consistency rate of 7.36%, which is in the limit for matrixes of five variables. In the area of space subcriteria, the key components are build quality and age distribution of housing stock with an eigenvector of 42.86% per variable and an ideal consistency. The eigenvectors of the environmental social subcriteria are, similar to the demographic development, again very balanced with a high consistency of just 3.53%, which is on a low level for matrixes with seven variables and indicates, therefore, a good reliability of the pairwise comparisons.

The alternatives, with a relative preference with respect to the subcriteria of demographic, space and environmental social characteristics, generally demonstrate a strong preference for the future customisation of real estate assets with high eigenvectors of the modernized and new-construction options. Again the consistency ratios are good with the highest rate of 2.8%.

The afore-mentioned significant preferences for customised asset portfolios are also highlighted in the alternative rankings of the criteria. The demographic criterion with its balanced eigenvectors ends with 47.79% for modernized, 36.25% for new-construction and 15.97% for extrapolated housings. In the space field build quality and age distribution of housing stock embrace major shares; nevertheless, as a result of same evaluations in all subcriteria, these different eigenvectors do not play a role in the alternative ranking. The result is a significant percentage for the modernized version with 47.21%, followed by the new-construction option of 44.43% and an extrapolated variant of 8.36%. The interviewee also evaluates the environmental social alternatives with a high similarity and an outcome of 44.77% for the modernized, 35.09% for the new-construction and 20.14% for the extrapolated alternatives. Because the effects of the different criteria portfolios are very comparable, also in the overall level the minor criteria share of the demographic characteristics is not relevant with a total result of 46.36% for the modernized, 39.42% for the new-construction and 14.21% for the extrapolated real estate portfolio.

- *Cluster 2: Estonia, Latvia, Lithuania*

The criteria that compare the relative importance with respect to the overall goal valuation of the properties highlight the space characteristics as the key criterion with an eigenvector of 60.0% and a consistency ratio of 0.0%.

Again the demographic subcriteria are analysed by the interviewee with close balanced eigenvector weights and a consistency ratio of 0.45%, which is a very good result for matrixes with five variables. In the space subcriterion level Pittini realises that the different variables are equal important with an ideal consistency ratio. The environmental social subcriteria are also very close together with eigenvectors between 16.64% for economic conditions and 9.25% for population density and a good consistency of 1.51%.

The alternatives, compared with the relative preference with respect to the demographic, space and environmental social subcriteria, primary indicate important eigenvector shares for the modernized versions. The reliability of the pairwise comparisons is good with a maximum value of a consistency ratio of 1.76%.

As the before-stated eigenvectors direct mainly to the modernized portfolios, also the alternative rankings of the subcriteria establish this alternative as the core variable. In the demographic level the alternative ranking comprises the modernized version with 60.85%, the new-construction type with 26.8% and the extrapolated kind with 12.36%. The same trend is apparent in the space level, but with a more balanced structure, especially 45.63% for the modernized, 41.54% for the new-construction and 12.83% for the extrapolated real estate portfolio mix. Also in the environmental social area the alternative ranking finishes with 45.94% for the modernized, 36.49% for the new-construction and 17.56% for the extrapolated version. Because the space characteristics embrace the key eigenvector share with 60.0%, this alternative ranking also influences the overall ranking with 48.73% for the modernized, 37.58% for the new-construction and 13.68% for the extrapolated real estate assets.

- *Cluster 3: Hungary*

For Hungary Pittini evaluated the demographic and the environmental social characteristics as the strongest criteria with eigenvector shares of 40.0% per variable with perfect consistency.

The demographic subcriterion embraces mainly stable eigenvector weights with a slight preference for housing indicators with 23.22% and a consistency ratio of 1.32%, which indicates a good outcome. The space criterion comprises a key eigenvector share of 50.0% for average number of rooms per dwelling and an ideal consistency ratio of 0.0%. The environmental social subcriteria are evaluated with nearly similar eigenvectors, but a slight preference for supply and demand with 16.64% and a very reliable consistency rate of 1.51%.

The alternatives that compare the relative preference with respect to the demographic, space and environmental social subcriteria again direct mainly to the modernized residential trade and industry portfolio with good consistency ratios of maximum 1.76%.

Hence, also the alternative rankings reflect these trends with 58.81% and 45.83% for the modernization, 26.49% respectively 33.39% for the new-construction and 14.7% or 20.78% for the extrapolated version in the demographic and environmental social field. This changes in the space criterion as average number of rooms per dwelling is the most important subcriterion with an eigenvector share of 50.0%; therefore, the effect of this outcome is the most significant for the alternative ranking with 45.07% for the new-construction, 37.07% for the modernized and 17.86% for the extrapolated option. Nevertheless, as a consequence of an 80.0% criteria ranking share for the demographic and environmental social criterion, these outcomes reflect the overall alternative ranking with 49.27% for modernization, 32.97% for the new-construction and 17.76% for the extrapolated portfolio assets with again a significant preference for a future customisation.

- *Cluster 4: Poland*

For Poland, Pittini evaluates the criteria equal important with respect to the overall goal of the ideal portfolio in 2050. The consistency ratio is 0.0%.

The eigenvectors of the demographic subcriteria are very balanced with a near-ideal consistency ratio of 0.6%. For the space subcriterion the build quality plays the most important role with an eigenvector of 53.96%. Also in this field the reliability of the pairwise comparisons is very high with a low consistency ratio of 0.89%. The environmental social subcriteria reflect eigenvector shares of 20.76% for tenure status and levels of rent to 6.73% for land area and supply and demand with a good result of the consistency ratio of 5.36%.

The alternatives, which compare the relative preference with respect to the subcriteria of demographic, space and environmental social characteristics, demonstrate key eigenvector percentages for the customised real estate assets, especially the modernized and new-construction versions with maximum consistency ratios of 2.8%, which demonstrates a good reliability for Pittini's pairwise comparisons.

The portfolio compositions of the demographic criterion illustrates very balanced alternative shares and subcriteria ranking eigenvectors that also influence the total ranking with 46.44% for the new-construction, 43.41% for the modernized and 10.15% for the extrapolated version. The similar alternative outcomes of the different subcriteria of the space characteristics reduce the importance of the subcriteria ranking, where build quality embraces the most significant share of 53.96%. Hence, the alternative ranking outlines the main percentage for the new-construction version with 46.24%, the modernized option with 44.01% and extrapolated variant with 9.75%. Because the weightings in the environmental social field are balanced, the alternative ranking reflects into the direction of the arithmetic means with 45.99% for the modernization, 38.35% for the new-construction and 15.67% for the extrapolation. For the overall result, all criteria are valued equally as the interviewee evaluates the criteria in a similar manner. The total ranking highlights a share of 44.47% for the modernized, 43.68% for the new-construction and 11.86% for the extrapolated version.

- *Cluster 5: Slovakia*

Also according to Pittini, demographic development and space characteristics play the most important role in this cluster with eigenvectors of 40.0% per variable and an ideal consistency ratio.

The demographic subcriteria are mainly balanced with a small preference for household indicators with an eigenvector of 25.36% and a good consistency ratio of 3.51%. For space characteristics the interviewee analysed the age distribution of housing stock with a high share of 50.0%. Also in this field the consistency rate is at a perfect level of 0.0%. In the environmental social level, land area is attributed the highest importance and an eigenvector share of 17.17%; the less significant subcriterion is the population density with 5.69%. The consistency ratio is at a maximum limit of 8.79%, as this ratio has to be smaller than 10.0% for matrixes with seven variables.

The alternatives that are compared to the various subcriteria in the demographic, space and environmental social fields illustrate key preferences for the customisation of the future real estate assets with a maximum consistency rate of 2.8%, which indicates good results.

The portfolio mixtures are very similar in the demographic criterion with also balanced subcriteria rankings; therefore, the total alternative ranking demonstrates the highest percentage for the new-construction alternative with 46.21%, followed by the modernized version with 43.52% and the extrapolated portfolio with a minor share of 10.27%. In the space level, the subcriteria ranking plays a minor role because the alternative-outcomes of the subcriteria are near together. Hence, the alternative ranking reflects the results of all subcriteria with 46.7% for the new-construction, 43.15% for the modernized and 10.15% for the extrapolated alternative. The weightings of the environmental social area are very balanced; therefore, the alternative ranking is the arithmetic mean with an effect of a slightly higher share of the modernized version with 43.79%, followed closely by the new-construction alternative with 43.55% and a small percentage of the extrapolated option with 12.67%. The overall alternative ranking is basically influenced by demographic and space characteristics as the total eigenvector percentage of these variables is 80.0% in total with the result of 45.87% for the new-construction, 43.43% for the modernized and 10.7% for the extrapolated version.

- *Cluster 6: Spain*

The criteria with relative importance to the overall target is evaluated by Pittini with a key share of 70.49% for the environmental social characteristics, followed by demographic characteristics with an eigenvector of 21.09% and a minor percentage for space characteristics with 8.41%. The consistency rate indicates a good result with 3.13%.

The demographic subcriteria embrace the main weightings for ageing indicators, household composition and housing indicators with 25.0% per variable and an eigenvector of 12.5% per variable household indicators and clusters of households. The consistency ratio is ideal with 0.0%. In the space segment, the subcriterion age distribution of housing stock is generally important with an eigenvector of 60.0% and perfect consistency ratio. The environmental social subcriteria illustrate very balanced eigenvector shares; the consistency ratio is at a maximum limit of 9.93%, which still demonstrates acceptable results.

The demographic alternatives with respect to the subcriteria show exclusively high preferences for the modernized alternative. In the space area also the extrapolated option embraces important shares with respect to the subcriteria build quality and average number of rooms per dwelling. This significance of the extrapolated alternative continues also in the environmental social segment with reference to population density, income level, tenure status and levels of rent. The consistency ratios end with good results at a maximum percentage of 2.81%.

The alternative results of the demographic subcriteria are basically close together and the subcriteria ranking is stable; therefore, the total alternative ranking is influenced by the arithmetic mean with 59.28% for the modernized, 21.35% for the new-construction and 19.37% for the extrapolated alternative. The alternatives of the space subcriterion age distribution of housing stock with an eigenvector of 60.0% demonstrate different alternative results to the other subcriteria. Although this subcriterion fulfils the most important influence of the end result, the other criteria balance these outcomes. The alternative ranking finishes with 53.0% for the modernized, 27.99% for the extrapolated and 19.01% for the new-construction version. The environmental social level mainly demonstrates balanced shares with the consequence of a high arithmetic mean where the modernized alternative comprises 43.5%, the extrapolated option 38.26% and the new-construction variant a minor share of 18.24%. As the environmental social characteristics embrace the major eigenvector share of 70.49% in the context of criteria ranking, this portfolio mix has the most stimulus for the overall result. Nevertheless, the other criteria balance this outcome with a ranking of 47.63% for modernization, 33.41% for extrapolation and 18.96% for new construction.

In total, Pittini evaluates the future residential trade and industry asset portfolios as follows:

Table 6.10 Real estate portfolio combinations Alice Pittini

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	14.21%	46.36%	39.42%
Estonia	13.68%	48.73%	37.58%
Germany	n.a.	n.a.	n.a.
Hungary	17.76%	49.27%	32.97%
Latvia	13.68%	48.73%	37.58%
Lithuania	13.68%	48.73%	37.58%
Poland	11.86%	44.47%	43.68%
Romania	14.21%	46.36%	39.42%
Slovakia	10.70%	43.43%	45.87%
Spain	33.41%	47.63%	18.96%

Source: Own analyses

Michael Pistorius

The interviewee is CEO of the national branch alliance vnw – Verband norddeutscher Wohnungsunternehmen e.V. in Hamburg, Germany with a quantity of 300 member companies in the residential trade and industry. He works as a consultant for the residential trade and industry with a special knowledge of the efficient advancement for housing space (vnw, 2015). The interview took place on 19th January 2015 from 2:00 to 4:00 p.m. in the alliance office in Hamburg (Appendix 55-57, 81).

For Pistorius, there is basically the main future development for most of the countries; therefore, the clustering is the following:

- Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Spain
- Cluster 2: Germany

He considers his special core field to be Germany.

- *Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Spain*

For the interviewee the demographic and the environmental social criteria play an important role for these countries with eigenvectors of 45.45% per variable and an ideal consistency ratio.

In the following subcriteria level with respect to the criterion demographic characteristics, the subcriteria household indicators with an eigenvector percentage of 31.40% and clusters of households with 30.64% are the key variables. The consistency rate is at an acceptable maximum level of 9.76% and still indicates good results. In the space area the subcriteria age distribution of housing stock and average number of rooms per dwelling comprise the main eigenvectors with in total 90.91% and an ideal consistency rate. The subcriterion environmental social characteristics indicate generally stable eigenvector quotations with a good consistency result of 6.61%.

The alternatives compared with a relative preference with respect to the demographic subcriteria, basically embrace high preferences for the customisation of future real estate portfolios. Nonetheless, the subcriteria household indicators and housing indicators highlight a contrasting result where the extrapolated portfolio embraces the highest eigenvector shares. In the space level the modernized and new-construction versions are the significant factors in all subcriteria. In the environmental social field, the extrapolated alternative generally comprises significant eigenvector shares between 33.3% and 71.43%. The consistency ratio is in most cases near the ideal value with a maximum of 3.58%, which indicates a high reliability of the pairwise comparisons.

The interviewee interprets the demographic variables, compared with the relative importance of the subcriteria with respect to the alternatives in a more balanced manner. Hence, the alternative ranking is close to the arithmetic mean and ends with 46.8% for the extrapolated, 41.28% for the new-construction, and 11.92% for the modernized alternative. Although build quality comprises a minor eigenvector percentage within the space subcriteria ranking, the results are equal to the key variable age distribution of housing stock and, therefore, significant for the end result with 57.26% for the new-construction, 31.29% for the modernized and 11.45% for the extrapolated alternative ranking. In the level of environmental social components, the rankings are highly balanced; therefore, the total alternative ranking is principally an arithmetic mean with 41.32% for the extrapolated, 32.0% for the new-construction and 26.68% for the modernized version. In the last stage of the total ranking, it is apparent that space characteristics end with a different result of portfolio mix in contrast to the demographic and environmental social characteristics. Nevertheless, as the space criterion plays a minor role in the criteria ranking, it does not influence the overall alternative ranking. The outcome is a balanced percentage of 41.09% for the extrapolated, 38.52% for the new-construction and 20.39% for the modernized version.

- *Cluster 2: Germany*

For this country Pistorius evaluates the criteria demographic, space and environmental social characteristics equal important with an ideal consistency ratio of 0.0%.

In the field of demographic subcriteria, the interviewee interprets the variables ageing indicators and household indicators as more significant than the other subcriteria with eigenvectors of 31.07 per variable. The consistency ratio is on a good level with 8.7%. In the space criterion, the variables age distribution of housing stock and average number of rooms per dwelling with a total eigenvector percentage of 90.91% highlight this area with perfect consistency ratio of 0.0%. The environmental social section embraces mainly balanced eigenvector shares and also results in a reliable pairwise comparison with a quote of 7.41%.

The alternatives, compared with a relative preference with respect to the subcriteria of demographic development, demonstrate high eigenvector results in the extrapolated and modernized version and a marginal effect on the new-construction type. This purpose shifts in the space segment, where the customized portfolios, especially the modernized and new-construction versions, indicate high significances. Also in the environmental social context another result is outlined with mainly balanced and equal shares of the alternatives. The consistency ratios are very reliable with a maximum matrix value of 3.58%.

The demographic subcriteria, compared with the relative importance with respect to the demographic alternatives, realise a generally balanced level of subcriteria and alternatives with the consequence of a mainly arithmetic mean. Therefore, the alternative ranking results in 53.61% modernized, 38.08% extrapolated and 8.31% new-construction versions. Because build quality and age distribution of housing stock in the section of space criterion embrace equal portfolio mixes, the minor subcriterion ranking of build quality of 9.09% plays only a slight role with an alternative ranking of 59.03% for the new-construction option, 30.24% for the modernized version and 10.74% for the extrapolated variant. In the environmental social area, similar to the demographic characteristics, the weightings are again very balanced with an arithmetic mean of the overall alternative ranking with 44.62% for the new-construction, 32.19% for the modernized and 23.19% for the extrapolated alternative. As a consequence of an equal criteria ranking, all criteria influence the overall alternative ranking with a percentage of 38.68% for the modernized, followed by 37.32% for the new-construction and 24.0% for the extrapolated version, which again indicates a high preference for the customisation of the real estate portfolios in the future.

In total, Pistorius analyses the following portfolio mixes for the future:

Table 6.11 Real estate portfolio combinations Michael Pistorius

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	41.09%	20.39%	38.52%
Estonia	41.09%	20.39%	38.52%
Germany	24.00%	38.68%	37.32%
Hungary	41.09%	20.39%	38.52%
Latvia	41.09%	20.39%	38.52%
Lithuania	41.09%	20.39%	38.52%
Poland	41.09%	20.39%	38.52%
Romania	41.09%	20.39%	38.52%
Slovakia	41.09%	20.39%	38.52%
Spain	41.09%	20.39%	38.52%

Source: Own analyses

Klaus Schrader

This interviewee is a scientific economic officer of the GdW – Bundesverband deutscher Wohnungsunternehmen in Berlin, Germany. His remit is in the fields of statistic and research, demographic development, economic conditions, social environment, databases and trends. Additionally, he is a member of various international confederations in Brussels, Belgium (GdW, 2015d). He realises diverse publications of residential trade and industry data and trends, e.g., "Wohnungswirtschaftliche Daten und Trends 2014/ 2015" (GdW, 2015a). The interview was on the 23rd February 2015 from 1:00 until 3:00 p.m. in the company's office in Berlin (Appendix 58-64, 82).

Schrader interprets the future tendencies of the real estate branch of the analysed countries in parts equal; therefore, the clustering is the following:

- Cluster 1: Bulgaria, Romania
- Cluster 2: Estonia, Latvia, Lithuania
- Cluster 3: Germany
- Cluster 4: Hungary, Slovakia
- Cluster 5: Poland
- Cluster 6: Spain

He considers his special core fields to be Estonia, Latvia, Lithuania, Germany, Poland and Spain.

- *Cluster 1: Bulgaria, Romania*

In Schrader's opinion, demographic development is the most important criterion with an eigenvector of 65.86%, followed by the environmental social area with 26.28%. The consistency rate indicates a good result with a quote of 3.13%.

The demographic subcriteria demonstrate an equal pairwise comparison in the fields of clusters of households and household composition with eigenvectors of 34.35% per variable. Also in this hierarchy level the consistency is good with a percentage of 6.67%. The space subcriteria illustrate high preferences for build quality with 73.96% and a minor share of age distribution of housing stock with 9.38%. The consistency ratio is low and, therefore, reliable with 1.37%. The environmental social subcriteria result in basically stable eigenvectors with a slight preference of the interviewee for income level with 26.77% and a consistency rate of 9.37%, which is at the maximum level of consistency but within an acceptable limit.

The alternatives, with respect to the demographic, space and environmental social subcriteria, indicate high eigenvectors of the new-construction versions. The pairwise comparisons are consistent with a maximum of 3.37%.

Because most of the demographic subcriteria embrace a balanced eigenvector share, the alternative ranking is near the arithmetic mean with a high preference for the new-construction version with 61.78%, followed by the modernized option with

26.57% and the extrapolated assets with 11.66%. The space subcriteria, compared with a relative importance with respect to the alternatives highlight a key eigenvector share of 73.96% in the area of build quality; therefore, this subcriterion influences the alternative ranking in a significant manner. Nevertheless, the subcriterion average number of rooms per dwelling with 16.66% balances the total result. Consequently, the ranking embraces a main share of 50.2% for the new-construction, 39.89% for the modernized and 9.91% for the extrapolated portfolio mix. In the environmental social segment, again the subcriteria are highly balanced with a ranking result near the arithmetic mean with 52.2% for the new-construction, 39.5% for the modernized and 8.30% for the extrapolated option. Because demographic development plays a significant role in the criteria ranking with an eigenvector share of 65.86%, this generally influences the overall result; nevertheless, the space and environmental social subcriteria with a total eigenvector of 34.14% balance this result with the consequence of 58.35% for the new-construction, 31.01% for the modernized and 10.64% for the extrapolated real estate assets.

- *Cluster 2: Estonia, Latvia, Lithuania*

In this cluster for the interviewee the environmental social criterion with 58.91% and the demographic characteristics with 35.68% are the most important eigenvectors with a good consistency ratio of 3.56%.

The demographic subcriteria demonstrate full stability with eigenvectors of 14.29% with the exception of ageing indicators that comprise 42.86%. The consistency ratio is at an ideal level of 0.0%. In the space level, build quality is the most significant variable with 79.28%. The consistency ratio comprises a good result with 2.1%. The environmental social subcriteria a basically very balanced, but demonstrates a very low percentage of the population density and the land area with 2.98% per variable and a low and therefore, reliable consistency rate of 3.8%.

The alternatives that compare the relative preference with respect to the demographic, space and environmental social subcriteria are interpreted with mainly high preferences for the future customisation of real estate assets with a good consistent percentage of a maximum of 3.72%.

The alternatives, which compare the relative importance of the subcriteria with respect to the demographic options, are strongly influenced by the subcriterion ageing indicators with an eigenvector of 42.86%. Nevertheless, as a consequence of a diverse portfolio mix in the subcriterion household indicators with a relative minor share of 14.29%, the total alternative ranking in this level is more balanced with 50.81% for the new-construction, 39.53% for the modernized and 9.66% for the extrapolated alternatives. Because build quality has the major subcriteria eigenvector of 79.28% in the space level, the overall ranking is nearly identical to this outcome. Nevertheless, also the other subcriteria are close to these outcomes; therefore, the criteria ranking illustrates a minor significance with a ranking of 48.86% for the new-construction, 44.88% for the modernized and 6.26% for the extrapolated residential trade and industry portfolio. Because the environmental social subcriteria are generally weighted as stable, the alternative ranking is near the arithmetic mean with a major percentage of 51.89% for the new-construction, 40.43% for the modernized and 7.68% for the extrapolated alternative. Although the criteria ranking comprises different eigenvector shares, it plays a minor role in the overall alternative result, because the portfolios of all criteria are close together. Therefore, the alternative ranking finishes with 51.34% for the new-construction, 40.35% for the modernized and 8.31% for the extrapolated alternative.

- *Cluster 3: Germany*

For Germany Schrader identifies the demographic and environmental social characteristics as the most important variables with eigenvectors of 46.67% per variable and an ideal consistency ratio.

The demographic subcriteria level embraces eigenvectors between 9.09% for the household indicators and household composition and 27.27% for ageing indicators, clusters of households and housing indicators and comprises a perfect stability of the pairwise comparisons. The interviewee considers the age distribution of housing stock and average number of rooms per dwelling as the most important subcriteria with eigenvectors of 46.67% per variable. The liability of the weightings of the comparisons is again of an ideal percentage. The eigenvectors of the environmental social context are generally very stable with a small shift to the variables income level and economic conditions with 17.19% per variable and a minor share of the population density with 3.68%. The consistency rate lies with 7.05% in the limit of smaller 10.0%, which indicates a good result.

The alternatives that compare the relative preference with respect to the demographic subcriteria demonstrate different results of portfolio mixes. The variables clusters of households and household composition embrace a high preference for the extrapolated real estate assets, while, e.g., ageing indicators or housing indicators highlight strong preferences for the customisations. The space alternatives are homogeneous with significances in the modernized and new-construction versions. The environmental social level is again heterogeneous with different portfolio mixes and preferences for all alternatives. Hence, e.g., the economic conditions embrace a high eigenvector of 65.86% for the extrapolated option, while e.g., land area illustrates an important preference for the modernized version. The consistency ratios are very stable with a maximum of 2.82%.

Because the demographic subcriteria rankings are mainly stable, the alternative ranking in the following hierarchy level ends with a shift to the arithmetic mean of the different subcriteria portfolios. The modernized version embraces the main share with 37.89%, the extrapolated the second important percentage with 31.95% and the new-construction option a similarly high share with 30.17%. This balance changes in the space level. As a consequence of the key eigenvector shares of the subcriteria, the variables age distribution of housing stock and average number of rooms per dwelling with 93.33% influence the end result in a significant manner with 52.48% for the modernized, 39.44% for the new-construction and with a small ratio of 8.08% for the extrapolated option. The environmental social area is different to the other two fields. Because the subcriteria ranking is more stable, the alternative ranking is an arithmetic mean with a basic importance for the extrapolated version with 40.06%, the modernized option with 33.72% and the new-construction alternative with 26.21%. For the overall outcome, the demographic and the environmental social characteristics with the key eigenvector of 46.67% per variable reflect the total alternative ranking with 36.92% for the modernized, 34.14% for the extrapolated and 28.94% for the new-construction alternative, which illustrates a high balance of the different real estate assets.

- Cluster 4: Hungary, Slovakia

Schrader considers the environmental social criteria as the most significant criterion giving it an eigenvector of 75.14% and a consistency rate of 2.82%, which is at a good level for matrixes with three variables.

The demographic subcriteria are basically weighted; nevertheless, there is one key subcriterion, ageing indicators, with a high eigenvector of 52.33%. The consistency is at a good level with a quotation of 7.06%. In the space segment there is also a significant subcriterion, build quality, with a share of 80.0% and an ideal consistency ratio. The environmental social subcriteria with a relative importance for the criterion mainly demonstrate balanced eigenvectors with an absence of high ranges. The liability of the pairwise comparisons is again on a good level with a ratio of 7.23%.

The alternatives with a relative preference with respect to the demographic, space and environmental social features generally demonstrate high significances for the customisation of real estate assets, especially for the modernized and new-construction assets with a maximum of a consistency ratio of 2.8%, which indicates good and stable pairwise comparisons.

The variables that compared the relative importance of the subcriteria with respect to the demographic alternatives, demonstrate different portfolio mixes in the various subcriteria. Although ageing indicators embrace the most important eigenvector of the subcriteria ranking, also the other subcriteria with different portfolio projections reflect the total alternative ranking with a share of 58.4% for the new-construction, 31.33% for the modernized and 10.28% for the extrapolated real estate assets. Because build quality in the space area is ranked with a key share of 80.0%, this portfolio replicates the total result with 65.85% for the new-construction, 25.02% for the modernized and 9.13% for the extrapolated alternative. Since the environmental social subcriteria ranking is more balanced, the outcome basically directs to the arithmetic mean with 53.02% for the new-construction, 38.2% for the modernized and a low share of 8.78% for the extrapolated option. The overall alternative ranking is strongly influenced by the environmental social criteria share of 75.14%. Consequently, the new-construction variant is the most important variable with 54.88%, followed by the modernized alternative with 36.05% and a low percentage of 9.07% for the extrapolated portfolio.

- Cluster 5: Poland

For Schrader demographic developments and the environmental social characteristics are the most important criteria with eigenvectors of 45.45% per variable. The consistency ratio embraces an ideal percentage of 0.0%.

The demographic subcriteria in the next hierarchy level demonstrates mainly stable eigenvector shares of each subcriterion with a slight preference for housing indicators with 28.0% and a low level of household indicators with 7.51%. The consistency rate is on a good level with 2.33%. In the space area the most important subcriterion is build quality with a key eigenvector of 73.96% and a consistency percentage of 1.37%, which indicates a good result of the pairwise comparisons of the variables. The environmental social subcriteria are again, similar to the demographic level, mainly balanced with eigenvector ratios on a stable level from a high percentage of 23.99% in the variable income level to the lowest level of the population density with 7.38%. The consistency ratio is within an acceptable limit for matrixes with seven variables and finishes with 8.13%.

The demographic alternatives, compared to the different subcriteria, indicate high preferences in the new-construction version and basically embrace balanced shares of the extrapolated and modernized options. The space alternatives generally focus on the customisation of real estate portfolios, especially the modernized and new-construction versions. In addition, also the environmental social field demonstrates the trend of the space level with strong preferences for the modernized and new-construction versions. The consistency ratios are very stable with a maximum percentage of 2.37% and, therefore, there is a high reliability of Schrader's weightings.

The relative importance, compared to the demographic alternatives, reflects relatively stable weightings of the subcriteria. Consequently, the total alternative ranking shifts into the direction of the arithmetic mean with the new-construction alternative of 57.31%, followed by the modernized version with 27.34% and a less but also balanced share of 15.34% for the extrapolated option. In the space area the subcriteria ranking is highly focused on build quality with an eigenvector share of 73.96%. The result of this subcriterion portfolio mix is mainly mirrored on the total result. Nevertheless, the additional subcriteria balance the alternative ranking. Thus, the new-construction version is the key variable with a percentage of 53.33%. The modernized option comprises 38.06% and the new-construction version has a low percentage of 8.61%. Because the variables of the environmental social context are balanced, also the alternative ranking is the arithmetic mean with again high preferences for the customisation with 49.03% for the new-construction, 40.82% for the modernized and 10.15% for the extrapolated variant. The overall result is strongly reflected by the high-ranked criteria demographic and environmental social characteristics with a percentage of 90.91% that ends with percentages of 53.19% for the new-construction, 34.44% for the modernized and 12.37% for the extrapolated version. Also this country has strong tendencies towards a customisation of future real estate portfolios.

- Cluster 6: Spain

For this country Schrader interprets demographic development as the most important criterion with an eigenvector of 60.0% and a consistency ratio of 0.0%.

The subcriteria of demographic development realises mainly stable eigenvector shares with a slightly higher level of the subcriterion household composition with an eigenvector of 30.88%. The consistency ratio is with a percentage of 3.91% on a good and reliable level. For the space subcriteria a high ranking is realised for age distribution of housing stock with 59.54% and a consistency rate near the ideal value of 0.53%. The eigenvectors of the environmental social area demonstrates basically a strong stability of the eigenvectors with a marginal preference for the economic conditions with a share of 21.27%. The consistency is within an acceptable limit with a percentage of 8.79%.

In the hierarchy level where the alternatives are compared to the subcriteria of the demographic, space and environmental social criteria, Schrader displays a main preference for new buildings. The consistency ratios are on a good level with a maximum of 3.13%.

In the following hierarchy level that compares the relative importance of the subcriteria with respect to the demographic alternatives the alternative ranking is near the arithmetic mean as a result of generally stable eigenvectors shares of the subcriteria. Therefore, the outcome is a key share for the new-construction version of 56.77%, followed by the extrapolated option with 30.05% and a lower percentage of 13.18% for the modernized alternative. In the level of space characteristics, the subcriterion age distribution of housing stock embraces the most significant eigenvector share of 59.54% and mainly reflects the total alternative ranking. Nevertheless, the second important subcriterion average number of rooms per dwelling with an eigenvector of 27.64% balances the total result to the effect of 52.28% for the new-construction, 24.17% for the modernized and 23.56% for the extrapolated option. As the eigenvectors of the subcriteria of the environmental social segment are mainly balanced, the result in this area is near the arithmetic mean with 57.49% for new construction, 28.07% for modernization and 14.44% for extrapolation. Although demographic development is the key criterion with a weighting of 60.0%, the other criteria stabilise the overall result with a share of 56.02% for the new-construction, 25.63% for the extrapolated and 18.36% for the modernized version.

In total, for Schrader the ideal residential trade and industry portfolio mixes are illustrated as follows:

Table 6.12 Real estate portfolio combinations Klaus Schrader

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	10.64%	31.01%	58.35%
Estonia	8.31%	40.35%	51.34%
Germany	34.14%	36.92%	28.94%
Hungary	9.07%	36.05%	54.88%
Latvia	8.31%	40.35%	51.34%
Lithuania	8.31%	40.35%	51.34%
Poland	12.37%	34.44%	53.19%
Romania	10.64%	31.01%	58.35%
Slovakia	9.07%	36.05%	54.88%
Spain	25.63%	18.36%	56.02%

Source: Own analyses

d. Interviewee group of special professionals

Petra Gaugisch

The interviewee is a scientific officer of the Fraunhofer Institut in Stuttgart, Germany. Her specialised research is in the fields of demographic projects of cut surface of individuals, technic and organisation and older people and their demands (Fraunhofer Institut, 2015). An example of her publications in the field of future care for 2020 is “Pflege 2020” (Fraunhofer Institut, 2012). The interview took place in Stuttgart, Germany, in the institute offices on 9th January 2015 from 10:00 to 12:00 p.m. Nevertheless, as a result of a time lack of the interviewee, the pairwise comparisons for Spain were realised by her and finished on 5th March 2015 (Appendix 65-67, 83).

She considers her specialised country fields to be Germany and Spain.

- Cluster 1: Germany
- Cluster 2: Spain

- *Cluster 1: Germany*

For Gaugisch the most important criteria are demographic development and environmental social characteristics with eigenvectors of 42.86% per variable and a consistency ratio of 0.0%.

The demographic subcriteria illustrate mainly stable eigenvectors with a slightly higher share of household composition with an eigenvector of 26.21% and a consistency ratio within the maximum limit of 9.53%, which indicates acceptable pairwise comparisons. For the interviewee, build quality in the space segment is the most significant variable with 70.96% and a stable consistency ratio of 1.77%. On the environmental social level, the eigenvectors are primary stable with a preference for the income level with 21.66%. The consistency rate is near the maximum limit with 9.42%, which still demonstrates acceptable results.

The alternatives, compared to the demographic, space and environmental social criteria, highlight a strong preference for the modernized version with eigenvectors up to 71.43%. The consistency percentages are highly reliable with a maximum of 2.8%.

The subcriteria, compared with relative importance with respect to the demographic characteristics, basically demonstrate balanced subcriteria with the consequence of an arithmetic mean for the alternative ranking with 58.9% for the modernized, 29.17% for the new-construction and 11.93% for the extrapolated version. Because build quality realises the highest eigenvector within the subcriteria ranking of 70.96%, this subcriterion reflects the total outcome of space characteristics with 58.65% for the modernized, 29.32% for the new-construction and 12.03% for the extrapolated version and illustrates the same trend fulfilled on the demographic level. The alternative ranking of the environmental social area demonstrates a high preference for the arithmetic mean as the subcriteria ranking reflects a balanced eigenvector share. Therefore, the outcome embraces 47.95% for modernization, 31.63% for new construction and 20.42% for extrapolation and is more balanced than the outcomes of the other criteria. In the following stages, the portfolio mixes of the different criteria alternatives are mainly close together. Consequently the minor share of space characteristics is not greatly relevant for the overall ranking. The result is an arithmetic mean with an overall future portfolio of 54.17% for the modernized, 30.24% for the new-construction and 15.58% for the extrapolated real estate portfolio.

- *Cluster 2: Spain*

Gaugisch interprets the demographic and the environmental social characteristics as the most significant variables with shares of 40.0% per variable and an ideal consistency ratio.

The demographic subcriteria are mainly weighted as stable with a major percentage of 31.27% for housing indicators. The consistency ratio is located at a level of 6.64% and is, therefore, on a good level for matrixes with five variables. In the space subcriteria build quality is the key variable with an eigenvector of 57.14% and a consistency ratio of 0.0%, which is the perfect result of the pairwise comparisons. Also the environmental social subcriteria eigenvectors are stable with a slight preference for the economic conditions with a ratio of 27.84%. The consistency is on an acceptable level with 7.24%.

The alternatives that compare the relative preference with respect to the demographic, space and environmental social subcriteria indicate mainly strong preferences for the future customisation of the real estate portfolios, especially the modernized and the new-construction version. The weightings are very consistent with a maximum percentage of 2.38%.

Because the demographic subcriteria rankings are basically balanced, the alternative ranking is the arithmetic mean of the portfolios with a total result of 63.85% for the modernized, 24.77% for the new-construction and 11.38% for the extrapolated alternative. Since the alternatives of the space subcriteria are close together, the subcriteria ranking plays a minor role with a total alternative ranking of 62.35% for the modernized, 27.85% for the new-construction and 9.8% for the extrapolated alternative. The environmental social subcriteria rankings are mainly stable; therefore, the alternative ranking is close to the arithmetic mean with a total result of 58.0% for modernization, 25.23% for new construction and 16.78% for extrapolation. Also in the total ranking level, the portfolio mixes of the different criteria are generally close together, therefore, the criteria ranking is less important. The overall alternative ranking ends with a high preference for the future customisation with 61.21% for the modernized, 25.57% for the new-construction and 13.22% for the extrapolated real estate assets.

In total, the countries are evaluated as follows:

Table 6.13 Real estate portfolio combinations Petra Gaugisch

Country	Extrapolated version	Modernized version	New construction version
Germany	15.58%	54.17%	30.24%
Spain	13.22%	61.21%	25.57%

Source: Own analyses

Klaus Kirchhoff

This interviewee is CEO of his own company Kirchhoff Consult AG, which is also responsible for the international project and development management in the residential trade and industry. Additionally, Kirchhoff is also honorary consul of Romania. He is member of the DVFA – Deutsche Vereinigung für Finanzanalyse und Asset Management and therefore, also representative of the European Federation of Financial Analysts Societies. In addition, he is a partner in NIRI – National Investor Relations Institute. Kirchhoff is reviser of the German-Romanian forum (Handelshochschule Leipzig, 2015). The interviewee publishes various articles and books with issues such as investor relations and financial communication between organisations and capital markets: “Die Praxis der Investor Relations. Effiziente Kommunikation zwischen Unternehmen und Kapitalmarkt” (Kirchhoff and Piwinger, 2001). The interview took place in Kirchhoff's office in Hamburg, Germany on 23rd January 2015, from 9:30 to 10:30. Because Kirchhoff is a specialist on Romania, the interview is focussed on that country (Appendix 68-69, 84):

- Romania

  - *Romania*

Kirchhoff interprets the environmental social criteria as the most important variable with a share of 74.18%, followed by demographic development with an eigenvector of 18.3%. The consistency ratio is 4.28% and, therefore, within a good limit for matrixes with three variables.

The demographic subcriteria are mainly ranked similarly with the less important subcriterion of the variable household indicators with 7.42%. The consistency is very good with a low percentage of 0.22%. The space subcriteria embrace a high preference for the build quality with 57.14% and an ideal consistency. In the field of environmental social subcriteria, the economic conditions comprise the main eigenvector with 31.53% and a consistency in the maximum limit of 8.76%, which still indicates a good result.

The alternatives, which compare the relative preference with respect to the demographic, space and environmental social subcriteria, indicate generally high preferences for the extrapolated and the new-construction future real estate portfolios with a maximum consistency ratio of 4.27% that illustrates a high reliability of the pairwise comparisons of the interviewee.

The relative importance of the subcriteria, compared to the demographic alternatives, demonstrates weighted eigenvectors of the subcriteria with the consequence of an arithmetic mean of the subcriteria portfolios with a total alternative ranking of 55.55% for new construction, 22.37% for extrapolation and 22.08% for modernization. In the space section, build quality embraces the main eigenvector with 57.14%. Nevertheless, as the subcriteria portfolios are close together, this classification has a less relevance with an overall ranking of 57.96% for the new-construction, 27.76% for the extrapolated and 14.28% for the modernized alternative. In the environmental social context the eigenvector shares are basically stable. Hence, the outcome mainly reflects the arithmetic mean of the different subcriteria portfolios with a result of 56.83% for the new-construction, 26.24% for the modernized and 16.93% for the extrapolated option. In the total ranking for the future portfolios, the key eigenvector of the environmental social characteristics with 74.18% reflects the overall alternative ranking with 56.68% for new construction, 24.58% for modernization and 18.74% for extrapolation and mirrors a high preference for the future customisation of real estate assets.

In total, in Kirchhoff's view the best future portfolio is analysed as follows:

Table 6.14 Real estate portfolio combinations Klaus Kirchhoff

Country	Extrapolated version	Modernized version	New construction version
Romania	18.74%	24.58%	56.68%

Source: Own analyses

Polina Stoykova

This interviewee is the managing director and head of research of the company Bulgarian Properties in Sofia, Bulgaria (Bulgarian Properties, 2015). She is a professional member of RICS – Royal Institution of Chartered Surveyors and has had various articles published such as "Housing Price Determinants and the Price Cycle in Bulgaria – a Paper by the Chief Operations Manager of BULGARIAN PROPERTIES" (Bulgarian Properties, 2011), "Housing prices and cultural values: A cross-nation empirical analysis" (Stoykova and Chou, 2013). The interview was conducted via Skype on 5th February 2015 from 1:30 until 2:30 p.m. and was fulfilled for the following country (Appendix 70-71, 85):

- Bulgaria

- *Bulgaria:*

For the interviewee the most significant criterion in the criteria level with importance to the overall target is the environmental social variable with an eigenvector of 60.0%. The other criteria demographic and space characteristics embrace 20.0% per variable. The consistency ratio is 0.0% and, therefore, an ideal value.

The demographic subcriteria that compare the relative importance with respect to the criterion validates basically stable eigenvectors with the highest percentage for housing indicators with 28.64% and a very low consistency ratio of 0.22%, which is a good result of the pairwise comparisons for matrixes with five variables. In the field of space subcriteria build quality is the key component with an eigenvector of 63.37% and a reliable consistency of 0.89%, which is a good outcome. The environmental social subcriteria again comprise mainly balanced eigenvectors with the highest percentage for the supply/ demand with 19.7% and a lowest value for the population density with 6.85%. The consistency ratio ends with 9.78% and hence with an acceptable ratio as the maximum limit for matrixes with seven variables is less than 10.0%.

The alternatives that compare the relative preference with respect to the demographic, space and environmental social subcriteria outline a strong significance for the future customisation of real estate assets, especially the modernized and the new-construction version with maximum eigenvectors of 90.91% in total. Also in these areas the consistency ratio is low with a maximum quotation of 1.76% and, therefore, good results.

The comparison of the relative importance of the subcriteria with respect to the demographic alternatives validate stable subcriteria rankings and subcriteria portfolios with a total alternative ranking of 43.51% for the new-construction, 43.5% for the modernized and 12.99% for the extrapolated alternative. This purpose comprises the arithmetic mean of the diverse eigenvectors. Because build quality is on the space level the most important subcriteria with an eigenvector of 63.37%, the outcome of this portfolio generally reflects the total alternative ranking with 43.6% for new construction, 42.52% for modernization and 13.89% for extrapolation. The environmental social level is again, similar to demographic development, mainly balanced with the outcome of an arithmetic mean that ends with a key share for the new-construction version with 44.71%, followed with 40.7% for the modernized option and 14.59% for the extrapolated alternative. The criteria, compared to the total alternative ranking, indicate a high eigenvector preference for the environmental social criterion with a percentage of 60.0% that significantly influences the overall result. Nevertheless, also the additional criteria portfolios are near to this result. Hence, Stoykova evaluates the overall alternative ranking with high preferences for future customisations with a main percentage for new construction with 44.25%, 41.63% for modernization and 14.13% for extrapolation:

Table 6.15 Real estate portfolio combinations Polina Stoykova

Country	Extrapolated version	Modernized version	New construction version
Romania	14.13%	41.63%	44.25%

Source: Own analyses

Overall results

As a consequence of the involvement of different interview partners as mentioned above, there is for researchers such as Aczel and Saaty (1983) or Gibney and Shang (2007) the necessity of an aggregation of the preferences of each interviewee into a consensus conclusion. Therefore, the geometric mean of the decisions of the individuals as a kind of mean that specifies the principal tendency of a cluster of numbers by realising the product of the pairwise comparison value into group decision-making is required as analysed by Aczel and Saaty (1983) with the following equation:

$$\int (x_1, x_2, \dots, x_n) = \prod_{k=1}^{n} x_k^{1/n} \tag{6.1}$$

The results in total demonstrate a high consistency of the pairwise comparisons and therefore, an indication of stable and robust group-decision results as analysed in the following (Appendix 86-93).

- *Bulgaria:*

For the interviewees as decision-maker group in the criteria level of the AHP hierarchy the most important variable is the environmental social one with an eigenvector of 43.27%, followed by the demographic characteristics with 32.11% and space characteristics with 24.62% and a low consistency ratio of 0.02%, which indicates a good result.

In the subcriteria level of demographic development the eigenvectors of the variables are very close together and lie between 16.08% for household composition and 23.63% for the clusters of households with a consistency ratio of 0.19%. The space subcriteria indicate a high preference for build quality with an eigenvector of 52.89% and a low consistency ratio of 0.05%. In the environmental social subcriteria area different eigenvectors are apparent that range from 8.1% for the population density to 23.62% for the income level. Also in this area the consistency is very stable with a ratio of 2.1%.

The alternatives, compared to the demographic, space and environmental social subcriteria illustrate a significant preference for the modernized and new-construction versions with low consistency ratios of a maximum of 0.32% that indicate robust outcomes.

The relative importance of the demographic and space subcriteria with respect to the alternatives demonstrates a high homogeneity of the variables with an alternative ranking of 45.15% and 48.12% of the new-construction version, 35.70% and 39.79% for the modernized option and 19.15% and 12.09% for the extrapolated real estate portfolio. In the field of environmental social characteristics there is a high minority of the extrapolated version for the variables land area and levels of rent. Nevertheless, also in this hierarchy level the most important portfolio is the new-construction version with 44.58%, followed by the modernized option with 37.58% and the extrapolated version with 17.84%.

The relative importance of the criteria with respect to the alternatives validates results of the criteria that are close together with a strong outcome of the total ranking of 45.63% for the new-construction, 37.52% for the modernized and 16.84% for the extrapolated alternative.

- *Estonia, Latvia, Lithuania*

Also in these countries in the criteria level the criterion environmental social characteristics dominate with 41.88% followed by the demographic variable with 34.6%. The consistency ratio is very stable at 0.17%.

The eigenvectors of the demographic subcriteria are close together and comprise a consistency rate of 0.61%. In the area of space subcriteria again, equal to Bulgaria, the eigenvector of build quality is the highest with 50.11%. The less important criterion from the point of view of the decision-makers is average number of rooms per dwelling with 23.89%. The consistency rate is again stable with 0.02%, which indicates a result near the perfect consistency of the pairwise comparisons. The environmental social subcriteria highlight a high preference for the income level and economic conditions and demonstrate a minority eigenvector of the variables population density, land area and supply/ demand. The consistency is stable with 1.47%.

The alternatives, compared to the demographic, space and environmental social subcriteria outline invariably strong tendencies for a customisation of real estate portfolios, especially with the modernized and new-construction versions and stable consistencies of the pairwise comparisons with a highest value of 0.37%.

The demographic, space and environmental social subcriteria, compared to the alternatives, evaluate results of the subcriteria that are close together. The alternative ranking of demographic development ends with 43.64% for the new-construction, 36.31% for the modernized and 20.05% for the extrapolated version that demonstrates a relatively balanced outcome. In contrast the level of space characteristics validate a broad spread of portfolio results with 46.22% of new-construction, 40.82% of modernized and 12.95% of extrapolated habitations. Also the environmental social alternative ranking demonstrates a strong trend to a customisation of future real estate assets with 44.74% for the new-construction, 35.93% for the modernized and 19.33% for the extrapolated option.

In the field of the total ranking, the portfolio mixture of the criteria differs in the extrapolated portfolio version. Therefore, the percentage of the extrapolated option of space characteristics embrace the lowest share with 12.95% while this share comprises 20.05% of the demographic characteristics and 19.33% of the environmental social characteristics. The other shares of the modernized and new-construction version are close together with a slight preference for higher levels of space characteristics. The alternative ranking in total realises a result of 44.71% for the new-construction, 37.21% for the modernized and 18.08% for the extrapolated real estate portfolio.

- *Germany*

In the criteria level of the AHP hierarchy the environmental social and the demographic characteristics are the most essential criteria from the point of view of the interviewees with eigenvectors of 42.8%, respectively 37.42% and a consistency ratio of 0.23%, which indicates a very stable result.

In the next level of demographic subcriteria, the eigenvector ratios are very balanced with a low consistency rate of 0.33%. In the area of space subcriteria, build quality embraces the highest eigenvector with 40.69%. The other subcriteria are nearly equal with 29.93% for the age distribution of housing stock and 29.38% for average number of rooms per dwelling. The consistency ratio is near-perfect stability with 0.03%. The eigenvectors of the environmental social subcriteria are mainly balanced with a slight preference for the income level with an eigenvector of 19.66%. The consistency ratio is again very stable with 1.4%, which indicates a high reliability of the pairwise comparisons of the interviewees.

In the following level of the alternatives, compared with the relative importance of the demographic, space and environmental social subcriteria, the modernized and new-construction alternatives dominate mostly the decisions with the exception in the subcriterion of land area. In this field the extrapolated version is more important than the new-construction alternative. The consistency ratios range between 0.0% and 0.25% and indicate robust interview results.

In the level that compares the relative importance of the demographic subcriteria with respect to the alternatives, the future real estate portfolio mixes of the subcriteria are close together with the overall outcome of 54.34% for the modernized, 24.87% for the new-construction and slightly behind 20.79% for the extrapolated alternative. The subcriteria portfolios of space characteristics differ in a more significant manner mainly in the modernized and new-construction versions. The overall alternative ranking comprises mainly the arithmetic mean with a high preference for the modernized alternative with 45.83%, followed by the new-construction option with 34.8% and a relatively low share of 19.37% for the extrapolated version. Again also in the environmental social level the modernized and new-construction alternative shares of the subcriteria varies with an alternative ranking that mainly includes the arithmetic mean with 41.18% for the modernized, 36.38% for the new-construction and 22.44% for the extrapolated alternative.

The total ranking that compares the criteria with respect to the alternatives illustrates portfolio variances within the demographic characteristics, mainly in the area of modernized and new-construction assets; the criteria space and environmental social characteristics are close together. The total alternative ranking ends with an important preference for 47.03% for the modernized, 31.76% for the new-construction and 21.21% for the extrapolated alternative.

- *Hungary*

The criteria level demonstrates analogue tendencies than the other above-mentioned countries with a basic preference for the environmental social criterion. The consistency ratio is again on a low level with 0.21%.

The subcriteria level that compares the relative importance with respect to the demographic criterion demonstrates balanced eigenvectors of the subcriteria and outlines stable results of the pairwise comparisons with a consistency ratio of 0.1%. The space subcriteria again highlight a strong preference for build quality with an eigenvector of 45.86% and a consistency ratio of 0.01%, which is near-perfect consistency. The eigenvectors of the environmental social subcriteria differs more with a lowest percentage of 7.17% for the subcriterion land area to 23.67% for the income level. The consistency ratio is very low and indicates, therefore, a good stability with a percentage of 1.27%.

The alternatives, compared with a relative preference with respect to the demographic, space and environmental social subcriteria, outlines high preferences for the customisation of future real estate assets with robust consistency ratios that range between 0.0% and 0.26%.

The demographic subcriteria, compared to the alternatives, evaluate mainly similar results of portfolio mixes of the different subcriteria with an overall result of 42.79% for the new-construction alternative, 35.91% for the modernized and 21.3% for the extrapolated alternative. Also the space characteristics level is very balanced and finishes with 47.62% for the new-construction, 38.15% for the modernized and 14.23% for the extrapolated version. The environmental social level differs in the alternatives ranking within the subcriteria mainly in the extrapolated and modernized field and ends near the arithmetic mean with 44.48% for the new-construction, 36.63% for the modernized and 18.9% for the extrapolated alternative.

The relative importance of the criteria, compared to the alternatives, differs mainly in the extrapolated version while the results of the modernized and new-construction criteria portfolios are close together. The overall alternative ranking demonstrates strong preferences for a future customisation of modernized and new-construction real estate assets with a share of 81.29% and a percentage of 18.71% for the extrapolated alternative.

- *Poland*

The criteria level of the AHP hierarchy validates similar tendencies to the other afore-mentioned countries with high preferences for the environmental social and demographic variables with a consistency ratio near to perfect stability of the pair-wise comparisons with 0.01%.

The demographic subcriteria in the following hierarchy level validate mainly stable eigenvector weights with a good consistency ratio of 0.04%. The space subcriteria illustrate again – similar to the other countries mentioned earlier – a basic preference for build quality with an eigenvector of 52.53% and a consistency ratio of 0.03%, which indicates a high robustness of the interviewees' pairwise comparisons. The environmental social subcriteria validate key preferences for income level, levels of rent and economic conditions and finish with a consistency ratio of 2.06%, which is a good and stable result as the maximum level for matrixes with seven variables lies by smaller 10% according to Saaty (1990).

The alternatives, compared with the relative importance to the demographic, space and environmental social subcriteria, validate clear results for the modernized and new-construction future real estate portfolio versions with low and, therefore, stable consistency ratios of a maximum of 0.2%.

The hierarchy level that compares the relative importance of the subcriteria with respect to the alternatives, illustrates in the area of demographic development mainly stable portfolio mixes of the subcriteria and an alternative ranking of 44.4% for the new-construction, 37.11% for the modernized and 18.49% for the extrapolated alternative version. The portfolios of the space subcriteria differ mainly in the modernization area. Nevertheless, because the criterion build quality comprises a key eigenvector share of 52.53%, the end result tends to this portfolio that could be slightly balanced by the other subcriteria. The overall alternative ranking comprises a main quote for the new-construction version with 45.81%, followed by the modernized portfolio with 41.3% and a low share of the extrapolated real estate assets with 12.89%. The portfolios of the environmental social level are generally balanced with an alternative ranking of the arithmetic mean and a high preference for the new-construction version with 41.79%, the modernized option with 38.85% and the extrapolated assets with 19.36%.

The total alternative ranking level comprises stable portfolio shares of the criteria in the fields of the modernization and new-construction portfolios and differs slightly in the extrapolated portfolios. The total outcome again validates significant shares for the customisation of real estate assets with 82.38% and a low quotation of 17.62% for the extrapolated alternative.

- *Romania*

In the criteria level of the hierarchy all criteria play a significant role with eigenvectors of 44.66% for the environmental social, 32.32% for the demographic and 23.01% for the space characteristics with a good consistency ratio result of 0.1%.

The subcriteria level that compares the relative importance with respect to the demographic criterion validates stable eigenvector ratios with a low consistency ratio of 0.21%. Comparable to the afore-mentioned interview results, in the space area again build quality is the key variable with a 52.5% eigenvector quotation. The consistency ratio indicates robust pairwise comparisons as the ratio embraces 0.09%, which is near the ideal percentage. The eigenvectors of the environmental social subcriteria are more unbalanced than in the other subcriteria levels with minor shares of the variables population density, land area and supply/ demand and key variables of income level and economic conditions. The consistency ratio indicates a reliable result of the pairwise comparisons of the interviewees with a quotation of 1.6%.

The alternatives, compared to the demographic, space and environmental social subcriteria illustrate high preferences for a customisation of future real estate assets, especially modernized and new-constructed ones and stable and low consistency ratios of a maximum of 0.34%. Nevertheless, for the demographic subcriteria the extrapolated alternative embraces also important outcomes of eigenvectors between 18.34% for the subcriterion clusters of households and 23.59% for the subcriterion household indicators. For the environmental social subcriterion land area the extrapolated version is the second most significant variable after the new-construction option with 27.61%.

The demographic subcriteria, compared with relative importance to the alternatives, validate different results of the portfolio mixes of the various subcriteria. As a consequence of the balanced criteria ranking, the overall alternative ranking comprises mainly the arithmetic mean with a share of 46.08% for the new-construction, 33.63% for the modernized and a significant share of 20.29% for the extrapolated alternative. The level of space characteristics evaluates mostly balanced portfolio mixes of the subcriteria; therefore, the criteria ranking with a high share of 52.5% for build quality plays a minor role for the alternative ranking in total. The outcome is a major percentage of 86.92% for a future customisation and a minor quote of 13.08% for the extrapolated alternative. In the environmental social area the subcriteria portfolio mixes differ mainly in the extrapolated and modernized version and finish with basically an arithmetic mean. Hence, the alternative ranking comprises 46.16% for the new-construction, 35.21% for the modernized and 18.63% for the extrapolated alternative.

The criteria, compared with relative importance to the alternatives, confirm related results of the criteria portfolio mixes of the modernized and new-construction versions; the extrapolated portfolios differ between the different criteria. The overall alternative ranking comprises a strong preference for the new-construction and modernized version with a total value of 82.11%, while the extrapolated version ends with a minor share of 17.89%.

- *Slovakia*

The criteria, compared with the relative importance with respect to the overall goal of the ideal real estate portfolio for 2050 validates mainly balanced eigenvector shares with a preference for the environmental social criterion and a consistency ratio of 0.21%, which indicates good interview results.

In the subcriteria level of the demographic characteristics, the eigenvectors are mainly balanced with a minor share of the variable household composition with an eigenvector of 14.73%. The consistency ratio is low and, therefore, a result of robust interviewee outcomes with a percentage of 0.07%. The space subcriteria realise a more balanced quotation than the other countries with a major eigenvector of 45.67% for build quality, 31.32% for the age distribution of housing stock and 23.01% for the average numbers of rooms per dwelling. The consistency ratio lies with 0.01% near the ideal consistency of pairwise comparisons. The eigenvector shares of the environmental social field demonstrates again, similar to other aforementioned countries, high preferences for the income level and the economic conditions with a consistency ratio of 1.55%, which indicates good and stable results.

The alternatives, compared with relative preference with respect to the demographic, space and environmental social subcriteria, illustrate good consistencies with a maximum quotation of 0.39% and again, similar to the other countries, high preferences for the modernized and new-construction alternatives for future portfolio mixes.

The demographic subcriteria, compared with a relative importance to the alternatives, demonstrate balanced portfolios of the extrapolated real estate assets; the modernized and new-construction portfolios of the subcriteria embrace spreads in the portfolio mixes. The outcome is basically an arithmetic mean with an alternative ranking of 44.84% for the new-construction version, 34.66% for the modernized alternative and 20.5% for the extrapolated option. The portfolio mixes of the space level are very balanced with an overall outcome of 48.94% for the new-construction, 37.57% for the modernized and a low share of 13.49% for the extrapolated alternative. In the environmental social field, the portfolio mixes of the extrapolated portfolios of the subcriteria embrace vital spreads; the modernized and new-construction versions are basically more stable and close together. The alternative ranking finishes with a key share of 81.68% for the customisation and 18.32% for the extrapolated real estate version.

The total ranking demonstrates a significant spread of the extrapolated versions of the criteria; the modernized and new-construction version of the different criteria embrace generally stable outcomes and are close together. The overall result for Slovakia ends with a high preference for the new-construction version with 45.96%, followed by the modernized real estate assets with 36.09% and a minor share of the extrapolated assets with 17.95%.

- *Spain*

In contrast to other countries, the criteria in the first level of the hierarchy demonstrate a strong preference for the demographic criterion with an eigenvector of 43.6%, followed by the environmental social criterion with 33.49% and the space criterion with 22.91%. The consistency ratio indicates stable results with a quotation of 0.12%.

The demographic subcriteria, compared with the relative importance with respect to the criterion, evaluate very balanced eigenvector rates and a good consistency of 0.19%. Also the eigenvectors of the subcriteria of space characteristics validate mostly similar quotations with a consistency rate of 0.01% near the ideal value of the interviewees' pairwise comparisons. In the environmental social field, land area plays a minor role with an eigenvector of 9.33%; the key variable economic conditions show the highest eigenvector with 19.95%. The consistency ratio proves a stable result with 0.85%.

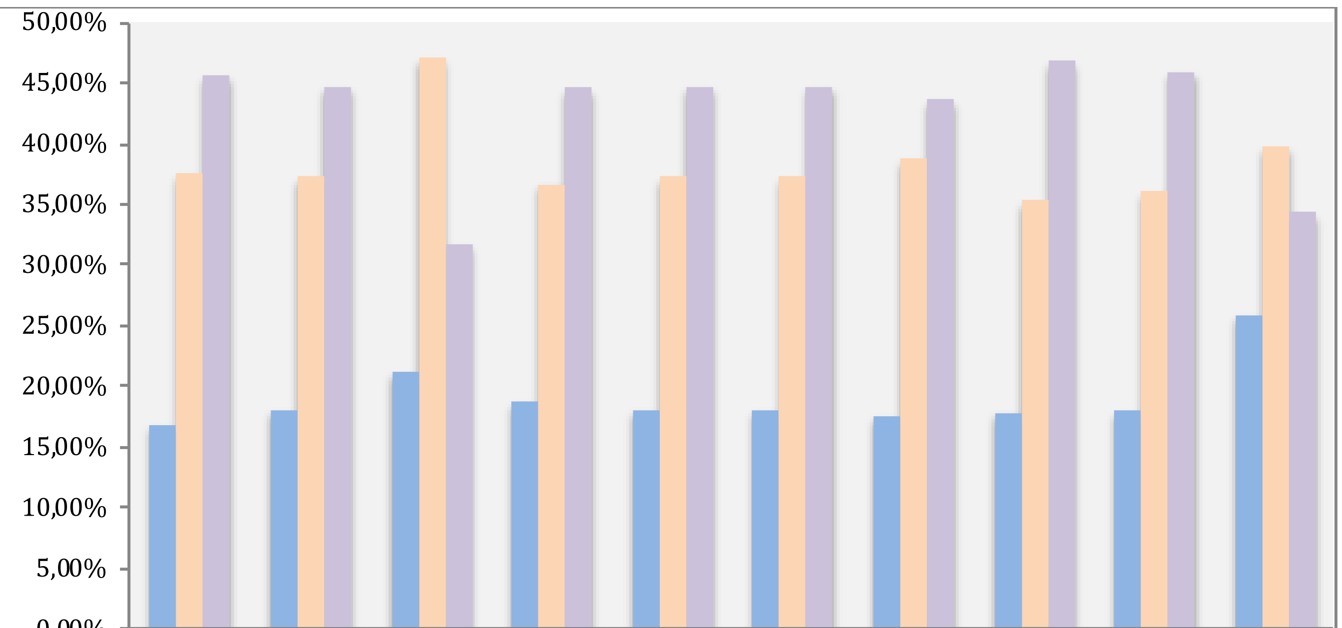
The alternatives, compared with the relative preference with respect to the demographic, space and environmental social subcriteria validate mostly the strongest preferences for the modernized portfolio alternatives with good consistency ratios of a maximum of 0.05%.

The subcriteria, compared with a relative importance with respect to the alternatives, demonstrate in the demographic development level mainly stabilised real estate portfolios of the different subcriteria with an overall outcome of 37.61% for the modernized, 35.6% for the new-construction and 26.79% for the extrapolated version, which indicates a very balanced result. The alternative ranking in the space area illustrates high variances of the different subcriteria portfolios of the modernization version; the extrapolated and new-construction versions are basically stable. The alternative ranking ends near the arithmetic mean with 43.59% for the modernized, 32.79% for the new-construction and 23.62% for the extrapolated real estate portfolios. The environmental social fields establish high spreads of the extrapolated and modernized portfolio versions, while the new-construction alternative of the subcriteria outlines stable results. The alternative ranking ends again with a high preference for the modernized version with 40.07%, followed by the new-construction alternative with 33.58% and the extrapolated option with 26.35%.

In the level of the total alternative ranking, the portfolio mixes of the criteria are stable with the highest consensus of the extrapolated and new-construction versions. As demographic development embraces the most important criteria share with 43.6%, the end result demonstrates mainly the portfolio mix of this criterion, but is just balanced by the other criteria. Again the most significant alternative is the modernized version with 39.8%, followed by the new-construction version with 34.28% and the extrapolated alternative with an important share of 25.92%.

In total, from all the interview results obtained by calculating the geometric mean, it is apparent that the interviewees interpret a strong preference for the future customisation of residential trade and industry portfolios. As illustrated in the following figure, the percentages for the extrapolated portfolios range between 16.84% in Bulgaria and 25.92% for Spain. The modernized versions comprise shares between 35.28% for Romania and 47.03% for Germany. The new-construction alternatives embrace choices between 31.76% for Germany and 46.83% for Romania:

Figure 6.1 Residential trade and industry portfolio 2050, in total

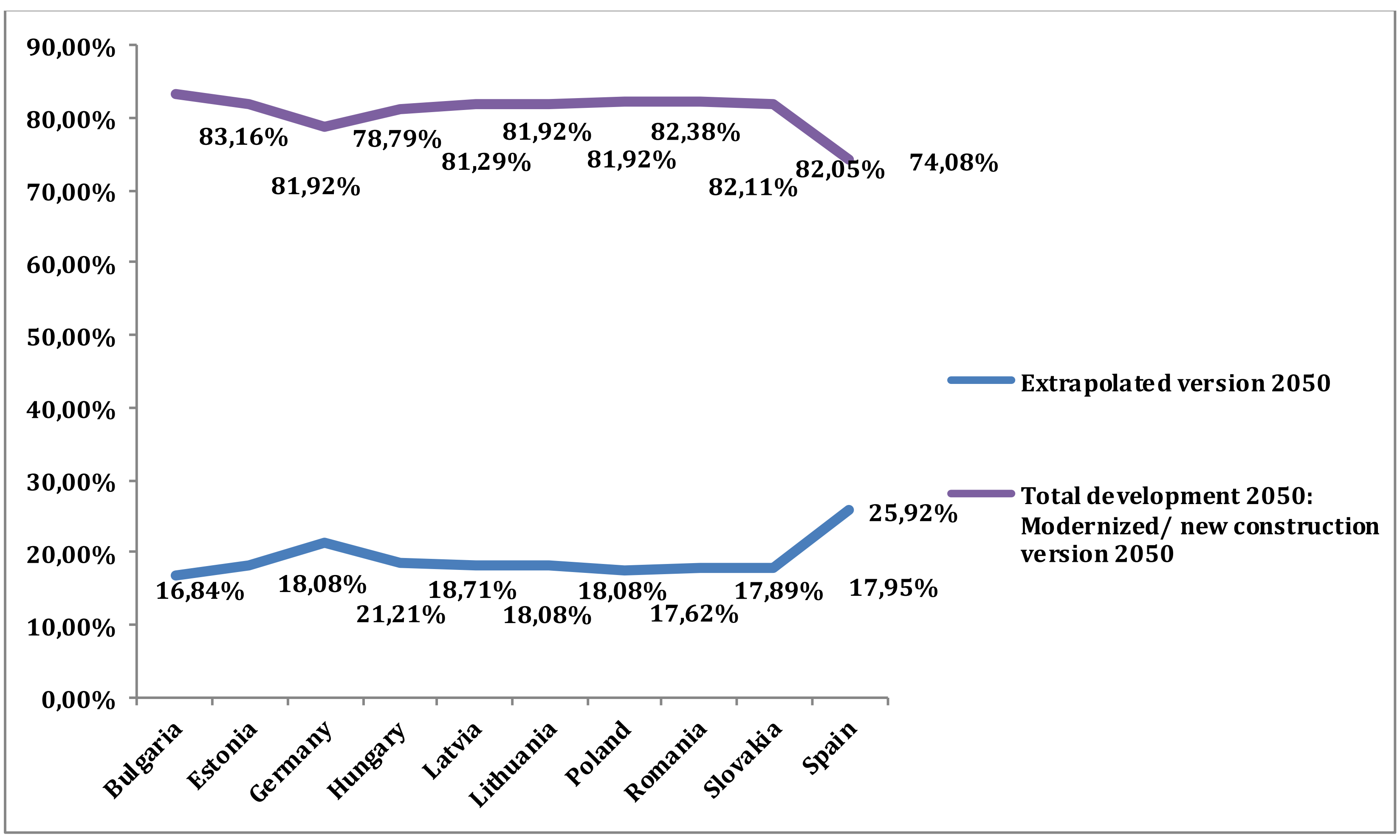


	Bulgaria	Estonia	Germany	Hungary	Latvia	Lithuania	Poland	Romania	Slovakia	Spain
Extrapolated version 2050	16,84%	18,08%	21,21%	18,71%	18,08%	18,08%	17,62%	17,89%	17,95%	25,92%
Modernized version 2050	37,52%	37,21%	47,03%	36,71%	37,21%	37,21%	38,76%	35,28%	36,09%	39,80%
New construction version 2050	45,63%	44,71%	31,76%	44,58%	44,71%	44,71%	43,62%	46,83%	45,96%	34,28%

Source: Own analyses

Hence, the lowest share for future customised real estate assets is analysed by the branch experts in Spain with 74.08%, followed by Germany with 78.79%. The key percentage is evaluated for Bulgaria with 83.16%:

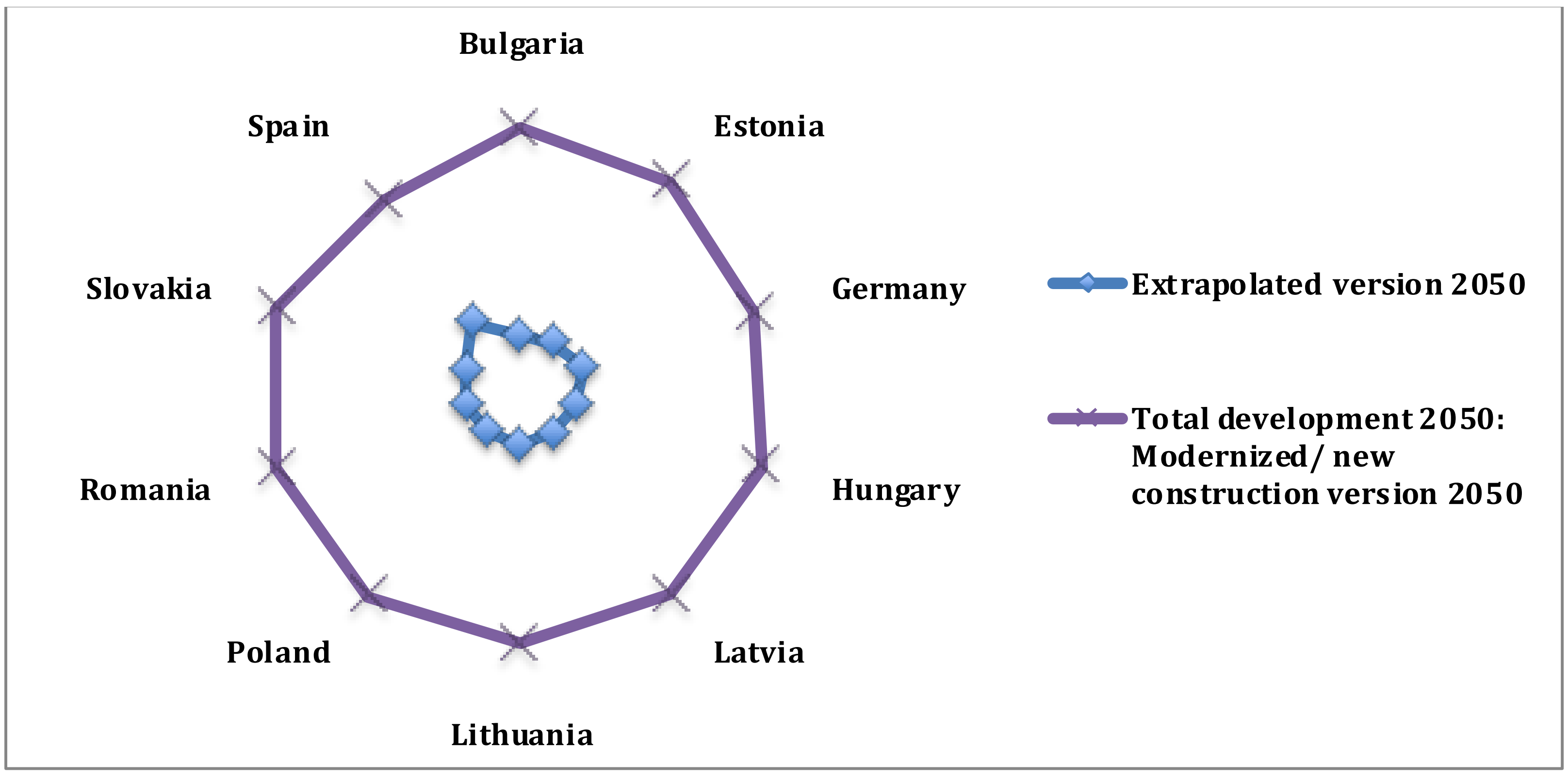
Figure 6.2 Extrapolated version in contrast to development version 2050, in total



Source: Own analyses

Nevertheless, the results for the different countries are very close together as the following polygon illustrates:

Figure 6.3 Similarities of the portfolio mixes of the different countries



Source: Own analyses

In total, the following tendencies of the overall interview results could mainly be proofed as follows:

a. Criteria level

Statistical fact: High interviewee preferences for the environmental social and demographic criteria level

Conclusion: Consideration of future economic and social development by out-lining the demographic circumstances

b. Subcriteria levels

Statistical fact: Similar relevance of demographic subcriteria

Conclusion: High importance of all variables

Statistical fact: Significant space subcriteria importances of build quality

Conclusion: Insufficient future build fitting

Statistical fact: Major eigenvector shares of the income level and economic conditions variables in the environmental social subcriteria area

Conclusion: Careful prognosis of the monetary future conditions and economic welfare

c. Alternative levels

Statistical fact: Key preferences for the modernized and new-construction versions of the different subcriteria

Conclusion: Important necessities for a future real estate portfolio customisation as a shift of population demands and a positive prognosis of the trend towards a shift to future economic growth

In Chapter 4 the market and status analysis of the main time period 1970 – 2050 outlines significant trends in the fields of demographic, space and social environmental developments of the residential trade and industry. The temporary hypothesis ends in the following portfolio management targets that are finally by confirmed the interview results:

H 1: High shares of modernized and new-construction habitations for 2050

H 2: Low shares of extrapolated habitations for 2050

Consequently, for all countries a significant necessity can be identified for a customisation of the residential trade and industry assets by 2050.

Nevertheless, as there are different interview partners from dissimilar expert areas with diverse outcomes, there is a necessity to progress with the analyses and interpretation of this empirical framework. Hence, these additional analyses are outlined in the subsequent chapters.

6.3 Statistical spreads of the overall interview results

For a realisation of the analyses and interpretations of the interview outcomes for the extrapolated, modernized and new-construction alternatives for the different countries, box-and-whisker plots are established to demonstrate the statistical spreads. These box-and-whisker plots are constructed in different summary ranges. The minimum value comprises the lowest percentage of the outcome of the interviewees per alternative and country; the maximum value embraces the greatest percentage for a country alternative, evaluated by the interviewees. The median is the middle value of all analysed shares of the attendants in total for one country and one alternative, sorted by lowest to highest rate. Furthermore, the ranges are again divided into the measurements of the 25th percentile and 75th percentile. The 25th percentile is also identified as the first quartile, while the 75th percentile is after the median value as the second quartile the third quartile. The 25th quartile is the delimitation at which 25% of the databases lies within this limit. In relation to this issue, the 75th quartile is the limit where 75% of the data are below that point (Pottel, 2013). When using Microsoft Excel, Pottel (2013) states that in the calculation the rank has to be calculated first, whereby n is defined as the overall ordinal ranking, P the percentile and N the number in the ranking list:

$$n = \frac{P}{100} * (N - 1) + 1 \tag{6.2}$$

In the second step, the rank with the value v has to be split into an integer factor k and a decimal component d with the result that $n = k + d$. Consequently, the percentile value v_p has to be calculated as follows (Pottel, 2013):

$$v_p = \begin{cases} v_1 & for\ k = 0 \\ v_n & for\ k = N \\ v_k + d(v_{k+1} - v_k), & for\ 0 < k < N \end{cases} \tag{6.3}$$

In the following box-and-whisker plots, these different values are analysed. To establish the boxes, the data for the charts are differentiated into 5 series. Series 1 is the minimum value, series 2 the 25th percentile less the minimum value. Series 3 illustrates the median less the 25th percentile and series 4 the 75th percentile minus the median. Finally series 5 demonstrates the maximum percentage less the 75th percentile (Pottel, 2013).

The box-and-whisker plots created in Excel Microsoft now comprise series 3 – the median less the 25th percentile – as the lower quartile, assigned as a green bar. Additionally, the purple bar outlines series 4 – the 75th percentile minus the median, which demonstrates the upper quartile. The median is evaluated between the lower and upper quartile. These green and purple bars including the median value are established as the interquartile range. Furthermore, series 1 and 2 outline the lower extreme and series 5 the upper extreme and highlight the error bars.

- *Bulgaria:*

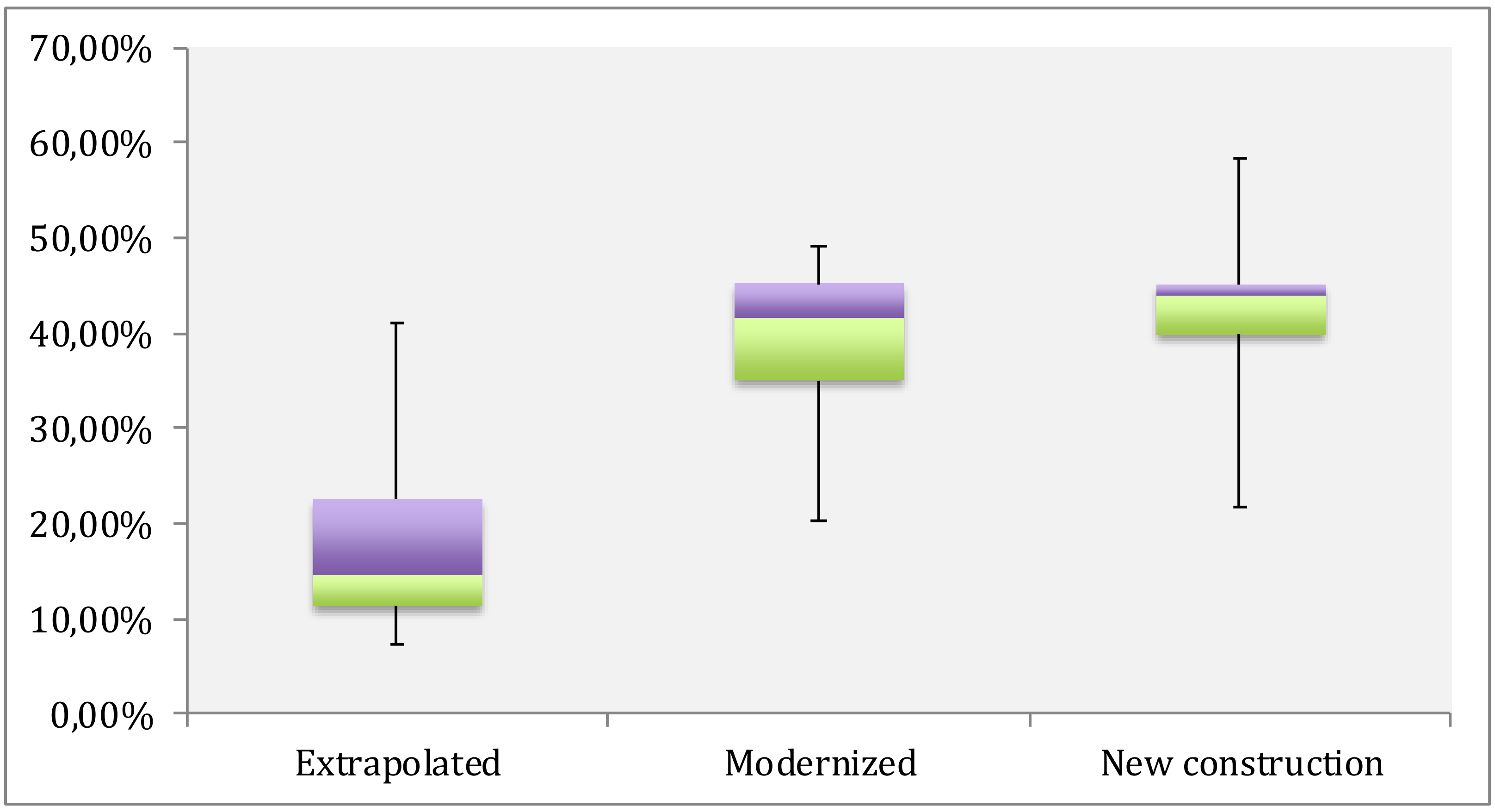
For the extrapolated alternative of Bulgaria it is apparent that the median of interviewee interpretations is 14.61%. The lower quartile of the 25th percentile is 11.32% and the upper quartile a maximum of 22.56%. The lowest extreme embraces a percentage of 7.22%, which comprise a share of 63.78% of the 25th percentile. Nevertheless, the other lower extremes are very close to the interquartile range with total values of 10.64% and 11.29% and demonstrate a good result. The upper extreme highlights a quotation of 41.09% and deviates from the 75th percentile with a high quote of plus 82.14%. Also in this upper field the further values of 23.55% and 29.23% demonstrate mainly acceptable deviates of 4.39% and 29.57%.

The modernized version comprises a median of 41.62% with a lowest acceptable quartile value of 35.11% and a maximum quartile share of 45.21%. The minimum extreme value outlines a share of 20.39%, the maximum extreme finishes with 49.11%. Consequently, the lowest significant extreme comprises a share of 58.07% of the 25th percentile and the upper deviation indicates a low deviance of plus 8.62%. Nevertheless, although the lower extreme indicates a significant deviance, half of the other values of the lower extremes are near the 25th percentile, which indicates a good and acceptable outcome.

For the new-construction version the interview results validate a median of 43.96%, a 25th percentile of 39.83% and a 75th percentile of 45.06%. Hence, the lower extreme deviates with a total percentage of 18.17% and the upper extreme with 13.29%. Also in the new-construction version, the lower values of 38.52% and 39.42% demonstrate results near the interquartile range. The upper extremes are with half of the values again close to the 75th percentile and, therefore, also these percentages are acceptable.

The box-and-whisker plots of the alternative results for Bulgaria are illustrated below (Appendix 94):

Figure 6.4 Box-and-whisker plots Bulgaria



Source: Own analyses

- *Estonia, Latvia, Lithuania*

The countries Estonia, Latvia and Lithuania are classed as equal by all of the interviewees with also the equivalent interquartile ranges and the extreme percentages. The interview results are analysed for all of these countries.

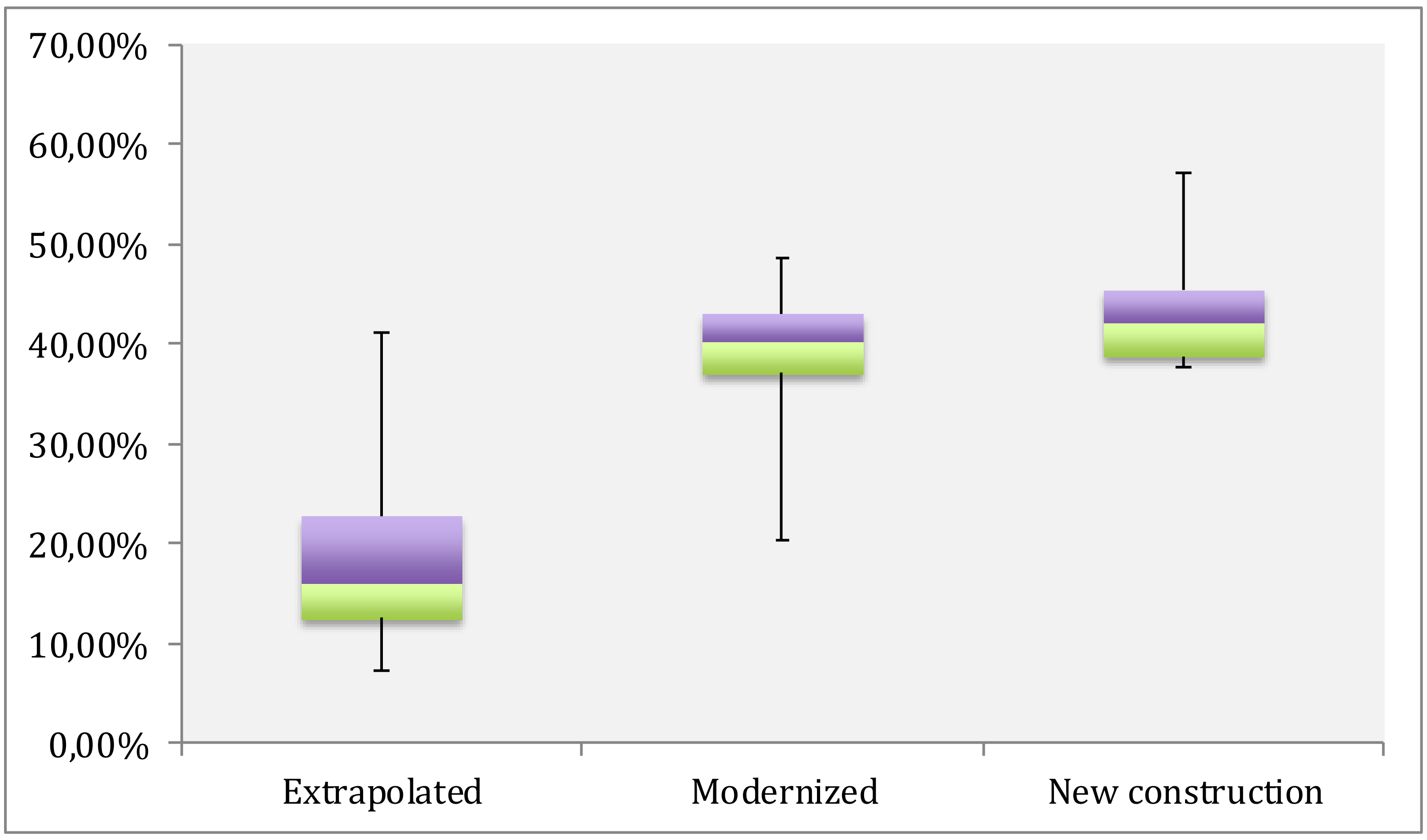
The interquartile range of the extrapolated version of these countries embraces the median value with 16.15%, the 25th percentile of 12.51% and the 75th percentile of 22.89%. The lowest extreme percentage is 7.36% and the upper extreme 41.09%. Hence, the lower extreme is a share of just 58.86% of the 25th percentile, but one of the other percentages of the lower group is with 11.33% near the 25th percentile indicating acceptable results. The upper extreme is with a share of plus 79.51% much higher than the 75th percentile ranging. However, this is the most extreme value; the other percentages in the upper extreme class comprise 23.55% and 24.1% and contain good outcomes close to the interquartile collection.

The interview results show the modernized version to have a median of 40.35%, a 25th percentile of 37.07% and a 75th percentile of 43.12%. The lower extreme percentage is 20.39% and is half as big as the 25th percentile with a share of 55.0%. Nevertheless, most of the other percentages in the lower extreme are very close to the interquartile range and, therefore, reliable. The upper extreme comprises a low and stable variance of plus 13.02%, which is a good result.

In the new-construction version the median is 42.24%. The 25th percentile is close to the median value with 38.84%, the 75th percentile outlines 45.49%. The lowest quote is 37.58% and comprises a share of 96.77% of the interquartile range that is a very close and reliable result. The upper extreme is with plus 25.81% also in an acceptable range.

The overall outcome is demonstrated as follows (Appendix 95):

Figure 6.5 Box-and-whisker plots Estonia, Latvia, Lithuania



Source: Own analyses

- *Germany*

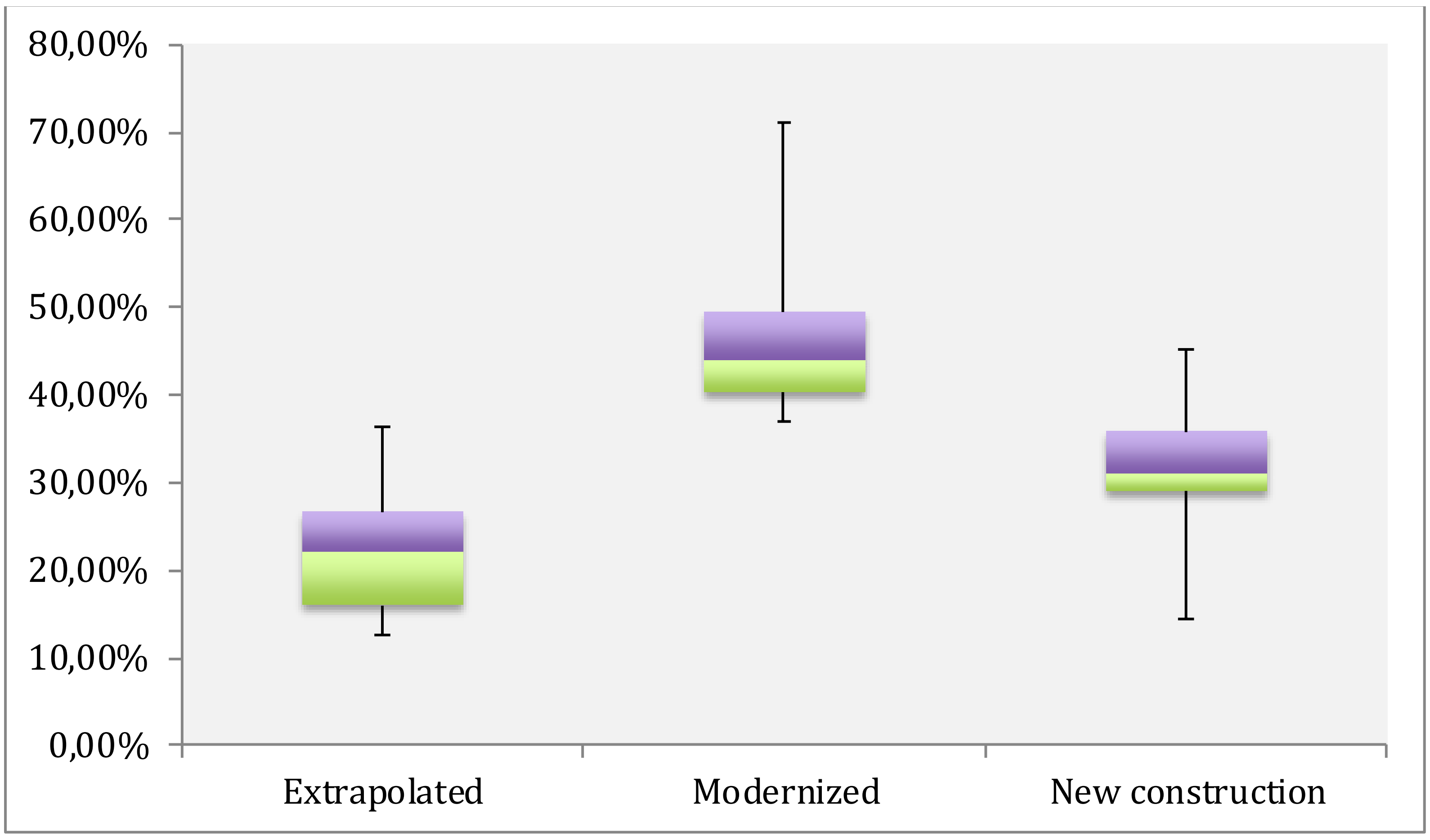
The extrapolated version includes a median of 21.99% with a 25th percentile of 15.93% and a 75th percentile of 26.57%. The minimum value of 12.64% is near the interquartile range with a share of 79.37% of the 25th quartile. Also the maximum level is with 36.24% in a good range, as this value comprises plus 36.42% from the upper interquartile range.

In the modernized version, the median percentage is 43.87% with a 25th percentile outcome of 40.2% and a 75th percentile result of 49.35%. The minimum extreme comprises 36.92%, which is a good and near share of 91.84% from the lower interquartile range. Also the upper extreme is with plus 44.25% and an absolute percentage of 71.18% within an acceptable limit.

The new-construction version outlines a median value of 30.94% with a 25th percentile of 28.93% and a 75th percentile of 35.78%. In contrast to the afore-mentioned alternatives, in this case the minimum extreme of 14.57% embraces a significant low share of 50.37% of the 25th percentile limit. Nevertheless, because half of the lower extremes are near the interquartile range, this is within an acceptable limit. The upper extreme highlights a percentage of 45.21% and, therefore, a deviance of plus 26.36%, which indicates stable results.

The overall outcomes are demonstrated in the next figure (Appendix 96):

Figure 6.6 Box-and-whisker plots Germany



Source: Own analyses

- *Hungary*

The median of the extrapolated alternative of Hungary is outlined with 17.76%. The 25th percentile is a quote of 13.17%, while the 75th percentile embraces a quotation of 21.97%. The minimum extreme is a value of 7.82% and, therefore, a low share of 59.38% of the 25th percentile. Nevertheless, as half of the lower extreme areas are near the 25th percentile, this is an acceptable field of extreme values. The maximum value is 41.09% and hence with plus 87.07% higher than the 75th percentile. Because the other quotes of the upper extreme area are quite near the interquartile range with total quotes of 22.23% respectively 29.23%, the outcome is in an acceptable range.

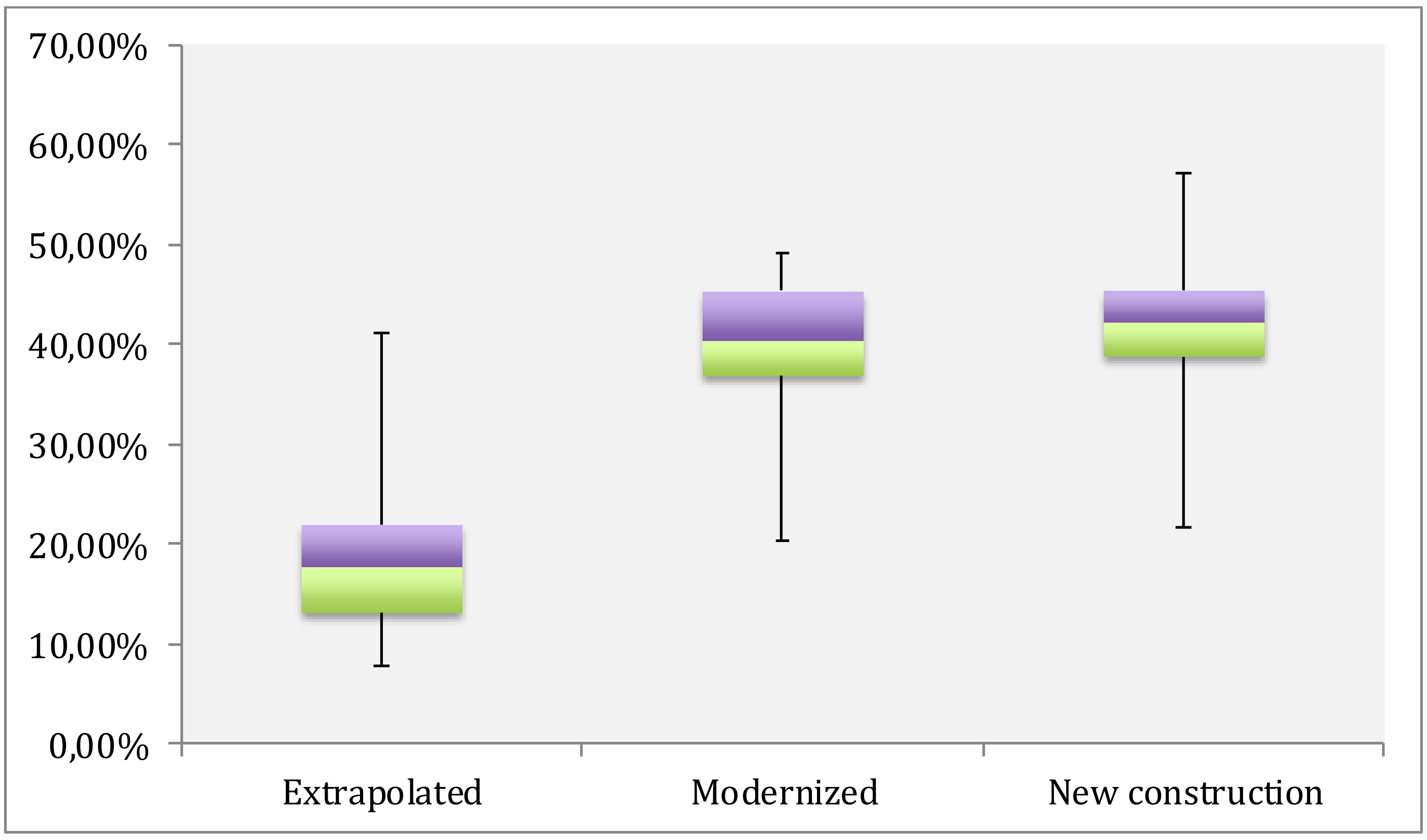
The modernized real estate option highlights a median of 40.4%. The interquartile range is fixed with a 25th percentile of 36.91% in the lower field and a quotation of

45.32% in the upper 75th percentile area. The minimum extreme is a value of 20.39%, but as half of this lower extreme area is near the interquartile area, this is still an acceptable result. The maximum lies with 49.27% just above the 75th percentile with plus 8.72% and is a stable outcome.

The interview results according to the new-construction alternative show a median value of 42.24%. The 25th percentile embraces 38.84% and the 75th percentile a quotation of 45.38%. While the minimum value finishes with a significant deviance of 44.23% in total, the maximum extreme ends with plus 26.11% over the 75th percentile or a total quote of 57.23%. However, also the minimum extremes are in a good limit as the other minimum percentages are with 32.97% and 38.52% very close to the interquartile range.

The following graphs show the interview results (Appendix 97):

Figure 6.7 Box-and-whisker plots Hungary



Source: Own analyses

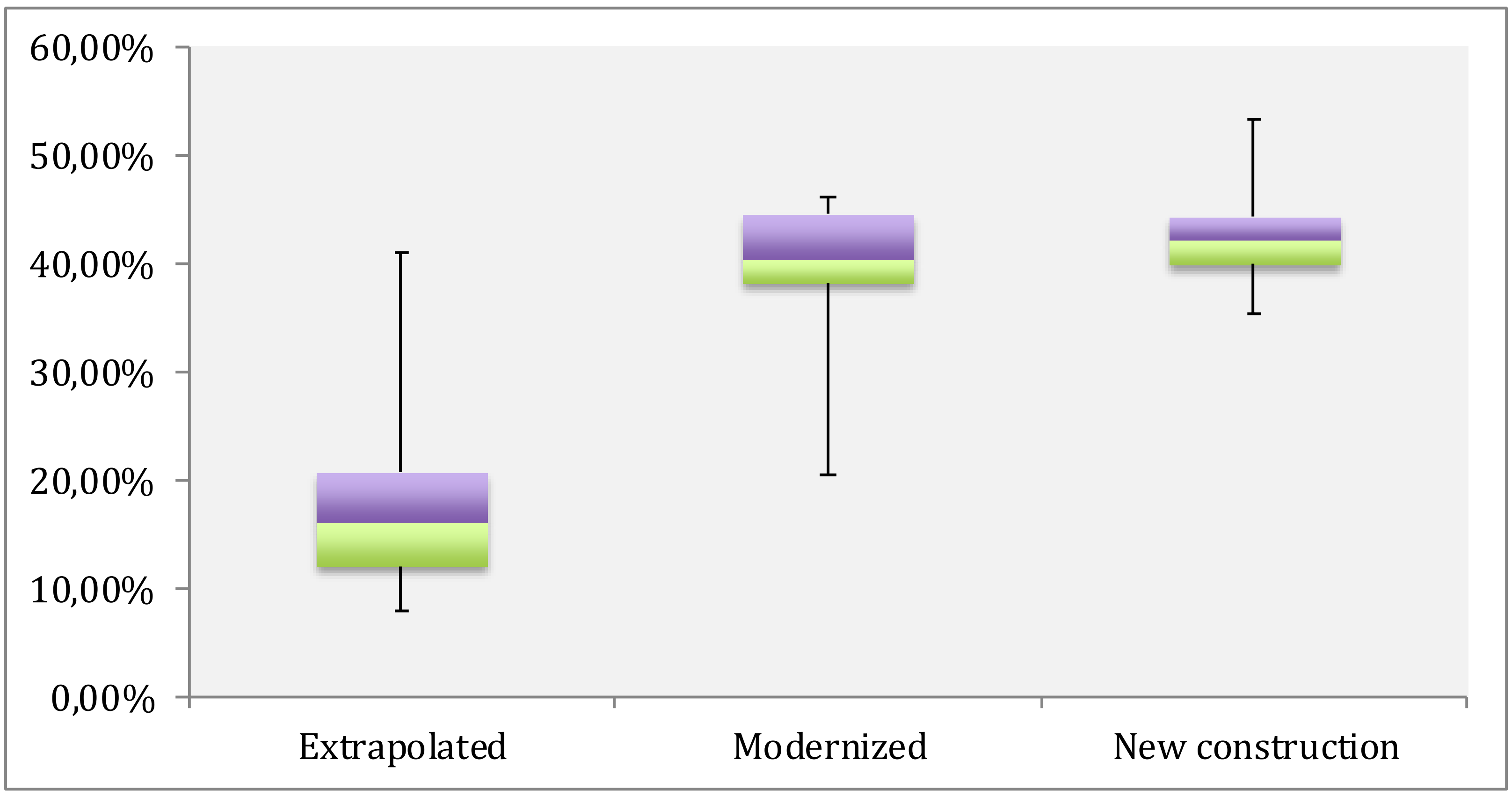
- *Poland*

The interview outcomes outline for Poland a median value of the extrapolated real estate portfolio of 16.15%. The 25th percentile embraces 12.12% and the 75th percentile 20.73%. The minimum extreme is a quote of 7.82%, which indicates a low share of 64.55% of the lowest interquartile area. Nevertheless, as the other quotations of the lower extreme are near the 25th percentile with 11.33% and 11.86%, the overall outcome is stable. The maximum includes 41.09% and is very high at plus 98.26% from the 75th percentile. Also in this upper extreme area this is a single significant value as the other quotes of this extreme area are again close to the interquartile range with 21.54% and 21.7% and, therefore, stable results.

For the modernized version the median is 40.4% with a fixed 25th percentile of 38.23% and a 75th percentile of 44.55%. The minimum extreme is 20.39%, which is the lowest value in terms of distance, while the other quotations in this extreme area are near the 25th percentile area with a good and stable outcome. The maximum quote is with 46.02% very close to the 75th percentile and embraces a variance of plus 3.31%, which demonstrates a high stability.

The new-construction version finishes with a median of all interviews of 42.24%, a 25th percentile of 39.93% and a 75th percentile of 44.32%. The lowest extreme comprises 35.36% and is a stable and close share of 88.55% of the 25th percentile. Also the maximum with 53.19% demonstrates a good stability of the overall interview outcomes with a variance of plus 20.01% of the 75th percentile (Appendix 98).

Figure 6.8 Box-and-whisker plots Poland



Source: Own analyses

- *Romania*

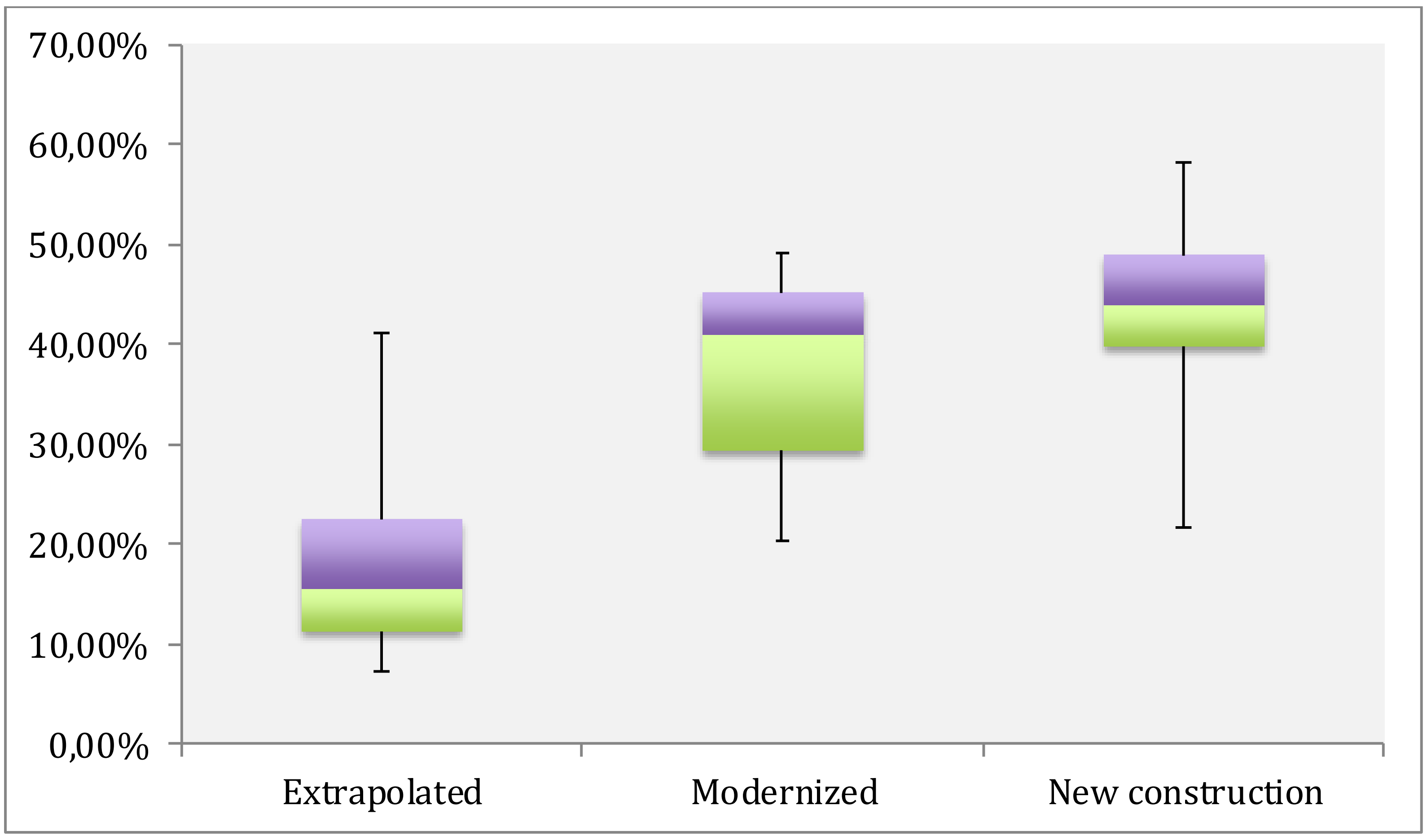
The interview results demonstrate for the extrapolated alternative a median of 15.58%. The lowest value of the interquartile range is the 25th percentile with 11.32% and the upper percentage the 75th percentile with 22.56%. The minimum contains 7.22%, which is a share of 63.78% of the 25th percentile. Nevertheless, because the other total quotes of the lower extreme area are near the 25th percentile with 10.64% and 11.29%, the outcome is on a good and stable level. The maximum is with plus 82.14% over the 75th percentile on a high level. Although in this case this is the only significant value in the upper extreme field as the other percentages of 23.55% and 29.23% as total quotations are again near the interquartile range and also demonstrate stable results.

For the modernized version the median illustrates 41.01%, the 25th percentile 29.4% and the 75th percentile is 45.21%. The minimum share shows a quotation of 20.39%, which is a share of 69.35% of the 25th percentile. However, because half of the lower extreme areas are near the 25th percentile, this outcome is still acceptable. The maximum value with 49.11% is close to the 75th percentile and deviates with plus 8.62%, which indicates stable interview results.

The new-construction version comprises a median of 43.96%. The 25th percentile shows a quote of 39.83%. Although the minimum quotation is with 21.66% a share of just 54.38% of the 25th percentile, the interview results are within a good limit, because the other lower percentages are very close to the 25th percentile with total quotations of 38.52% and 39.42%. The maximum value with 58.35% covers a variance of plus 19.06% in relation to the 75th percentile, which also indicates a stable interview outcome.

The afore-mentioned results are illustrated below (Appendix 99):

Figure 6.9 Box-and-whisker plots Romania



Source: Own analyses

- *Slovakia*

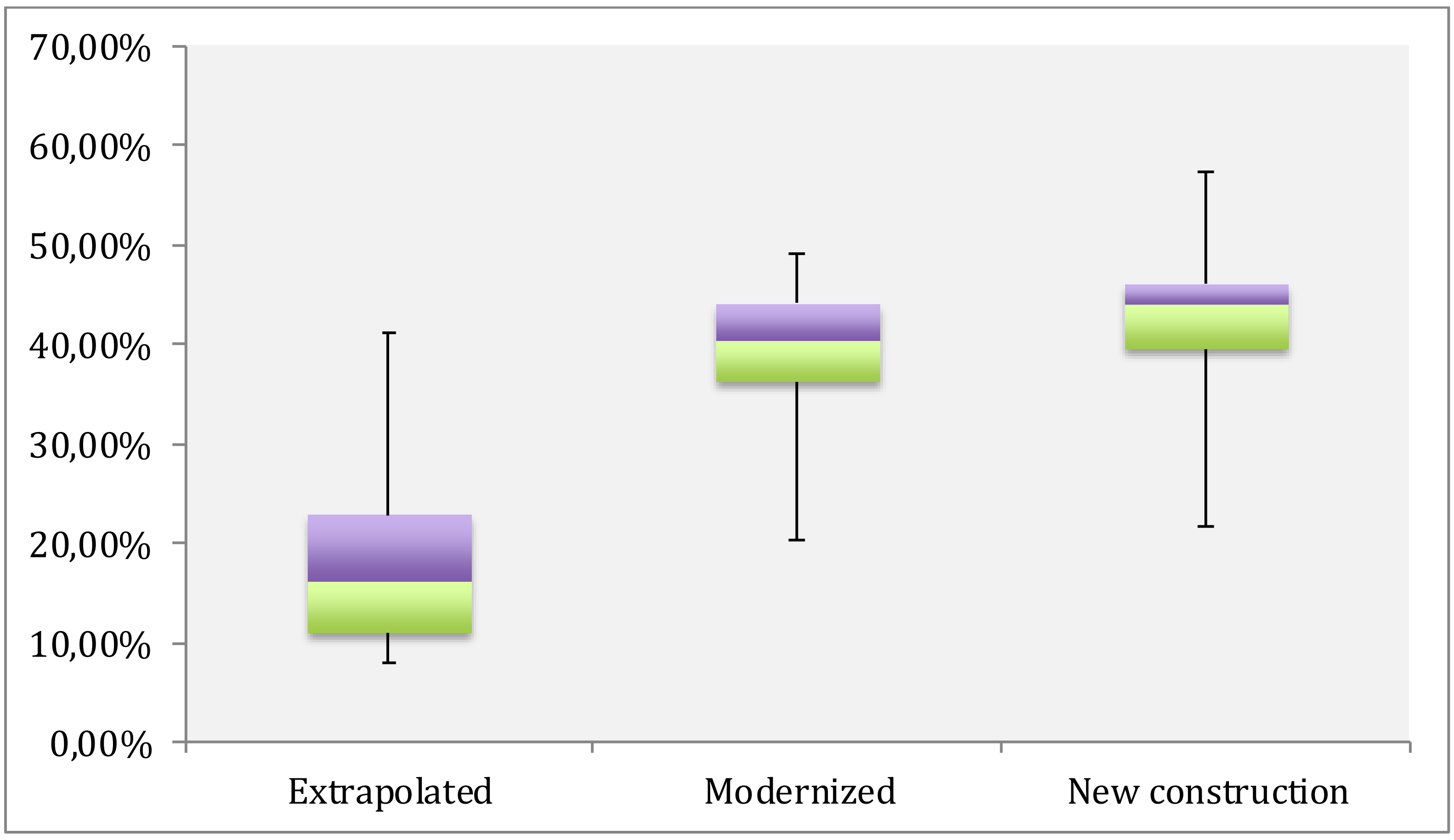
For Slovakia the extrapolated alternative embraces a median of 16.15% with a 25th percentile of 11.02% and a 75th percentile of 22.89%. In this area the minimum value is close to the 25th percentile with a quote of 70.99% of this percentile. The maximum value demonstrates a quotation of 41.09%, which is a high deviance of plus 79.51%. Nonetheless, also in this segment the interview outcomes are stable as the additional quotes in the upper extreme area are similar to the 75th percentile with 23.55% and 29.23%.

The modernized version includes an interquartile range of 40.4% for the median, 36.27% for the 25th percentile and 44.03% for the 75th percentile. The minimum value is with a total quote of 20.39% in a high deviation area in which half of the extreme area are near the interquartile range and still demonstrate, therefore, acceptable results. The maximum value is 49.11% with a stable deviance of plus 11.55%.

In the new-construction version the median covers 44.05% with a 25th percentile of 39.56% and a 75th percentile of 46.02%. The minimum extreme quotation lies with 21.66% in a significant deviance, as the quote comprises a share of 54.75% of the 25th percentile. However, the other quotes in this extreme field end with stable values near the 25th percentile of 38.52% and 39.15% and demonstrate good results. The maximum value of 57.23% is in a constant range with a deviance of plus 24.36%.

The interview outcomes are highlighted below (Appendix 100):

Figure 6.10 Box-and-whisker plots Slovakia



Source: Own analyses

- *Spain*

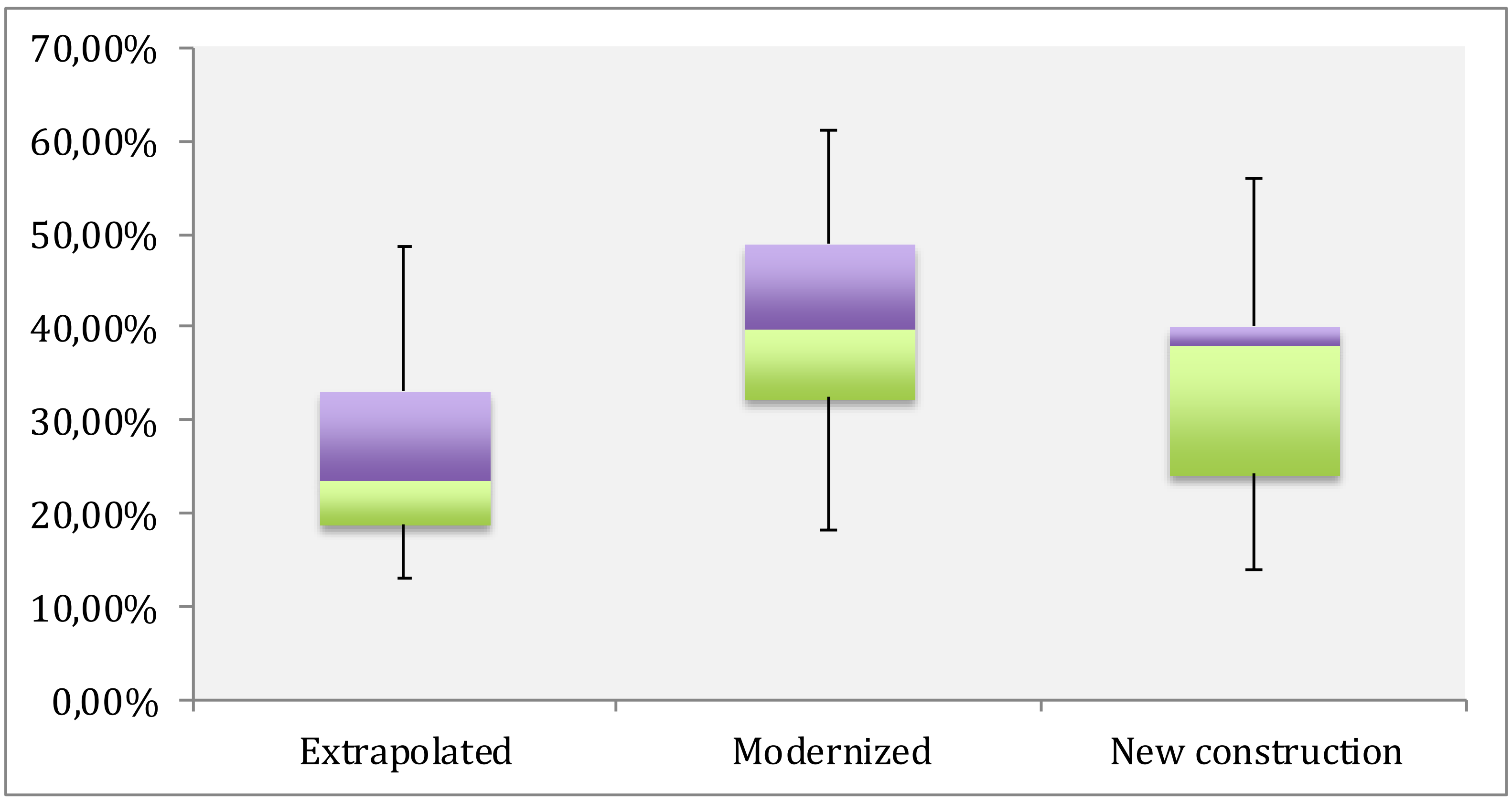
In this country the median of the extrapolated option is on a low level with 23.67%, a 25th percentile of 18.92% and a 75th percentile of 33.17%. The minimum value of 13.22% embraces a share of 69.88% of the 25th percentile. Because the other values in this minimum extreme area are near the 25th percentile, the interview results are stable. Also the maximum quotation of 48.54% outlines a high deviance with plus 46.34%; because half of this maximum area is similar to the 75th percentile, the interview outcomes are still on a good level.

The modernized alternative demonstrates a median of 39.94%, a 25th percentile of 32.4% and a 75th percentile of 48.99%. The minimum quotation embraces 18.36% and therefore, a share of 56.67% of the 25th percentile. Also in this case parts of this minimum area are stable in this percentile, with the consequence that the results still indicate consistent quotations. The maximum quote covers 61.21% with a deviation of plus 24.94% and also the other quotations in this area are near the 75th percentile. Therefore, additionally these outcomes indicate a good stability of the interview results.

For the new-construction alternative the median is 38.19%. The 25th percentile lies by 24.23% and the 75th percentile by 40.14%. The lowest value is a quote of 13.84%, which demonstrates a low share of 57.13% of the 25th percentile. Also in this case the other percentages in the minimum area are stable in relation to the 25th percentile with 18.96% and 20.19% and the interviews also illustrate an acceptable stability. The maximum value of 56.02% is a deviance of 39.57% but is again by far the highest value as the additional percentages in this area are near the 75th percentile with 43.1% and 43.42% and thus indicate good interview outcomes.

The interview results are illustrated in the following figure (Appendix 101):

Figure 6.11 Box-and-whisker plots Spain



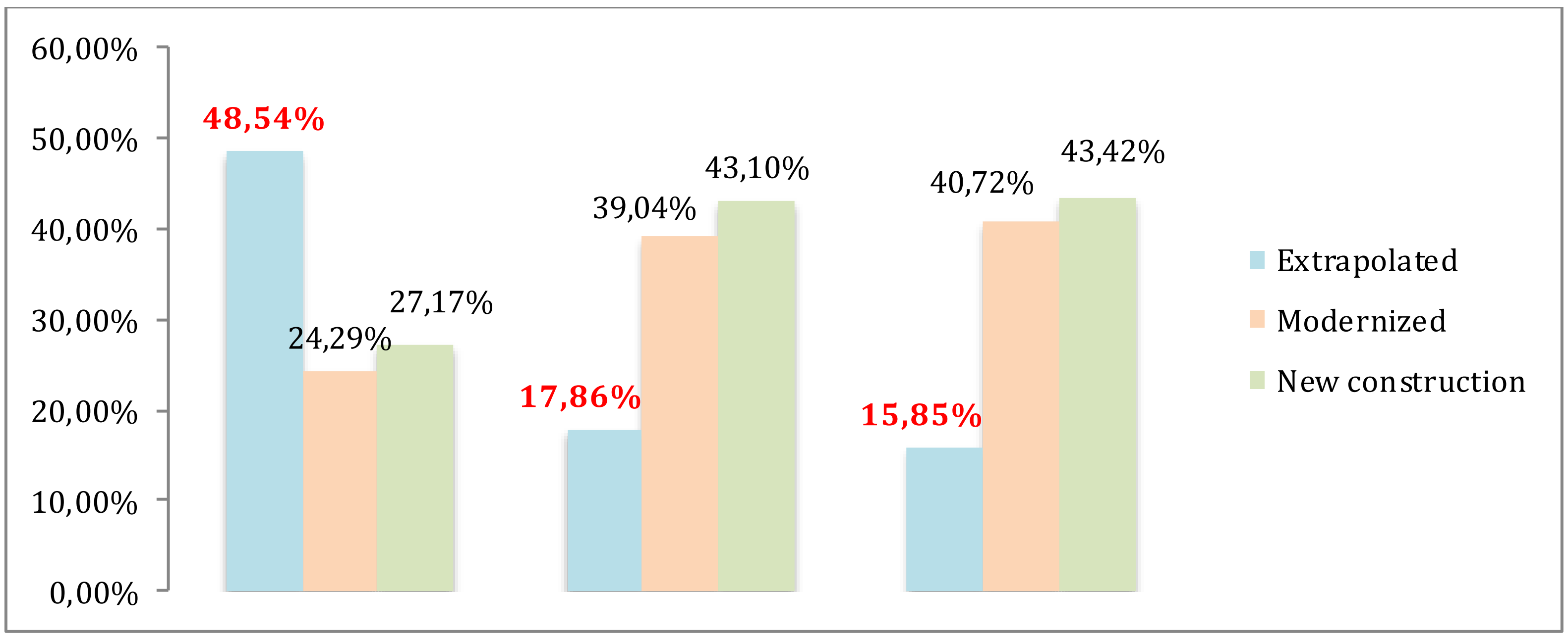
Source: Own analyses

In a nutshell the most important spreads from the minimum to the maximum values are in the areas of extrapolated real estate assets of the different countries; the modernized and new-construction alternatives realise mainly short-distance spreads. The most extensive portfolio spreads are apparent for Germany and Spain. Nevertheless, as stated before, as there are a total of 15 interviewees who fulfil 82 pairwise comparisons per country, the results with a minimum of outliers indicate high stabilities and robustness.

As there are different expert groups, an analysis of the expert cluster interview outcomes has to be outlined to detect, if interviewees in one cluster comprise similar results of an ideal real estate portfolio until 2050 (Appendix 102-133).

The expert group of academics comprising three interviewees generates very stable results of the countries with a minimum of outcome ranges. The spreads of the academic results are mainly small with the most important, but also small outliers in the extrapolated real estate alternatives of the countries. The modernized and new-construction versions are close together. Furthermore, important variances are apparent in Spain where two of the interviewees generate very similar results, but one of the participants ends with percentages different to the rest of the group:

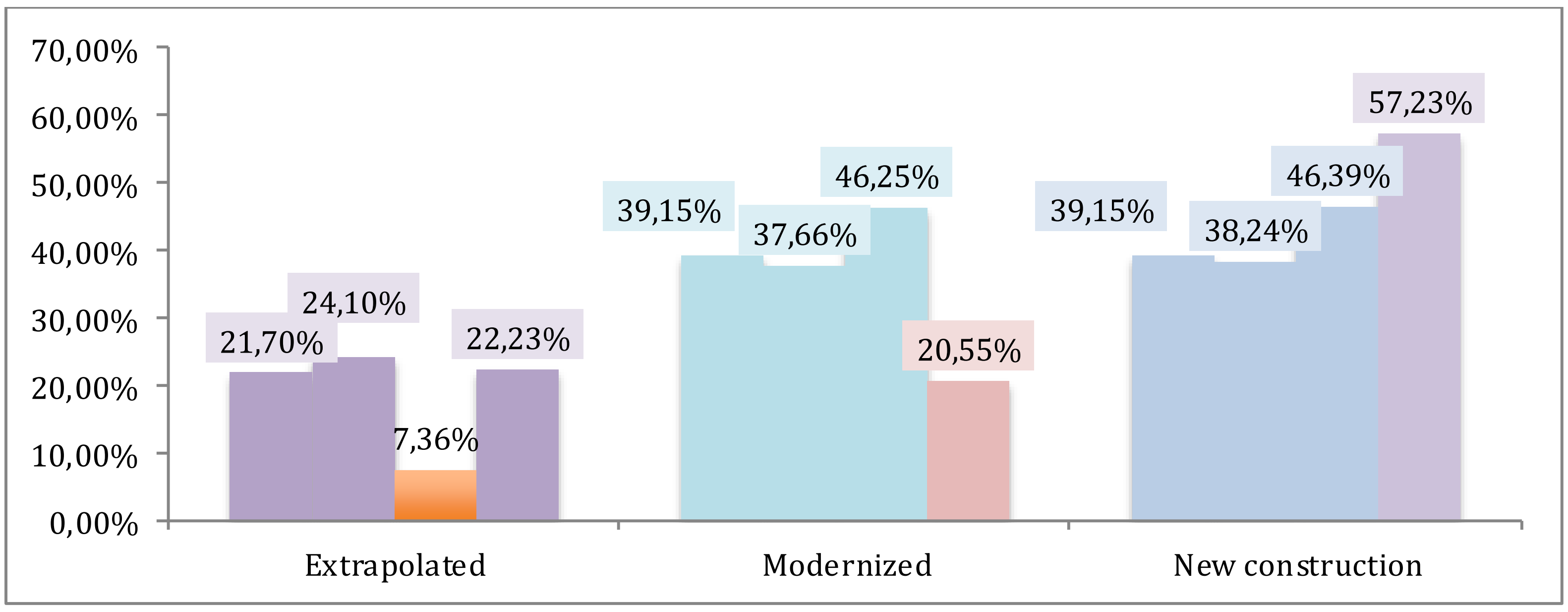
Figure 6.12 Outlier of the expert group of academics, Spain



Source: Own analyses

At first glance for the group of the practical professionals high variances for the different future portfolio assets and countries could be analysed. The important variances are analysed in different portfolio alternatives, respectively assorted countries with an absence of a special pattern. Although it is analysed that different outliers are available in the area of minimum or maximum values. Nevertheless, at second glance, it can be detected that there is one key outlier per real estate alternative and country, which embraces a high variance in contrast to the other interview results; these other interviewee outcomes are again close together. An example is highlighted in the following figure for the country cluster Estonia, Latvia and Lithuania. In this figure similar results are marked with one colour and the outlier with another:

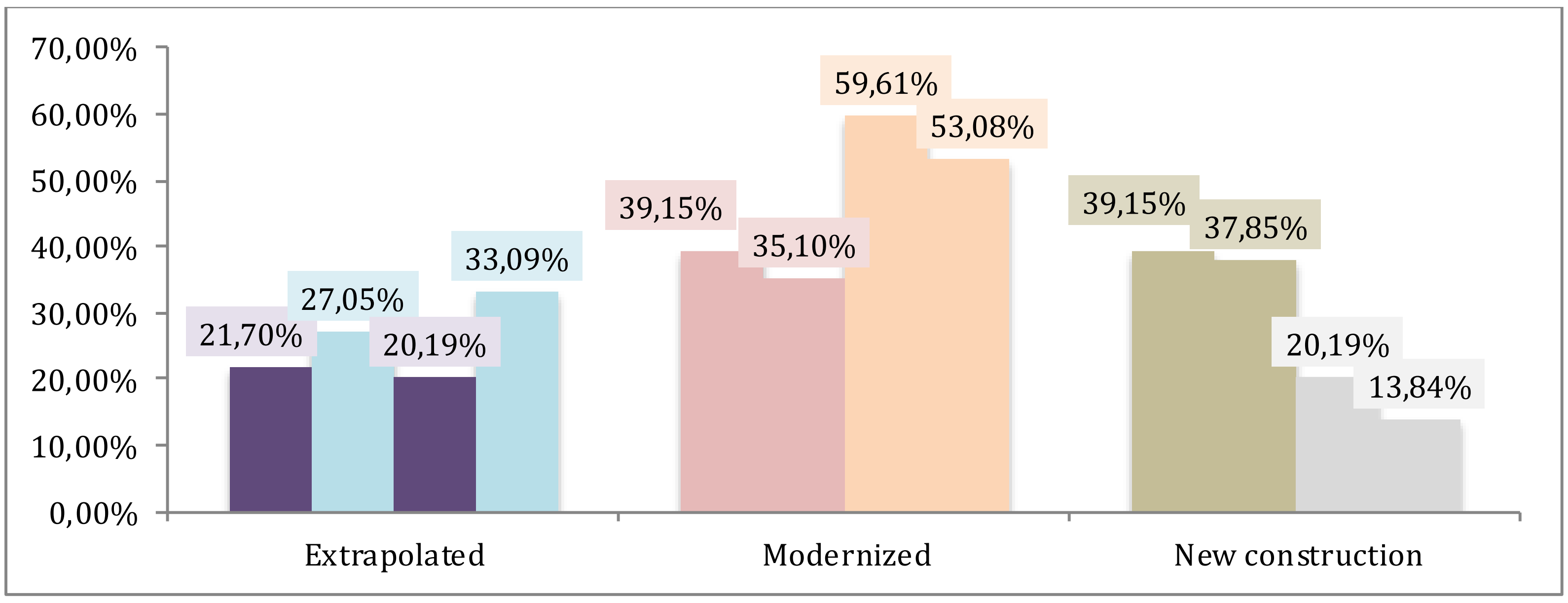
Figure 6.13 Different country clusters of the expert group of practical professionals, Estonia/ Latvia/ Lithuania



Source: Own analyses

Furthermore, it also can be identified in other cases that there are two different clusters of similar values per cluster and solely dissimilarities between the different clusters that is also illustrated in varying coloured pillars:

Figure 6.14 Key outliers of the expert group of practical professionals, Spain



Source: Own analyses

Also in this expert group a good plausibility could be determined.

This phenomenon is also mainly apparent in the field of the branch alliances expert group, whereas the single outlier is the key occurrence. The cluster of the experts with special country knowledge embraces country analyses with basically single spreads with the most equal result of Bulgaria and the most central variances for Germany and Spain.

In summary, there is no generality of equal conclusions within one expert cluster or inside one specialist group with the consequence of high shares of related and analogous conclusions of overlapped expert-constellations. These results validate the high complexity of this topic as well as the challenges of decision-making for future real estate portfolios. Nevertheless, it also proves the strong future necessity for a shift towards a key level of modernized and new-constructed real estate portfolios in the EU-27 countries. For an additional evaluation of the stability of the interview results, sensitivity analyses are outlined in the following.

6.4 Sensitivity analyses of the overall interview results

In the afore-mentioned sub-chapter, studies of the variances of the interview results demonstrate stable as well as plausible and, therefore, acceptable outcomes of the interviewees. For an additional evaluation of the effects of the pairwise comparisons of the decision-makers, the following sensitivity analyses are highlighted. These types of analyses test the sensitivity of the pairwise comparisons to shifts in the priorities of the variables. As pairwise comparisons within interviews are based on the subjective valuation of the branch experts, the robustness of the interviews can be verified to give credence to the interview results. Sensitivity analyses can be realised from any hierarchy level of the AHP methodology (Gibney and Shang, 2007; Tahriri et al., 2008).

The foundation of sensitivity analyses is the identification of the critical hierarchy level, in which deviations of the pairwise comparisons could influence the overall result of the alternative rankings. In the first level of the hierarchy that compares the relative importance of the criteria with respect to the goal, the influence of the different criteria towards this overall alternative classification is not realisable as the alternative rankings that compare the relative importance of the demographic, space and environmental social subcriteria with respect to the criteria illustrate equivalent real estate portfolios. Also the second hierarchy level that compares the subcriteria with respect to the criteria is not reasonable for sensitivity analyses, because most of the subcriteria are balanced without significant shares of single variables. Nevertheless, primary the fact that the alternatives of these subcriteria are equalised and close together, deviations in this second hierarchy level would not influence the overall alternative result. The most significant level of the AHP hierarchy is the third stage since the real estate alternatives of the subcriteria demonstrate nearly the same key trends of minor shares of the extrapolated versions and important eigenvectors of the modernized and new-construction versions of the demographic, space and environmental subcriteria, which influence the overall result in the most important way. By changing these eigenvectors in a sensitivity analysis, the overall alternative results would be manipulated.

Therefore, the sensitivity analyses of the different countries are realised in this third hierarchy level. Two different simulations of sensitivity analyses are illustrated below. The first simulation – following illustrated as simulation 1 – demonstrates the eigenvectors of all subcriteria in this hierarchy level that are deviated in the section of the criteria with the highest eigenvector ranking. Because the eigenvectors of the extrapolated alternatives embrace the minor shares, in the sensitivity analyses these eigenvectors are modified by simulation with the result of a converted overall alternative ranking that outlines the extrapolated real estate alternatives at the first position. The second simulation – following described as simulation 2 – changes the eigenvectors of the extrapolated alternatives of all subcriteria in the third level of the hierarchy in the demographic, space and environmental social criteria areas. These both simulations are highlighted for every country in the following explanations.

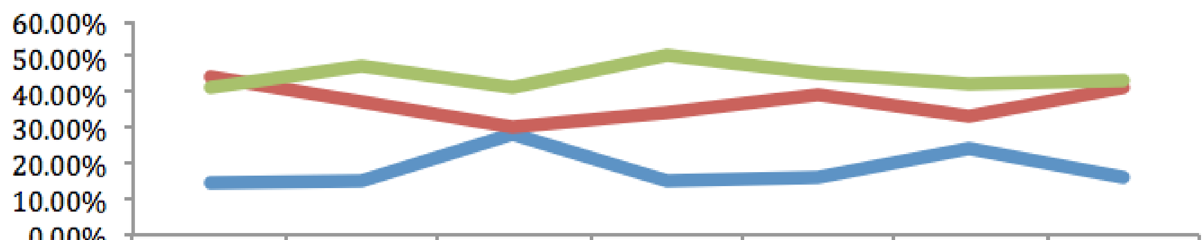
- *Bulgaria:*

For simulation 1, the most important criterion is the environmental social variable with an eigenvector of 43.27% in the first hierarchy level. Therefore, the eigenvectors of the extrapolated alternatives of the environmental social criterion are manipulated with the target to modify the overall alternative ranking for this country. For a slight shift of the overall ranking, an adjustment of 750.0% is necessary to influence the outcome.

Without this manipulation, a strong tendency towards a customisation with modernized and new-construction alternatives is apparent with minor shares of the extrapolated alternatives in the environmental social field and a low percentage of the overall result of 16.84%. With the manipulation of simulation 1, the extrapolated versions of the environmental subcriteria change to high eigenvectors with the overall effect that the alternative ranking in total embraces a slight preference for 35.6% of the extrapolated version over the additional alternatives as demonstrated below (Appendix 134):

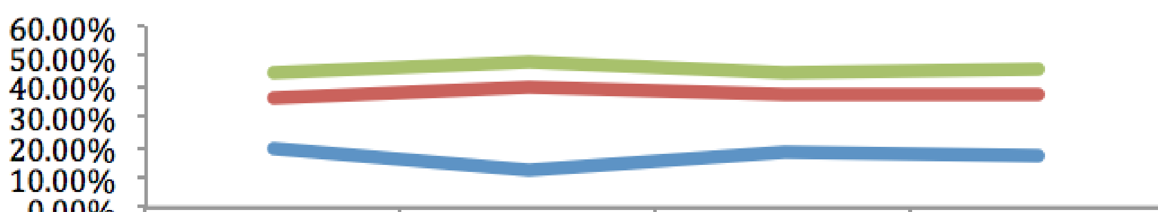
Figure 6.15 Simulation 1 of the sensitivity analysis, Bulgaria

Alternative ranking environmental social subcriteria, without manipulation



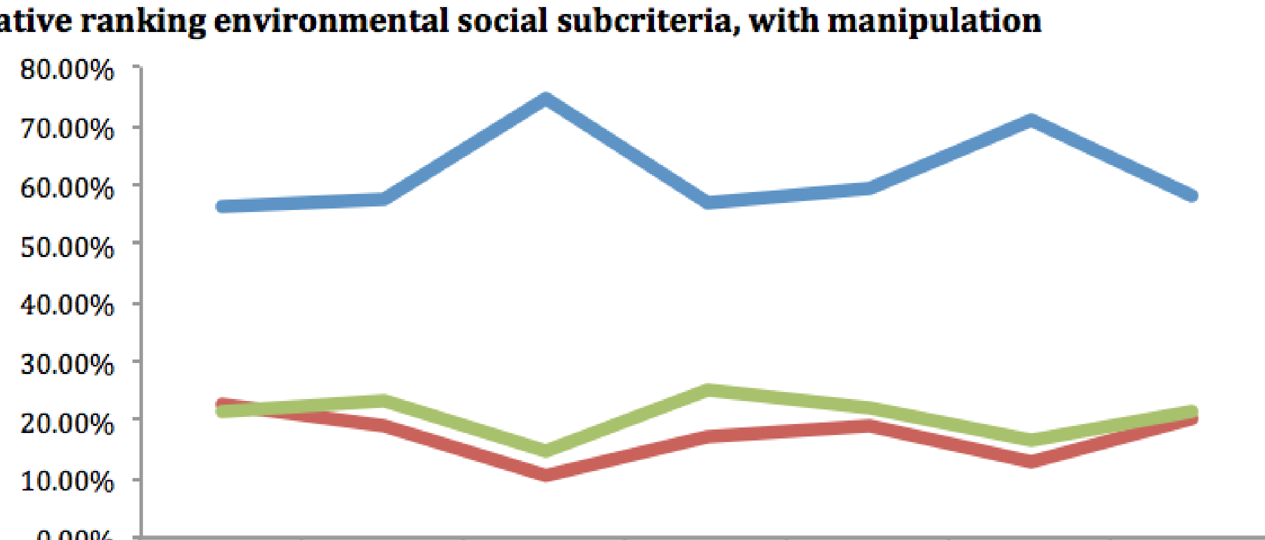
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	14.61%	15.33%	28.24%	15.10%	16.24%	24.34%	15.74%
Modernized version	44.00%	37.69%	30.06%	34.51%	38.86%	33.30%	41.09%
New construction version	41.39%	46.98%	41.71%	50.39%	44.90%	42.36%	43.16%

Alternative ranking in total, without manipulation

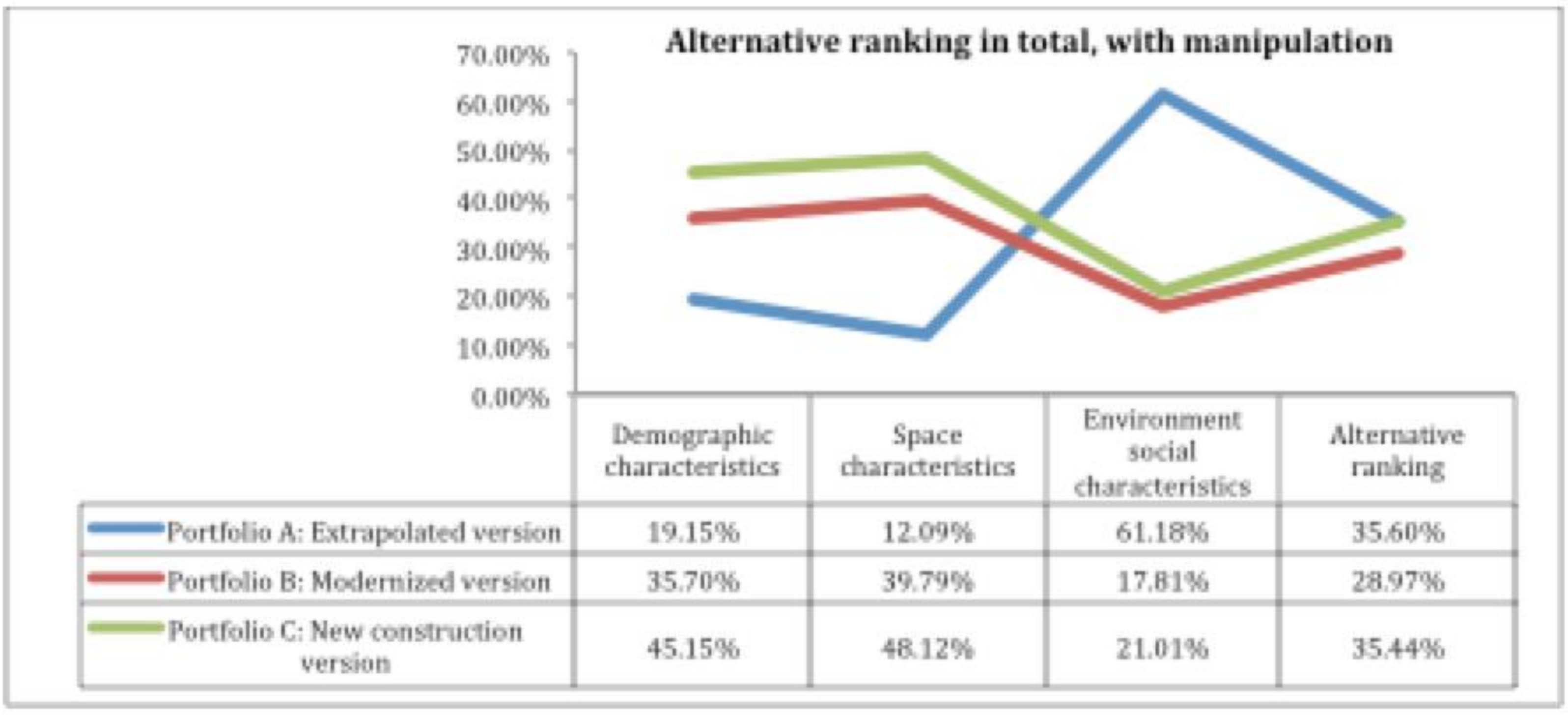


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	19.15%	12.09%	17.84%	16.84%
Portfolio B: Modernized version	35.70%	39.79%	37.58%	37.52%
Portfolio C: New construction version	45.15%	48.12%	44.58%	45.63%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	56.20%	57.59%	74.69%	57.15%	59.25%	70.70%	58.36%
Modernized version	22.57%	18.88%	10.60%	17.42%	18.90%	12.90%	20.31%
New construction version	21.23%	23.53%	14.71%	25.43%	21.85%	16.40%	21.33%

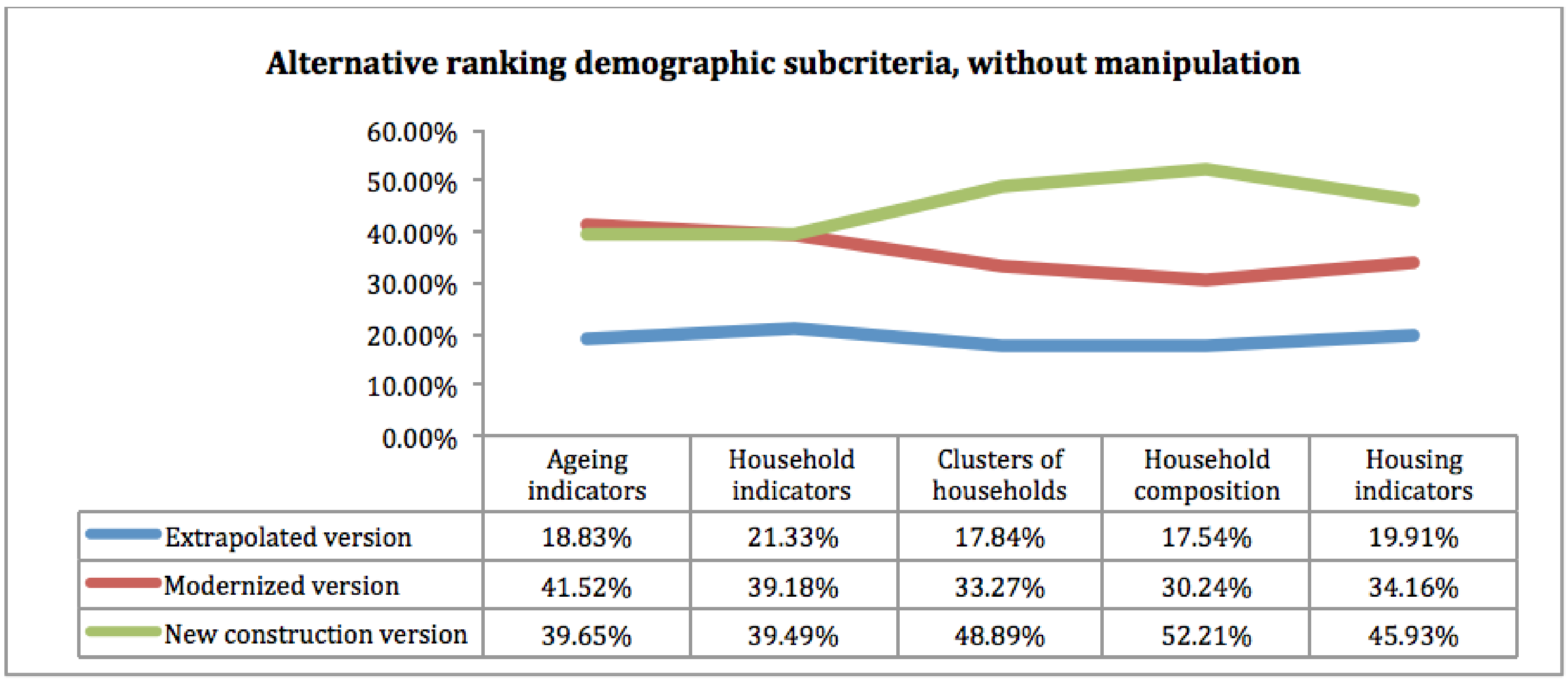


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	19.15%	12.09%	61.18%	35.60%
Portfolio B: Modernized version	35.70%	39.79%	17.81%	28.97%
Portfolio C: New construction version	45.15%	48.12%	21.01%	35.44%

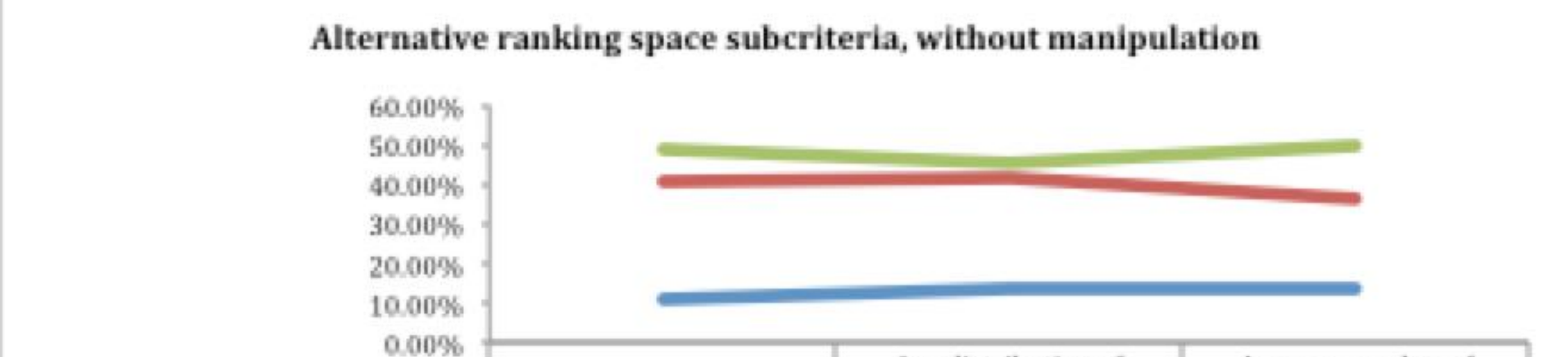
Source: Own analyses

In simulation 2 all pairwise comparisons in the third level of the hierarchy are manipulated for the extrapolated alternative and receive a 5.5 times higher value in comparison to the real values with the result of strong preferences in the demographic, space and environmental social and overall results. The total alternative ranking then shows a share of 51.97% for the extrapolated version. In contrast to the real values that highlight low preferences of the extrapolated version with an overall result of 16.84%, the manipulation of simulation 2 shifts the total outcome into a direction in which the customisation of the modernized and new-construction versions play a minor role. Simulation 2 is illustrated next (Appendix 135).

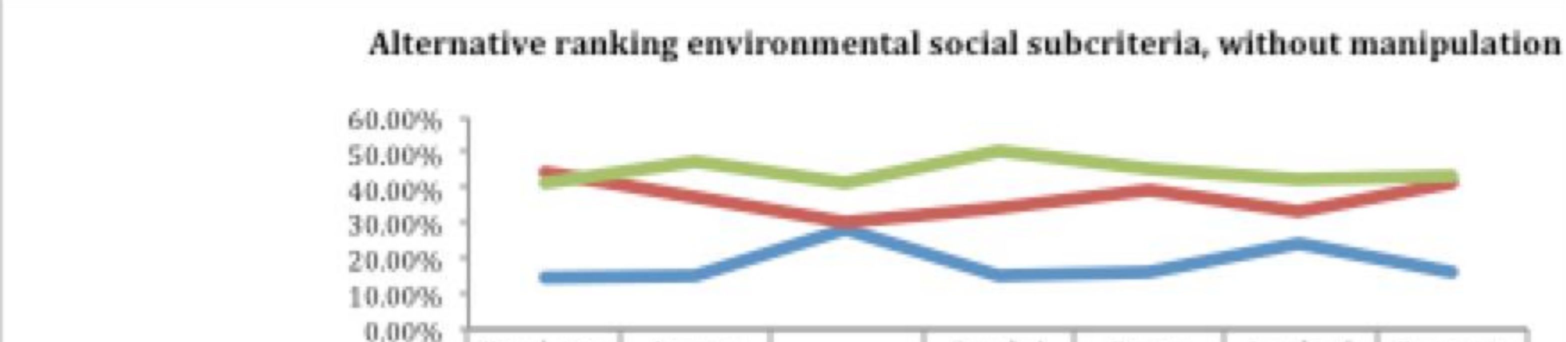
Figure 6.16 Simulation 2 of the sensitivity analysis, Bulgaria



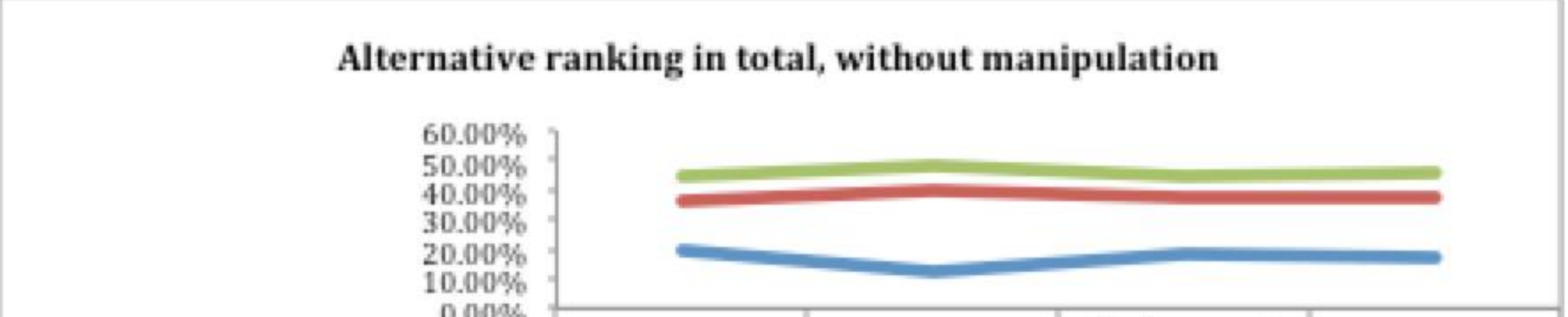
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	18.83%	21.33%	17.84%	17.54%	19.91%
Modernized version	41.52%	39.18%	33.27%	30.24%	34.16%
New construction version	39.65%	39.49%	48.89%	52.21%	45.93%



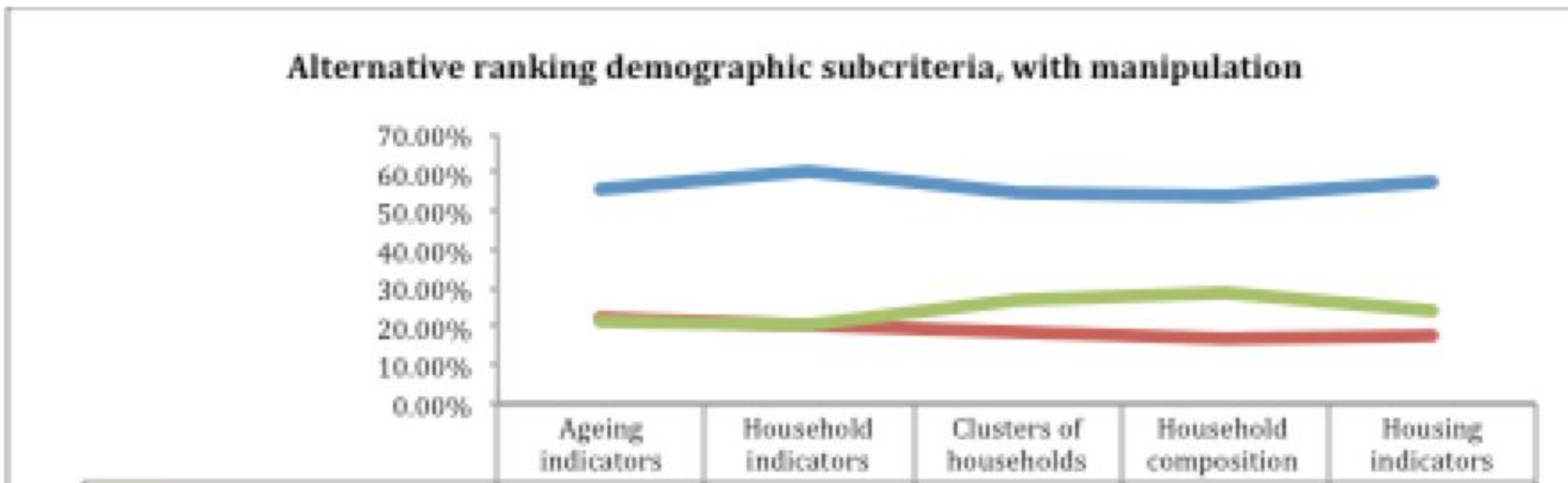
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	10.87%	13.20%	13.74%
Modernized version	40.44%	41.54%	36.27%
New construction version	48.69%	45.26%	49.99%



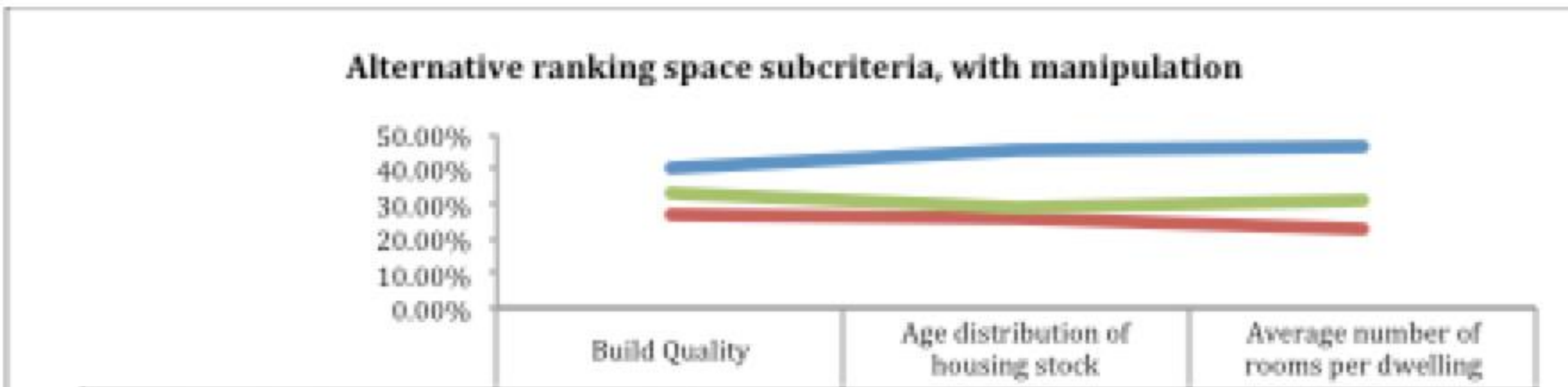
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	14.61%	15.33%	28.24%	15.10%	16.24%	24.34%	15.74%
Modernized version	44.00%	37.69%	30.06%	34.51%	38.86%	33.30%	41.09%
New construction version	41.39%	46.98%	41.71%	50.39%	44.90%	42.36%	43.16%



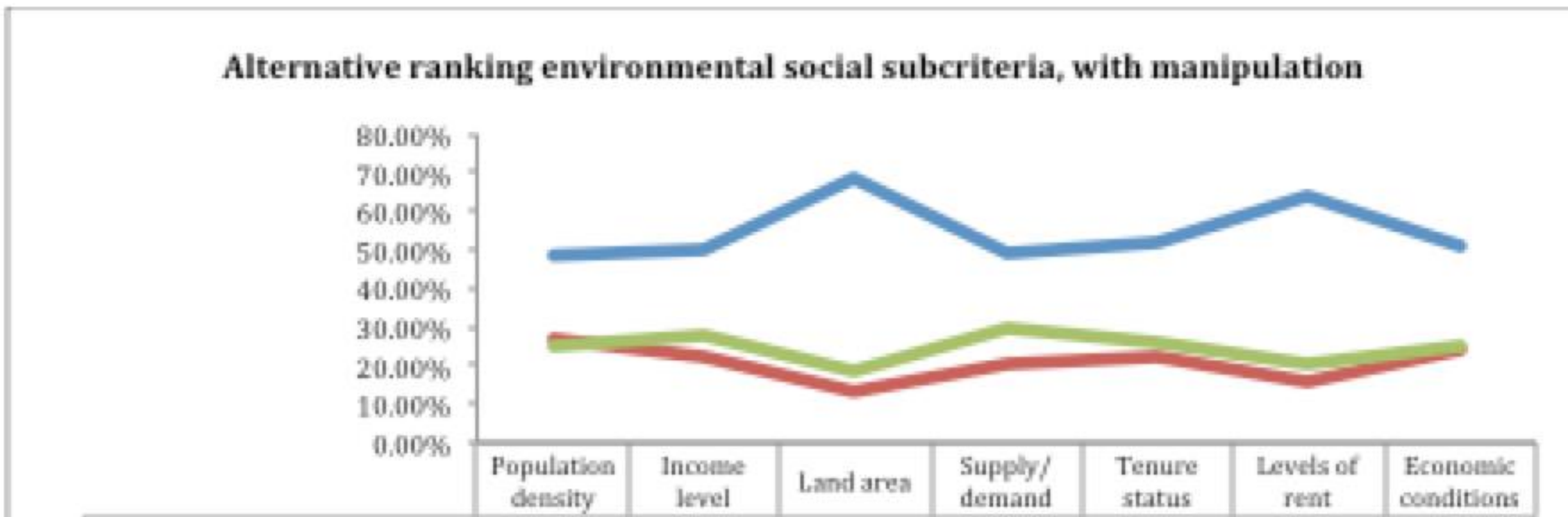
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	19.15%	12.09%	17.84%	16.84%
Portfolio B: Modernized version	35.70%	39.79%	37.58%	37.52%
Portfolio C: New construction version	45.15%	48.12%	44.58%	45.63%



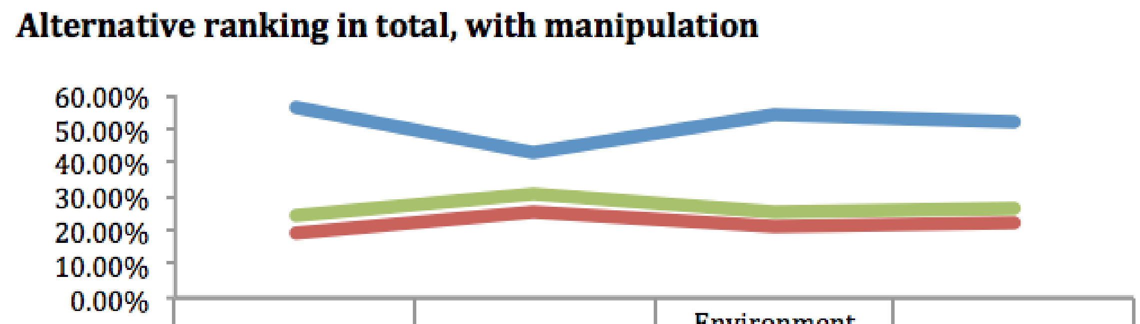
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	56.06%	59.85%	54.43%	53.92%	57.75%
Modernized version	22.48%	19.99%	18.46%	16.90%	18.02%
New construction version	21.46%	20.15%	27.12%	29.18%	24.23%



	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	40.15%	45.55%	46.71%
Modernized version	27.15%	26.06%	22.41%
New construction version	32.70%	28.39%	30.89%



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	48.47%	49.90%	68.39%	49.45%	51.60%	63.89%	50.68%
Modernized version	26.55%	22.30%	13.24%	20.55%	22.45%	15.89%	24.05%
New construction version	24.98%	27.80%	18.37%	30.00%	25.95%	20.22%	25.26%



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	56.50%	42.95%	53.74%	51.97%
Portfolio B: Modernized version	19.16%	25.83%	21.21%	21.69%
Portfolio C: New construction version	24.35%	31.22%	25.05%	26.34%

Source: Own analyses

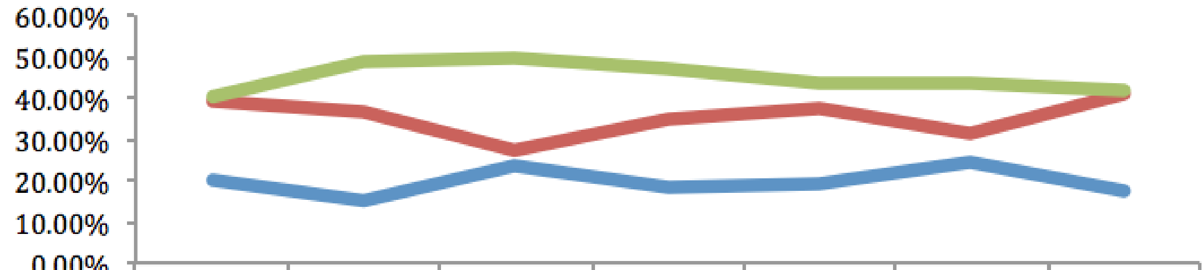
- *Estonia, Latvia, Lithuania:*

Also for simulation 1, the most central criterion is the environmental social one with an eigenvector of 41.88%. Consequently the eigenvectors of the extrapolated versions of the environmental social characteristics are influenced to change the overall alternative ranking for these countries. To influence the overall outcome, the pairwise comparisons are increased with a percentage of 650.0%.

The real results of the countries embrace a share of 18.08% for the extrapolated version and significant shares for a customisation with quotations of 37.21% for the modernized and 44.71% for the new-construction versions. In simulation 1, the extrapolated versions of the environmental subcriteria transform to high eigenvectors with the general conclusion that the alternative ranking in total develop to a small preference for 35.31% of the extrapolated version over the additional alternatives as determined following (Appendix 136):

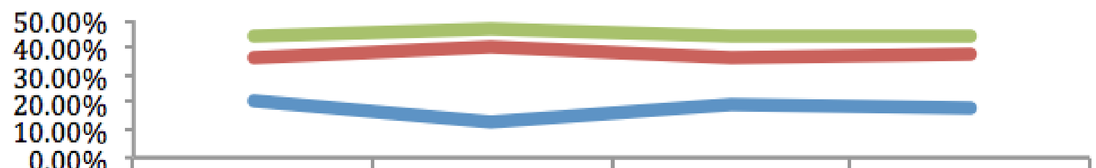
Figure 6.17 Simulation 1 of the sensitivity analysis, Estonia, Latvia, Lithuania

Alternative ranking environmental social subcriteria, without manipulation



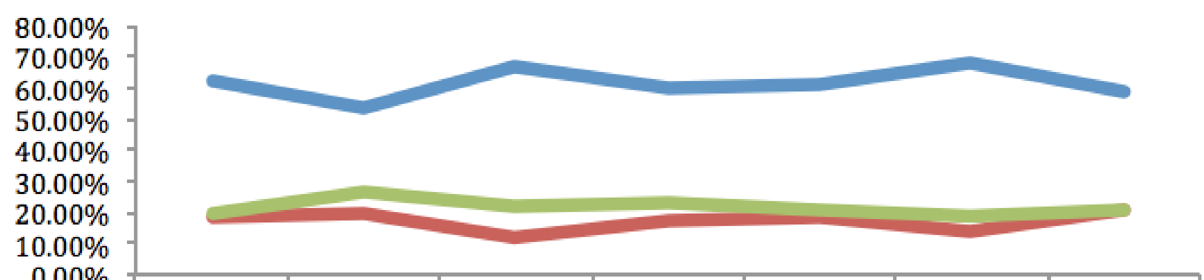
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	20.19%	15.03%	23.57%	18.38%	19.56%	24.41%	17.68%
Modernized version	39.55%	36.38%	27.24%	34.55%	37.23%	31.71%	40.57%
New construction version	40.26%	48.59%	49.18%	47.07%	43.21%	43.88%	41.75%

Alternative ranking in total, without manipulation

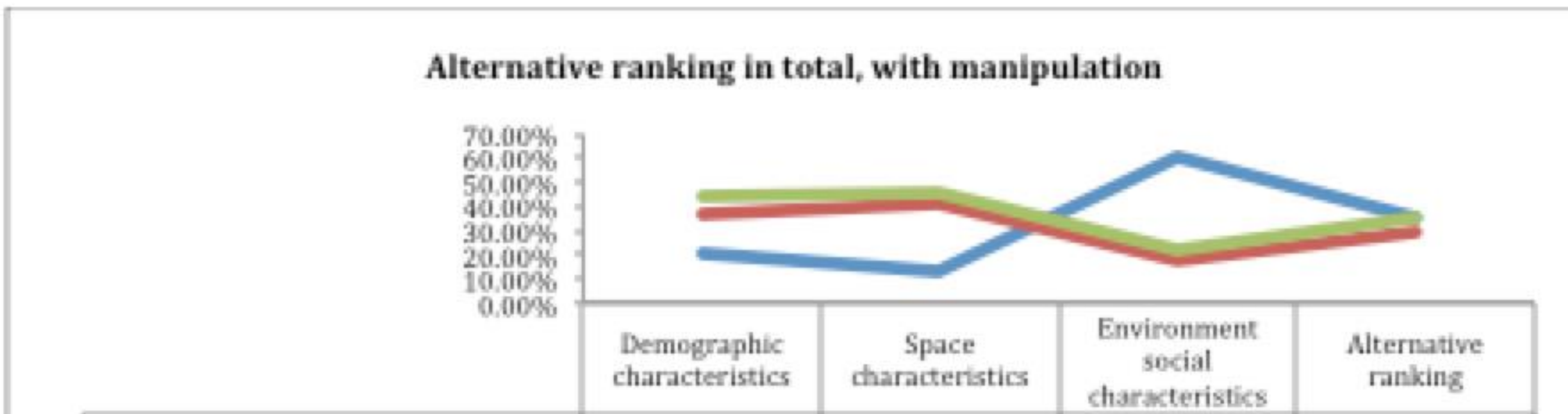


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.05%	12.95%	19.33%	18.08%
Portfolio B: Modernized version	36.31%	40.82%	35.93%	37.21%
Portfolio C: New construction version	43.64%	46.22%	44.74%	44.71%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	62.18%	53.49%	66.72%	59.41%	61.25%	67.73%	58.26%
Modernized version	18.74%	19.91%	11.86%	17.18%	17.93%	13.54%	20.57%
New construction version	19.08%	26.59%	21.41%	23.41%	20.82%	18.73%	21.17%

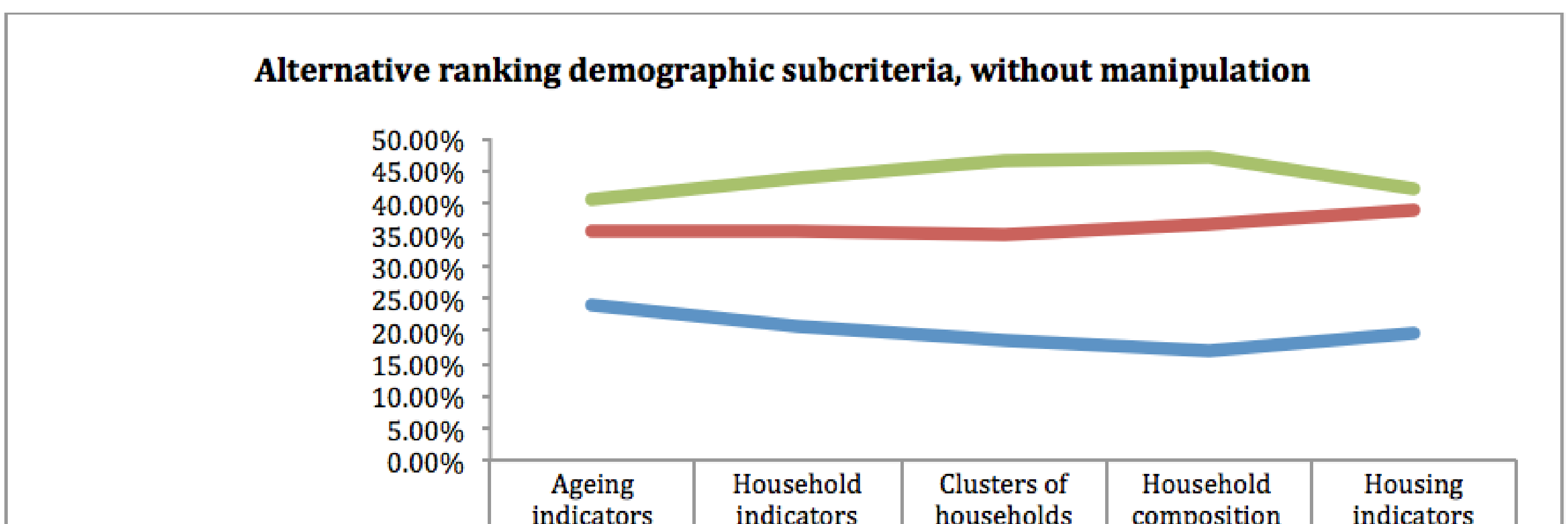


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.05%	12.95%	60.47%	35.31%
Portfolio B: Modernized version	36.31%	40.82%	17.65%	29.55%
Portfolio C: New construction version	43.64%	46.22%	21.89%	35.14%

Source: Own analyses

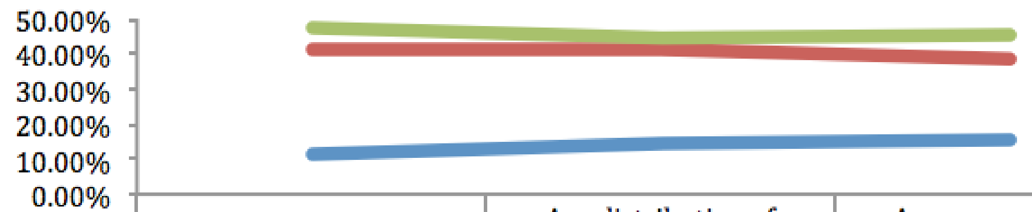
Simulation 2 manipulates all pairwise comparisons in the third level of the hierarchy for the extrapolated alternative and increases the values by 500.0% with the effect of important significances in the demographic, social and environmental social and overall consequences. The total alternative ranking then expresses a quotation of 51.84% for the extrapolated version. Simulation 2 is outlined below (Appendix 137).

Figure 6.18 Simulation 2 of the sensitivity analysis, Estonia, Latvia, Lithuania



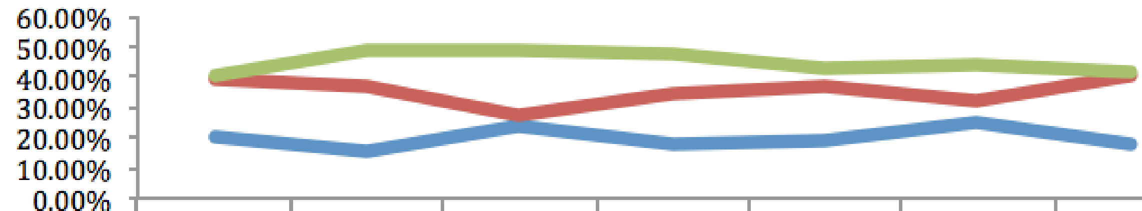
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	24.04%	20.69%	18.50%	16.80%	19.49%
Modernized version	35.59%	35.78%	34.77%	36.43%	38.56%
New construction version	40.37%	43.52%	46.73%	46.76%	41.95%

Alternative ranking space subcriteria, without manipulation



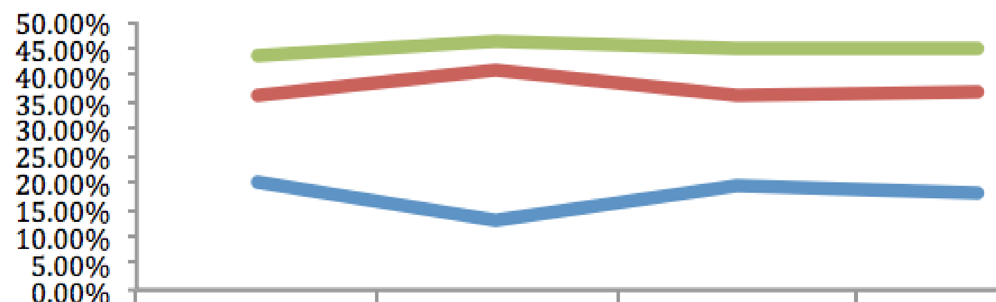
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	11.03%	14.04%	15.80%
Modernized version	41.61%	41.41%	38.54%
New construction version	47.36%	44.55%	45.65%

Alternative ranking environmental social subcriteria, without manipulation



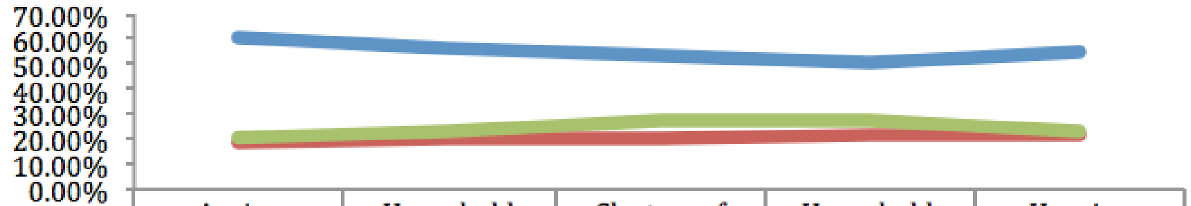
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	20.19%	15.03%	23.57%	18.38%	19.56%	24.41%	17.68%
Modernized version	39.55%	36.38%	27.24%	34.55%	37.23%	31.71%	40.57%
New construction version	40.26%	48.59%	49.18%	47.07%	43.21%	43.88%	41.75%

Alternative ranking in total, without manipulation



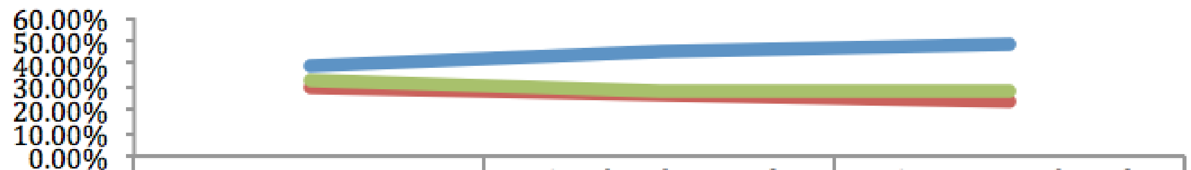
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.05%	12.95%	19.33%	18.08%
Portfolio B: Modernized version	36.31%	40.82%	35.93%	37.21%
Portfolio C: New construction version	43.64%	46.22%	44.74%	44.71%

Alternative ranking demographic subcriteria, with manipulation



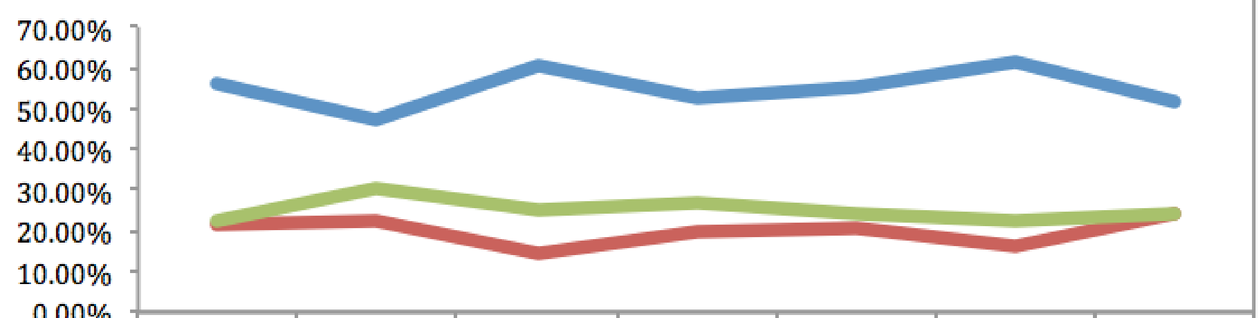
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	61.27%	56.61%	53.16%	50.24%	54.75%
Modernized version	18.15%	19.58%	19.98%	21.79%	21.67%
New construction version	20.58%	23.81%	26.86%	27.97%	23.58%

Alternative ranking space subcriteria, with manipulation

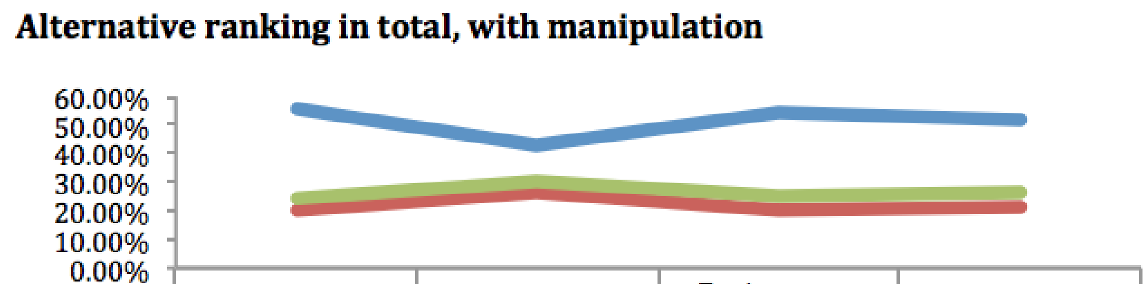


	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	38.27%	44.95%	48.41%
Modernized version	28.87%	26.52%	23.62%
New construction version	32.86%	28.53%	27.97%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	55.84%	46.94%	60.67%	52.96%	54.87%	61.75%	51.78%
Modernized version	21.88%	22.72%	14.02%	19.91%	20.89%	16.05%	23.77%
New construction version	22.28%	30.34%	25.31%	27.13%	24.24%	22.20%	24.45%



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	55.46%	42.43%	54.13%	51.84%
Portfolio B: Modernized version	20.21%	27.00%	20.47%	21.92%
Portfolio C: New construction version	24.34%	30.57%	25.40%	26.25%

Source: Own analyses

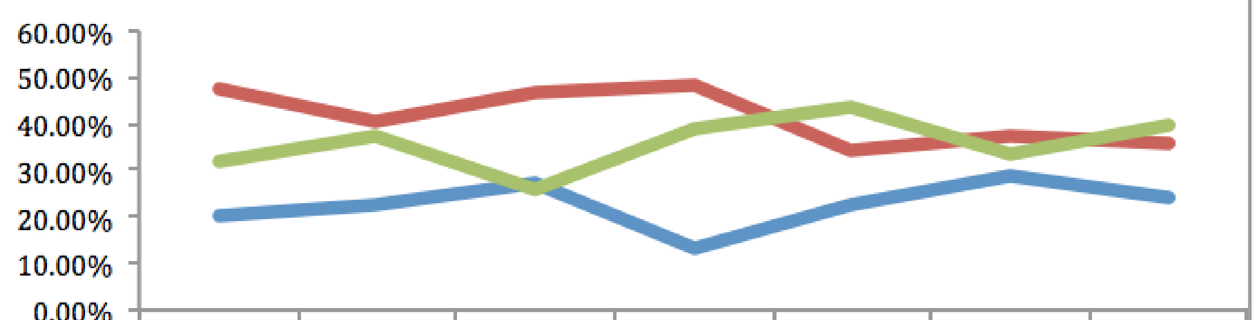
- *Germany:*

In simulation 1 of Germany, also the key criterion is the environmental social one with a share of 42.8%. Hence, the extrapolated version eigenvectors of the environmental social subcriteria are persuaded to change the alternative rankings in total. To manipulate the overall ranking, the pairwise comparisons are enlarged by 600.0%.

The non-manipulated results of the countries outline quotations of 21.21% for the extrapolated alternative and 47.03% for the modernized as well as 31.76% for the new-construction versions. In simulation 1, the total ranking changes to a first rank of the extrapolated alternative with 38.39%, a second ranking for the modernized version with 37.92% and a new-construction option with 23.69% as illustrated in the following figure (Appendix 138).

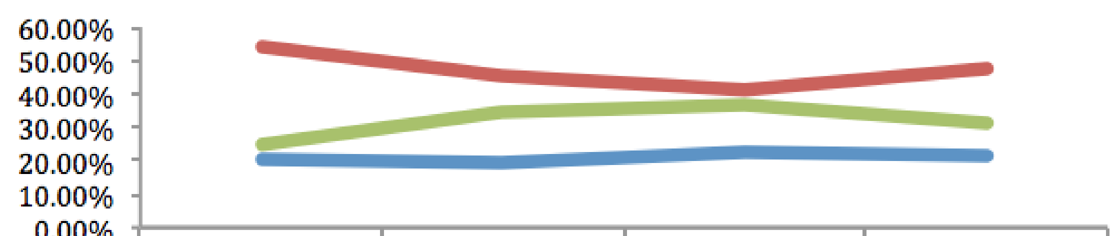
Figure 6.19 Simulation 1 of the sensitivity analysis, Germany

Alternative ranking environmental social subcriteria, without manipulation



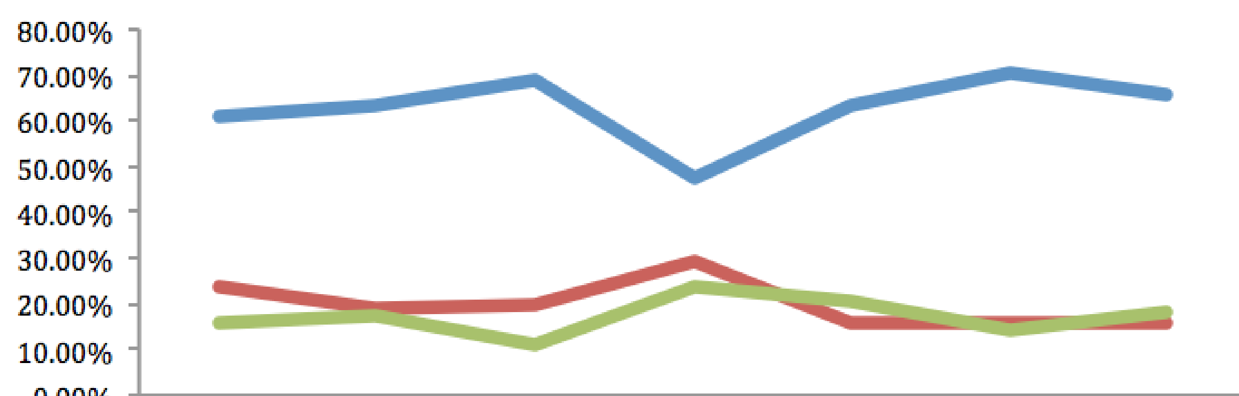
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	20.44%	22.50%	27.18%	13.03%	22.20%	28.55%	24.32%
Modernized version	47.31%	40.49%	46.94%	48.15%	34.12%	37.75%	35.85%
New construction version	32.25%	37.01%	25.88%	38.82%	43.68%	33.70%	39.82%

Alternative ranking in total, without manipulation



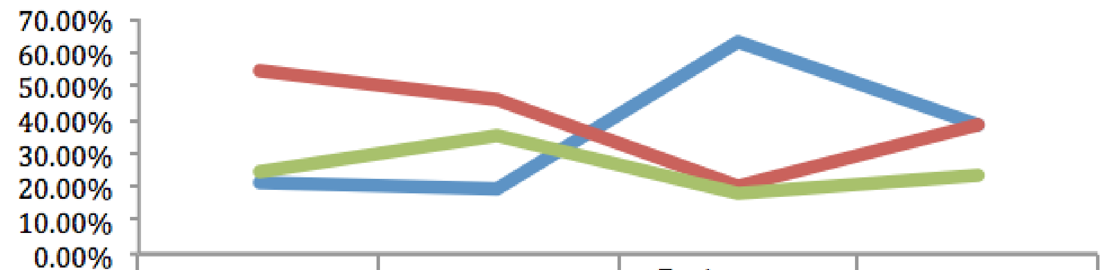
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.79%	19.37%	22.44%	21.21%
Portfolio B: Modernized version	54.34%	45.83%	41.18%	47.03%
Portfolio C: New construction version	24.87%	34.80%	36.38%	31.76%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	60.66%	63.52%	69.13%	47.34%	63.12%	70.57%	65.85%
Modernized version	23.40%	19.06%	19.90%	29.15%	16.17%	15.55%	16.18%
New construction version	15.95%	17.42%	10.97%	23.51%	20.70%	13.88%	17.97%

Alternative ranking in total, with manipulation



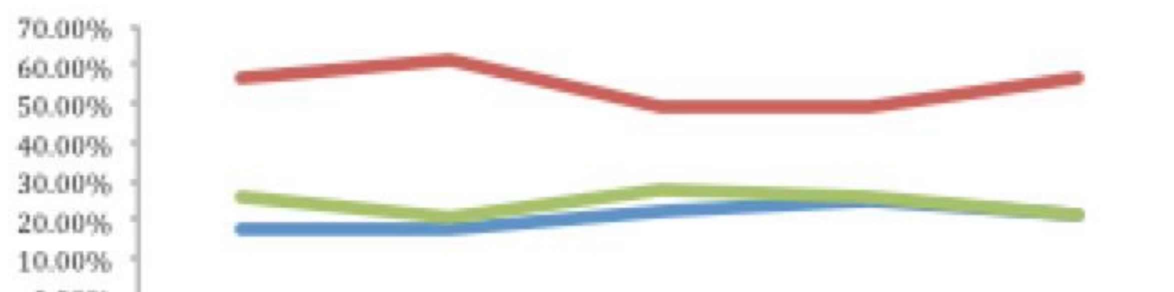
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.79%	19.37%	62.58%	38.39%
Portfolio B: Modernized version	54.34%	45.83%	19.90%	37.92%
Portfolio C: New construction version	24.87%	34.80%	17.52%	23.69%

Source: Own analyses

In simulation 2 all pairwise comparisons in the third level of the hierarchy for the extrapolated alternative are manipulated and increase the pairwise comparisons by 400.0% with the outcome of key impacts in the demographic, social and environmental social and overall consequences. The overall alternative ranking then ends with a quote of 51.43% for the extrapolated version. Simulation 2 is explained below (Appendix 139).

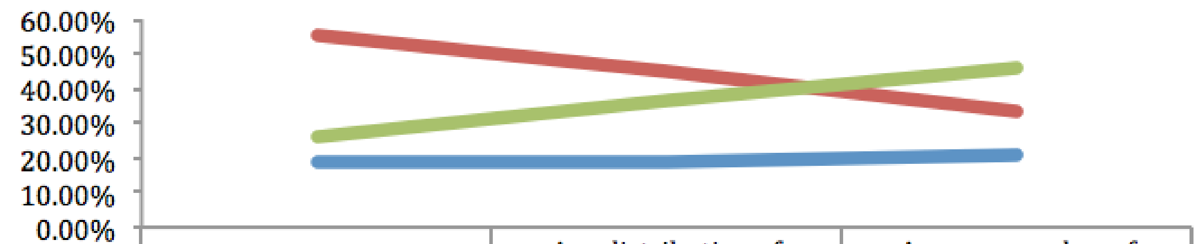
Figure 6.20 Simulation 2 of the sensitivity analysis, Germany

Alternative ranking demographic subcriteria, without manipulation



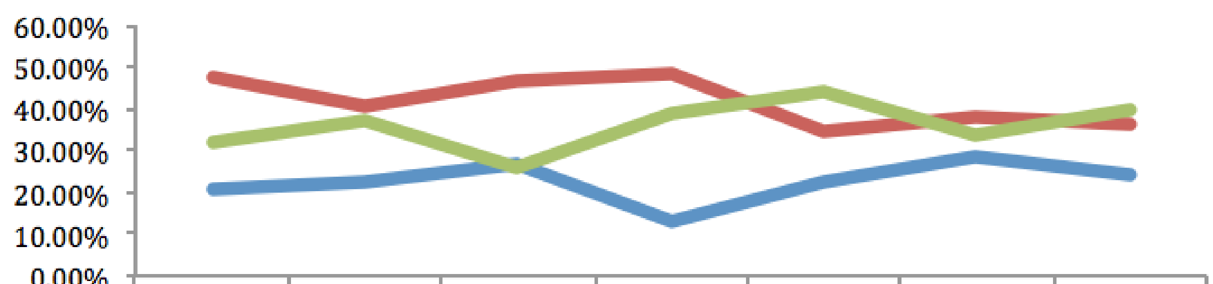
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	17.86%	17.68%	22.62%	24.71%	21.32%
Modernized version	56.19%	61.58%	49.12%	49.33%	56.90%
New construction version	25.96%	20.74%	28.27%	25.96%	21.79%

Alternative ranking space subcriteria, without manipulation



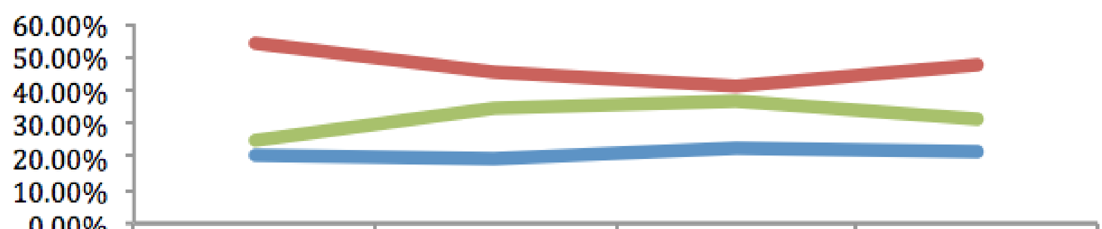
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	18.52%	18.60%	21.32%
Modernized version	55.51%	45.12%	33.14%
New construction version	25.97%	36.28%	45.53%

Alternative ranking environmental social subcriteria, without manipulation



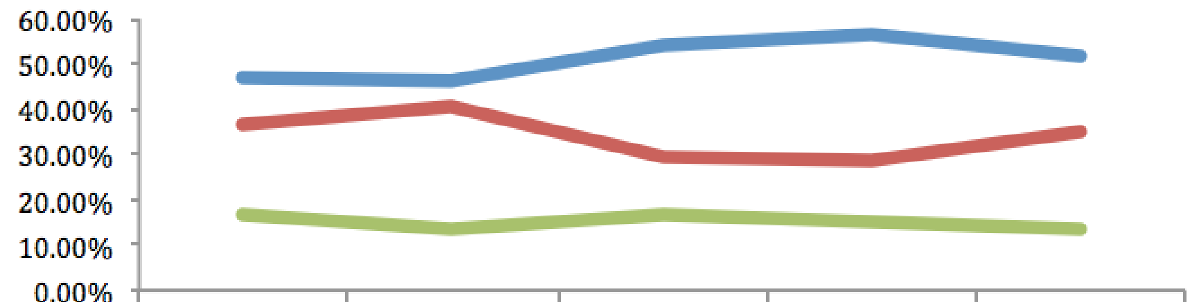
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	20.44%	22.50%	27.18%	13.03%	22.20%	28.55%	24.32%
Modernized version	47.31%	40.49%	46.94%	48.15%	34.12%	37.75%	35.85%
New construction version	32.25%	37.01%	25.88%	38.82%	43.68%	33.70%	39.82%

Alternative ranking in total, without manipulation



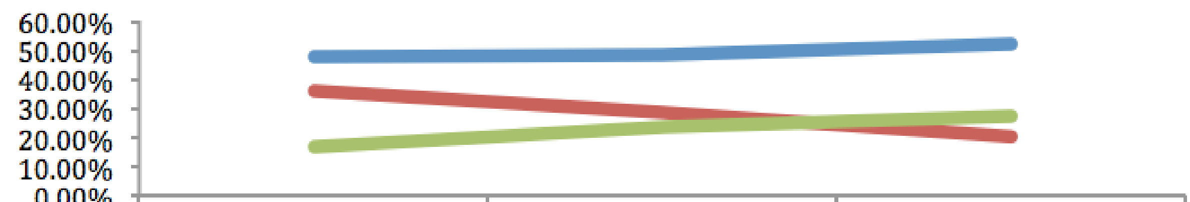
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.79%	19.37%	22.44%	21.21%
Portfolio B: Modernized version	54.34%	45.83%	41.18%	47.03%
Portfolio C: New construction version	24.87%	34.80%	36.38%	31.76%

Alternative ranking demographic subcriteria, with manipulation



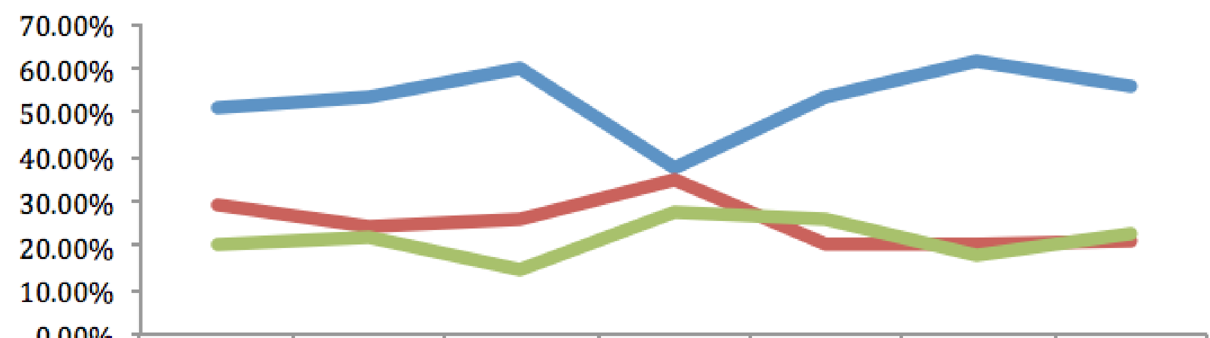
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	46.51%	46.21%	53.90%	56.76%	52.01%
Modernized version	36.59%	40.24%	29.26%	28.33%	34.70%
New construction version	16.90%	13.55%	16.84%	14.91%	13.29%

Alternative ranking space subcriteria, with manipulation

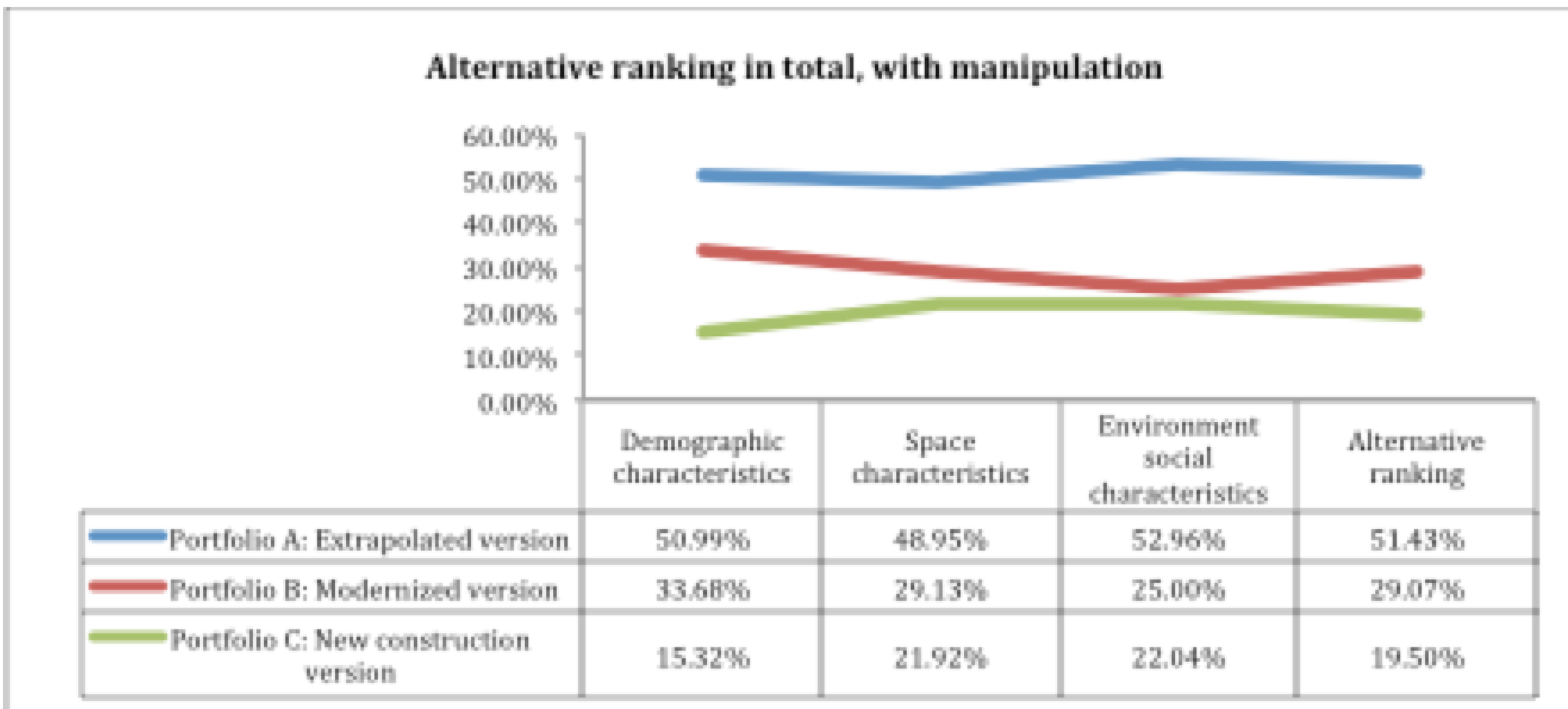


	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	47.62%	47.75%	52.02%
Modernized version	35.69%	28.96%	20.21%
New construction version	16.70%	23.29%	27.77%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	50.69%	53.73%	59.89%	37.48%	53.30%	61.51%	56.25%
Modernized version	29.33%	24.18%	25.85%	34.61%	20.48%	20.33%	20.73%
New construction version	19.99%	22.10%	14.25%	27.91%	26.22%	18.15%	23.02%



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	50.99%	48.95%	52.96%	51.43%
Portfolio B: Modernized version	33.68%	29.13%	25.00%	29.07%
Portfolio C: New construction version	15.32%	21.92%	22.04%	19.50%

Source: Own analyses

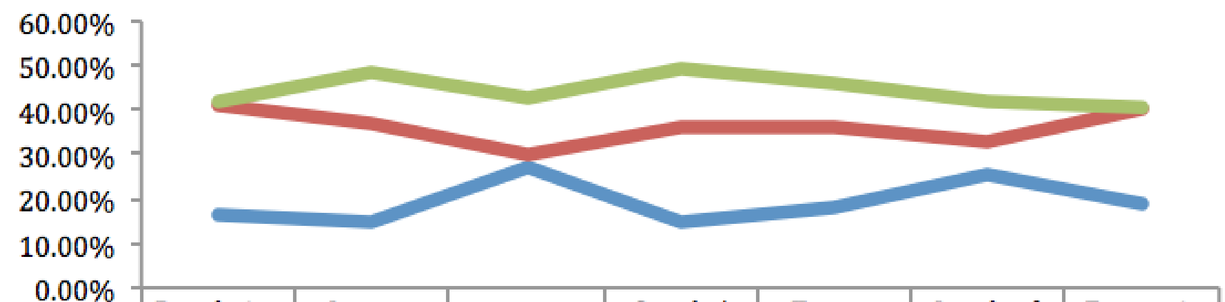
- *Hungary:*

Because the environmental social criterion is the most important variable with a percentage of 44.98%, in simulation 1 the eigenvectors of the extrapolated version of the environmental social subcriteria are manipulated by 600.0%.

The non-manipulated and the manipulated results show different shares of 18.71% for the extrapolated, 36.71% for the modernized and 44.58% for the new-construction versions in the non-manipulated results in contrast to the manipulated outcomes of simulation 1 with 36.12% for the extrapolated, 28.85% for the modernized and 35.03% for the new-construction alternatives as highlighted below (Appendix 140).

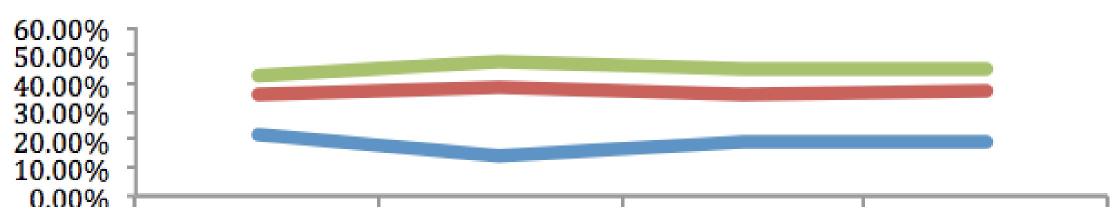
Figure 6.21 Simulation 1 of the sensitivity analysis, Hungary

Alternative ranking environmental social subcriteria, without manipulation



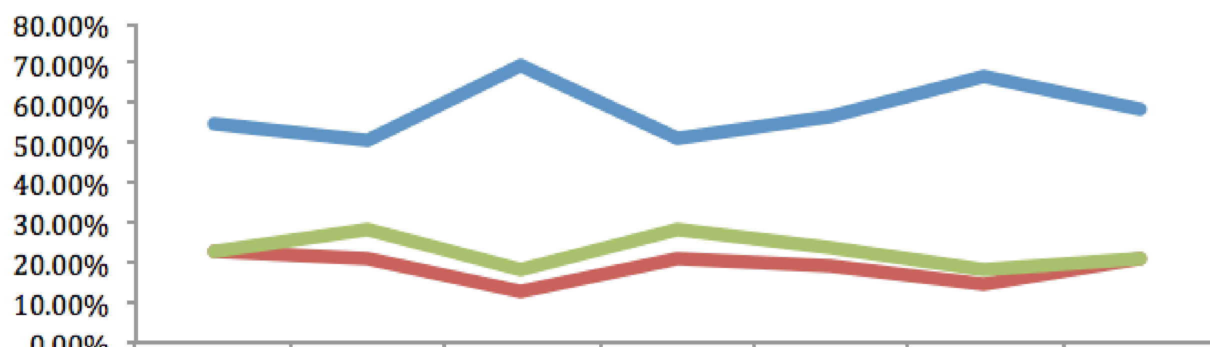
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	16.72%	14.64%	27.41%	14.99%	17.98%	25.07%	19.04%
Modernized version	41.35%	36.67%	29.97%	36.05%	36.25%	32.78%	40.38%
New construction version	41.93%	48.69%	42.62%	48.96%	45.77%	42.15%	40.58%

Alternative ranking in total, without manipulation

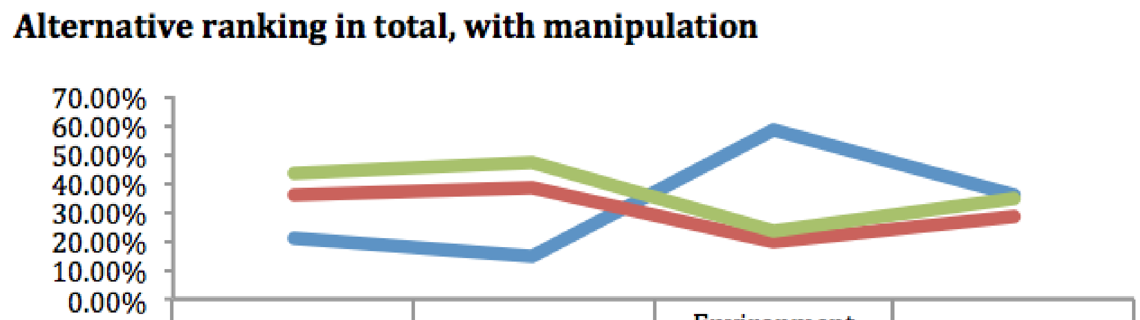


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	21.30%	14.23%	18.90%	18.71%
Portfolio B: Modernized version	35.91%	38.15%	36.63%	36.71%
Portfolio C: New construction version	42.79%	47.62%	44.48%	44.58%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	54.64%	50.72%	69.38%	51.41%	56.80%	66.75%	58.52%
Modernized version	22.52%	21.17%	12.64%	20.61%	19.09%	14.55%	20.69%
New construction version	22.83%	28.11%	17.98%	27.98%	24.10%	18.71%	20.79%

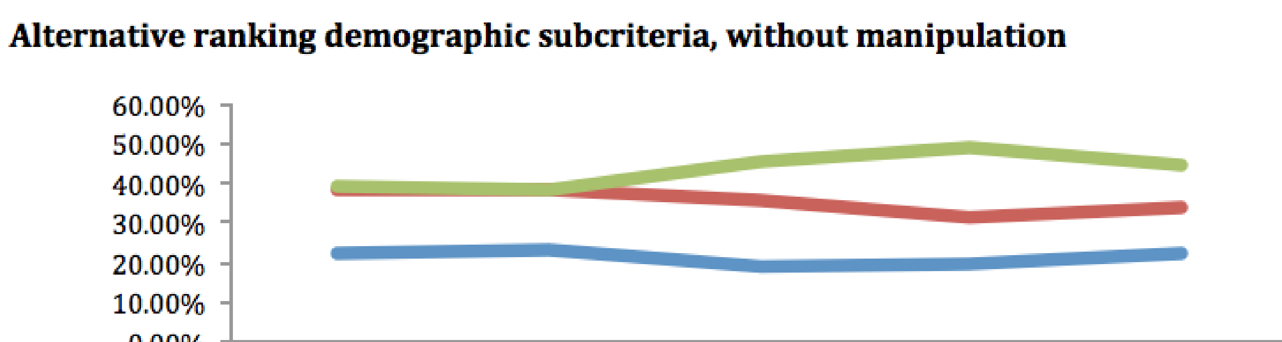


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	21.30%	14.23%	57.61%	36.12%
Portfolio B: Modernized version	35.91%	38.15%	19.14%	28.85%
Portfolio C: New construction version	42.79%	47.62%	23.25%	35.03%

Source: Own analyses

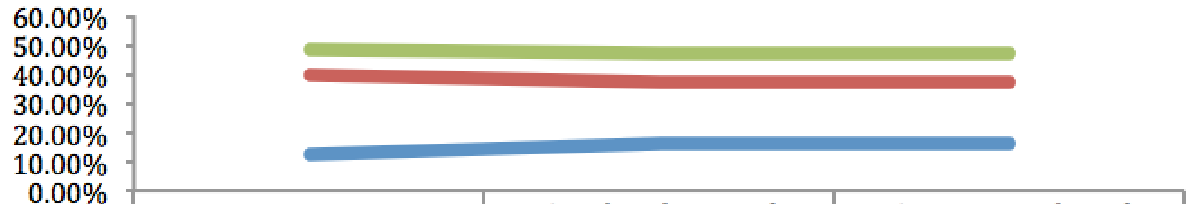
In simulation 2 all values of the pairwise comparisons in the third level of the hierarchy for the extrapolated alternative are influenced and increase the pairwise comparisons by 450.0% with an effect of central influences in the demographic, space and environmental social and the overall results. The overall alternative ranking then concludes with a share of 50.31% for the extrapolated version. Simulation 2 is clarified in the following figure (Appendix 141).

Figure 6.22 Simulation 2 of the sensitivity analysis, Hungary



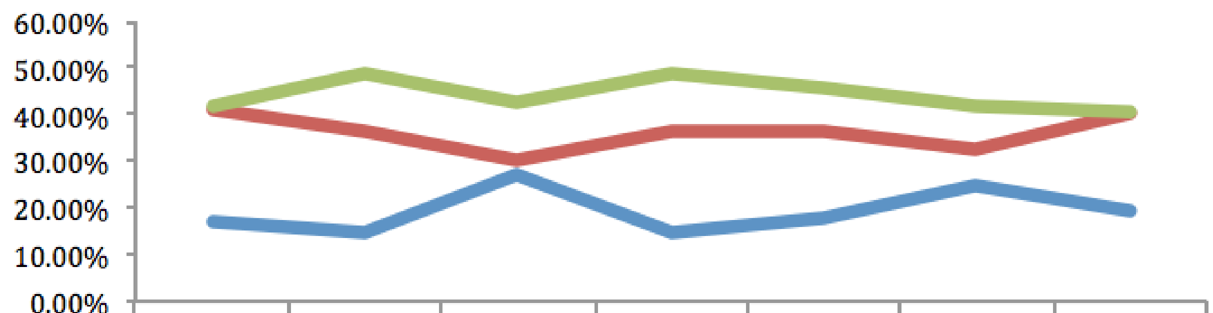
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	22.20%	23.28%	18.91%	19.61%	21.86%
Modernized version	38.36%	38.51%	35.74%	31.29%	33.93%
New construction version	39.43%	38.21%	45.35%	49.10%	44.20%

Alternative ranking space subcriteria, without manipulation



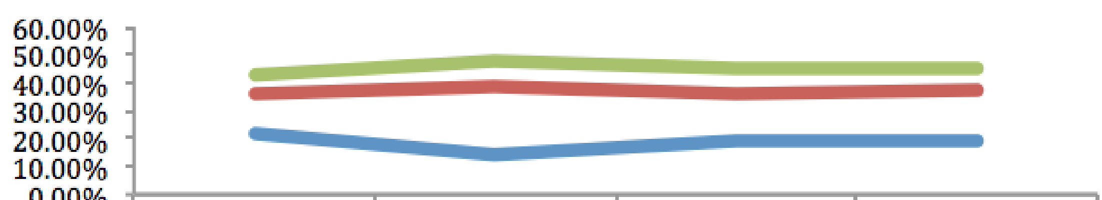
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	12.13%	16.02%	15.98%
Modernized version	39.39%	37.54%	36.58%
New construction version	48.48%	46.44%	47.44%

Alternative ranking environmental social subcriteria, without manipulation



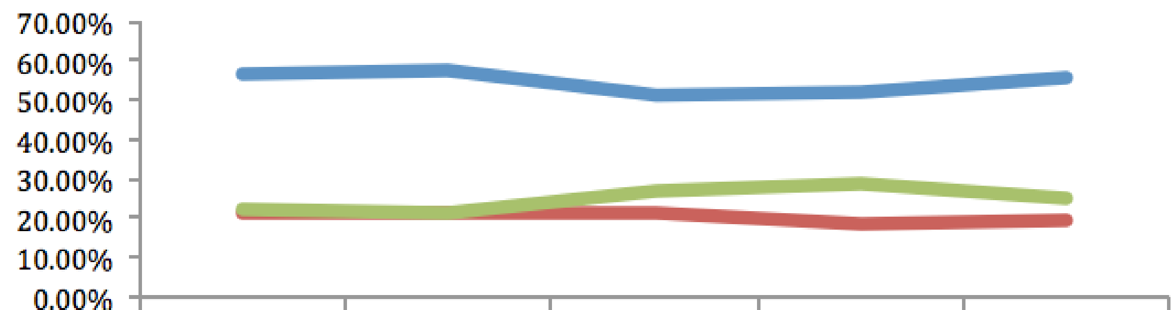
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	16.72%	14.64%	27.41%	14.99%	17.98%	25.07%	19.04%
Modernized version	41.35%	36.67%	29.97%	36.05%	36.25%	32.78%	40.38%
New construction version	41.93%	48.69%	42.62%	48.96%	45.77%	42.15%	40.58%

Alternative ranking in total, without manipulation



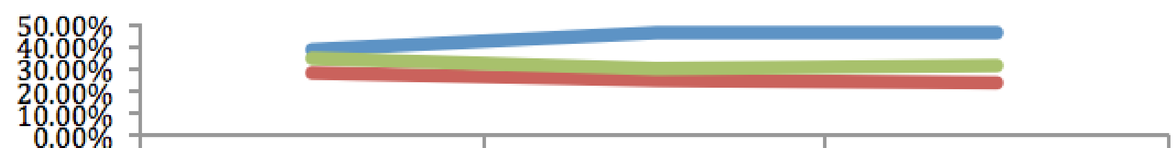
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	21.30%	14.23%	18.90%	18.71%
Portfolio B: Modernized version	35.91%	38.15%	36.63%	36.71%
Portfolio C: New construction version	42.79%	47.62%	44.48%	44.58%

Alternative ranking demographic subcriteria, with manipulation



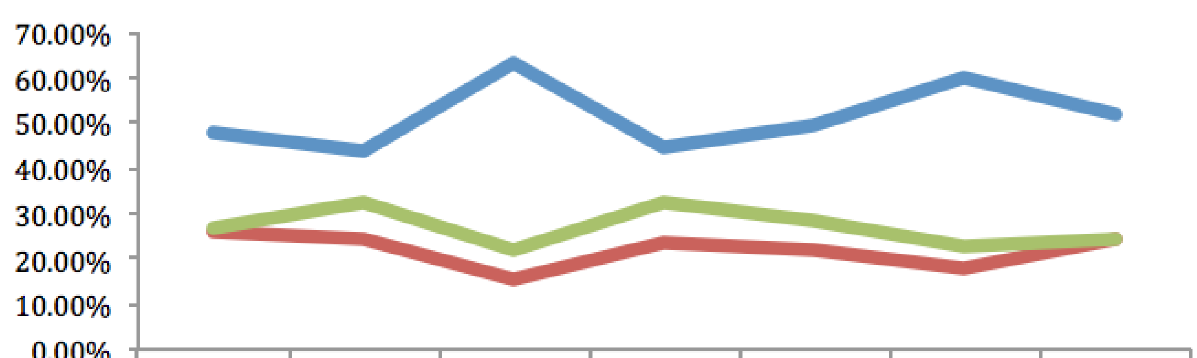
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	56.22%	57.73%	51.20%	52.33%	55.74%
Modernized version	21.59%	21.22%	21.51%	18.55%	19.22%
New construction version	22.19%	21.05%	27.29%	29.12%	25.04%

Alternative ranking space subcriteria, with manipulation



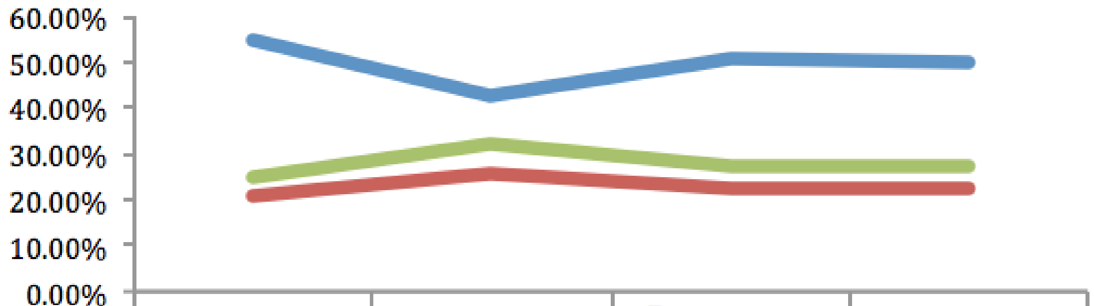
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	38.32%	46.19%	46.11%
Modernized version	27.65%	24.05%	23.46%
New construction version	34.03%	29.75%	30.43%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	47.47%	43.56%	62.95%	44.24%	49.66%	60.09%	51.41%
Modernized version	26.08%	24.25%	15.30%	23.65%	22.25%	17.46%	24.23%
New construction version	26.45%	32.19%	21.75%	32.11%	28.09%	22.45%	24.35%

Alternative ranking in total, with manipulation



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	54.83%	42.56%	50.60%	50.31%
Portfolio B: Modernized version	20.57%	25.56%	22.31%	22.42%
Portfolio C: New construction version	24.60%	31.88%	27.09%	27.28%

Source: Own analyses

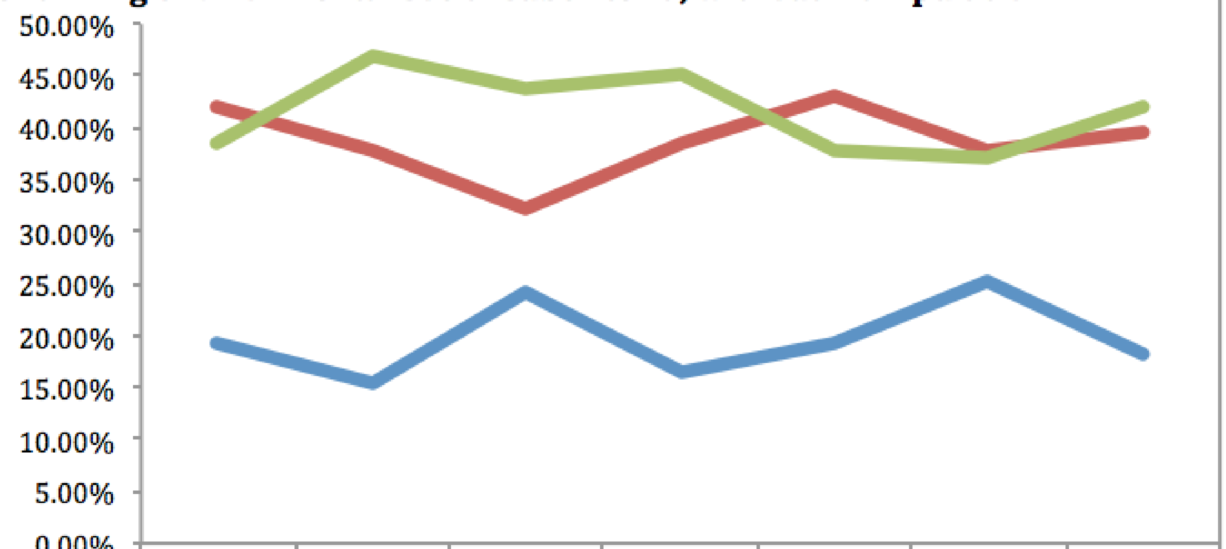
- *Poland:*

Analogous to the other afore-mentioned countries, also for Poland the environmental social criterion is the central criterion with a quote of 41.83% and, therefore, the area for simulation 1, where the eigenvectors of the extrapolated version of the environmental social subcriteria are manipulated with a 650.0% increase.

The real alternative results validate shares of 17.62% for the extrapolated, 38.76% for the modernized and 43.62% for the new-construction versions. The manipulated alternatives of simulation 1 include percentages of 34.81% for the extrapolated, 30.46% for the modernized and 34.73% for the new-construction alternatives, which indicates a slight preference for the extrapolated version as outlined below (Appendix 142):

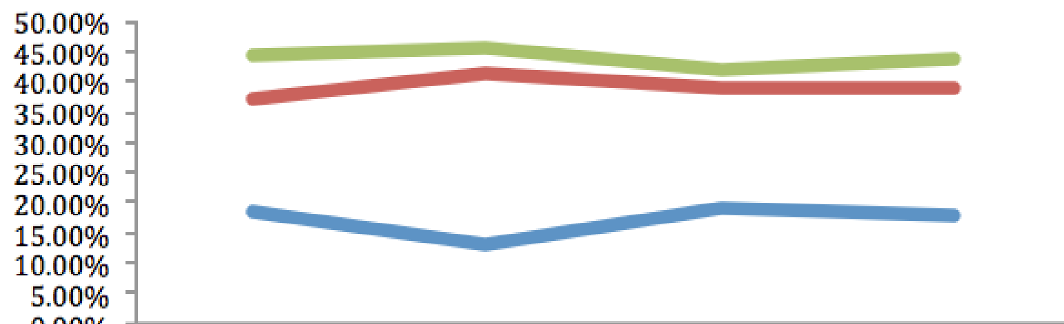
Figure 6.23 Simulation 1 of the sensitivity analysis, Poland

Alternative ranking environmental social subcriteria, without manipulation



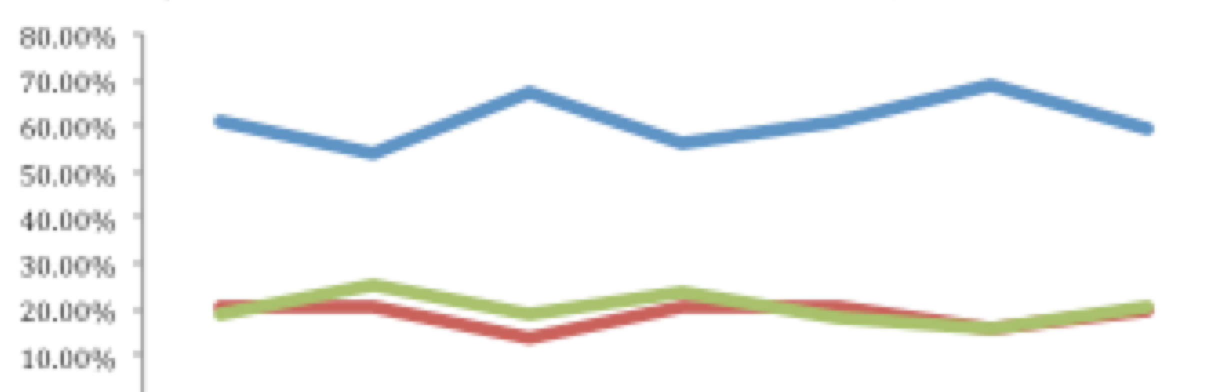
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	19.31%	15.28%	24.12%	16.42%	19.16%	25.31%	18.35%
Modernized version	42.02%	37.85%	32.07%	38.55%	42.93%	37.76%	39.72%
New construction version	38.68%	46.87%	43.81%	45.03%	37.92%	36.94%	41.93%

Alternative ranking in total, without manipulation



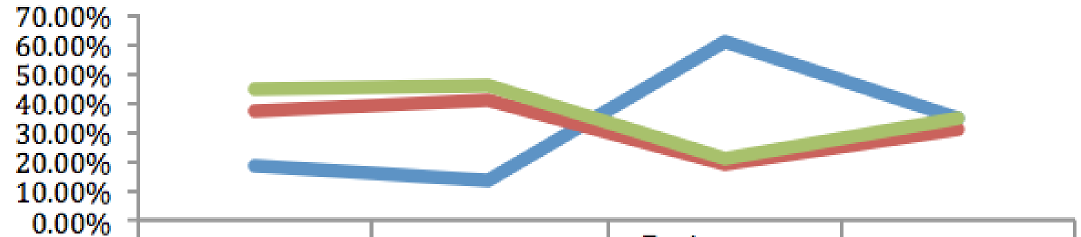
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	18.49%	12.89%	19.36%	17.62%
Portfolio B: Modernized version	37.11%	41.30%	38.85%	38.76%
Portfolio C: New construction version	44.40%	45.81%	41.79%	43.62%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	60.86%	53.97%	67.39%	56.09%	60.63%	68.77%	59.36%
Modernized version	20.38%	20.56%	13.78%	20.25%	20.90%	15.79%	19.77%
New construction version	18.76%	25.46%	18.83%	23.66%	18.46%	15.44%	20.87%

Alternative ranking in total, with manipulation



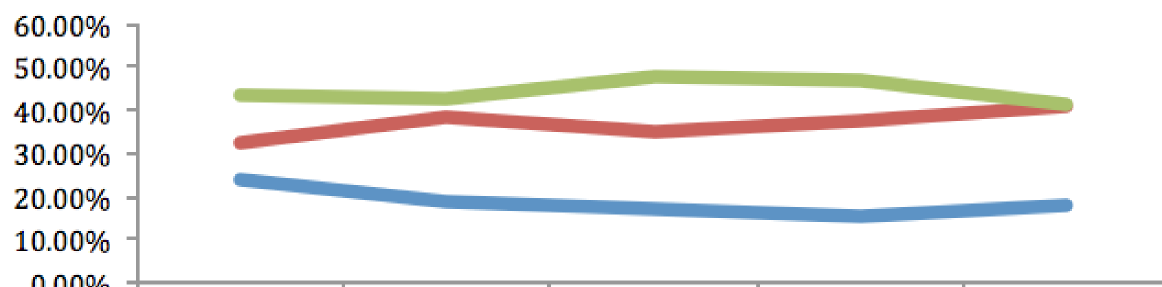
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	18.49%	12.89%	60.46%	34.81%
Portfolio B: Modernized version	37.11%	41.30%	19.01%	30.46%
Portfolio C: New construction version	44.40%	45.81%	20.53%	34.73%

Source: Own analyses

In simulation 2 all values of the pairwise comparisons in the third level of the hierarchy for the extrapolated alternative are manipulated with a 500.0% increase with an overall outcome of a high preference for the extrapolated version of 51.0% and low shares for the customisation with 23.07% for the modernized and 25.93% for the new-construction alternative as shown in the following figure (Appendix 143).

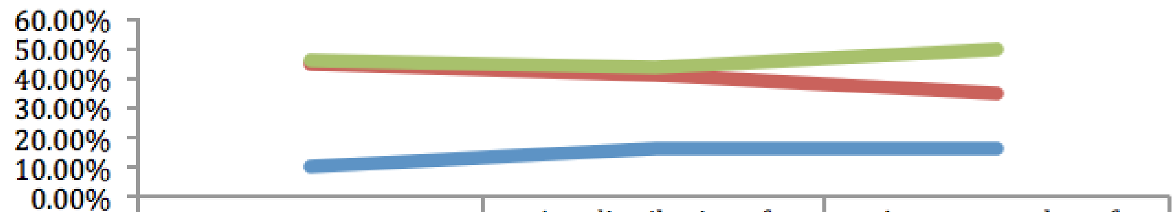
Figure 6.24 Simulation 2 of the sensitivity analysis, Poland

Alternative ranking demographic subcriteria, without manipulation



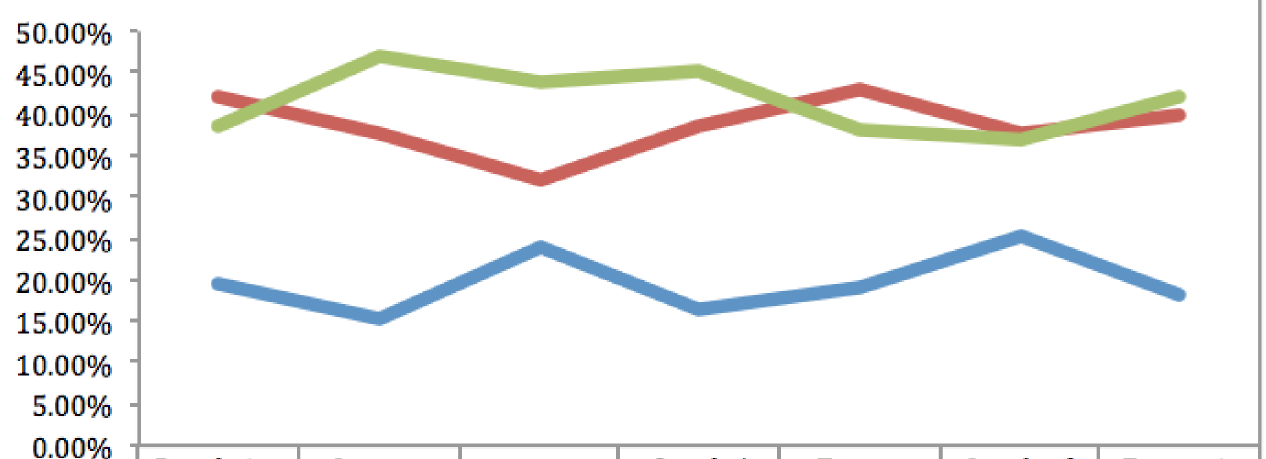
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	24.25%	18.79%	17.30%	15.19%	17.96%
Modernized version	31.94%	38.59%	34.78%	37.67%	40.77%
New construction version	43.81%	42.61%	47.91%	47.14%	41.27%

Alternative ranking space subcriteria, without manipulation



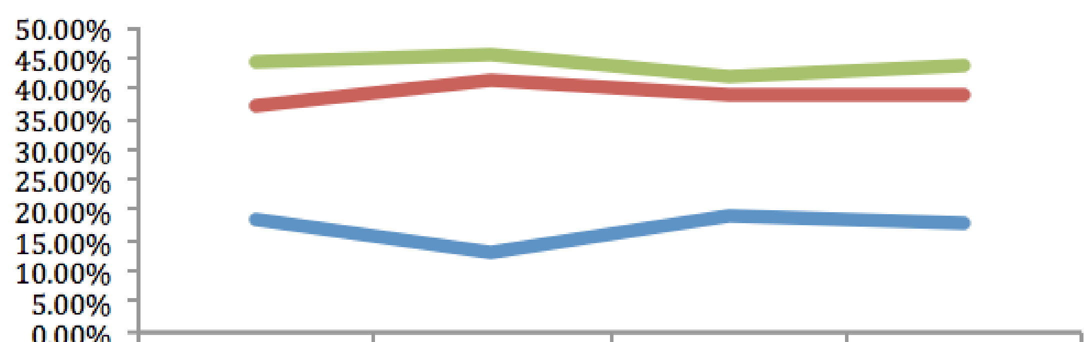
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	9.98%	15.97%	16.23%
Modernized version	44.81%	40.67%	34.34%
New construction version	45.21%	43.36%	49.43%

Alternative ranking environmental social subcriteria, without manipulation

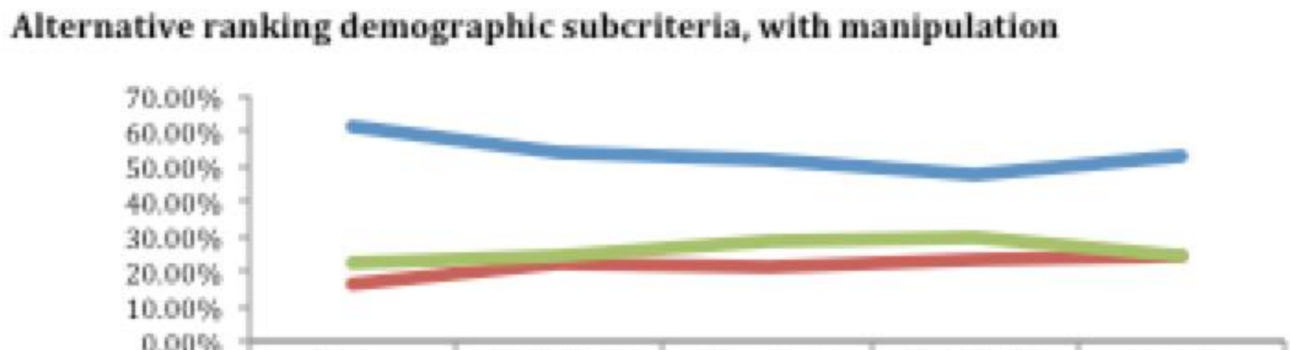


	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	19.31%	15.28%	24.12%	16.42%	19.16%	25.31%	18.35%
Modernized version	42.02%	37.85%	32.07%	38.55%	42.93%	37.76%	39.72%
New construction version	38.68%	46.87%	43.81%	45.03%	37.92%	36.94%	41.93%

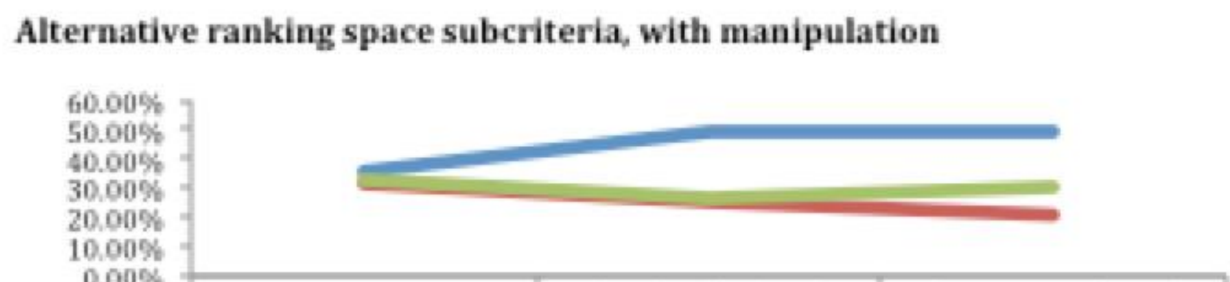
Alternative ranking in total, without manipulation



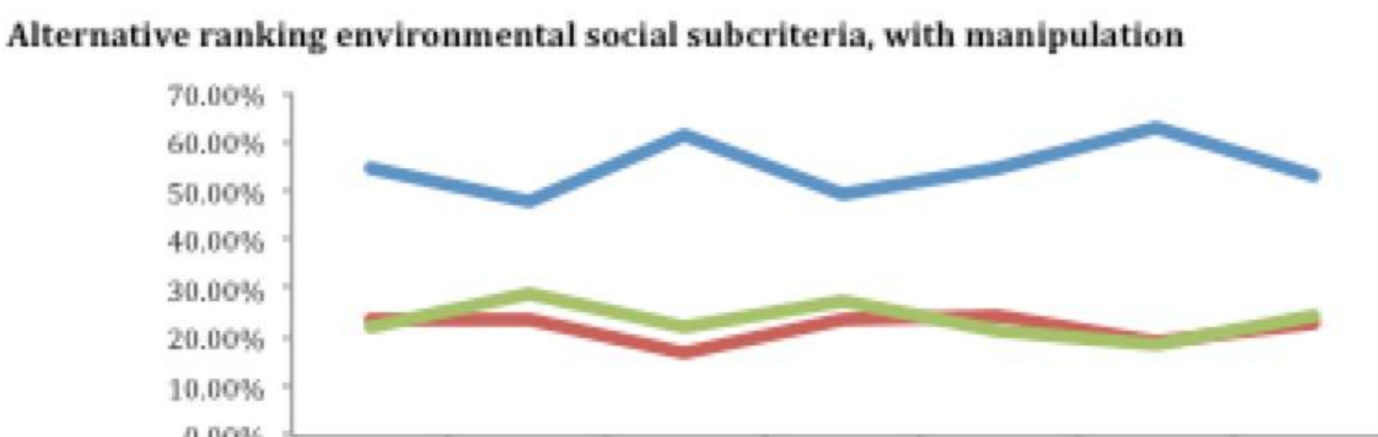
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	18.49%	12.89%	19.36%	17.62%
Portfolio B: Modernized version	37.11%	41.30%	38.85%	38.76%
Portfolio C: New construction version	44.40%	45.81%	41.79%	43.62%



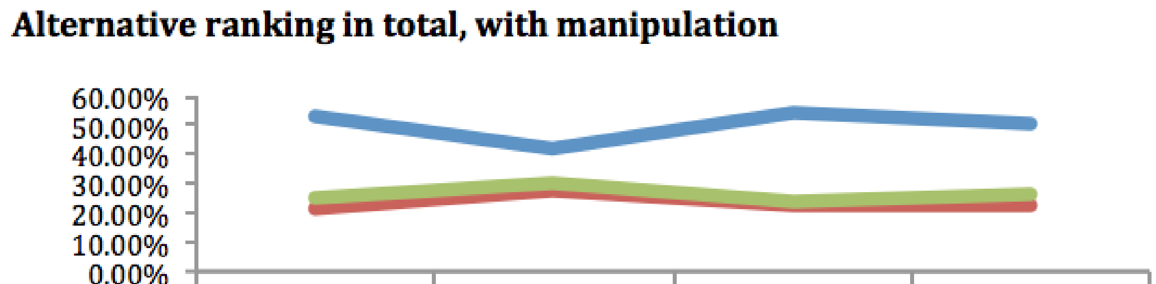
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	61.55%	53.64%	51.13%	47.25%	52.26%
Modernized version	16.21%	22.03%	20.56%	23.43%	23.72%
New construction version	22.24%	24.33%	28.32%	29.32%	24.02%



	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	35.67%	48.72%	49.20%
Modernized version	32.02%	24.81%	20.82%
New construction version	32.31%	26.46%	29.97%



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	54.47%	47.42%	61.39%	49.56%	54.23%	62.88%	52.91%
Modernized version	23.71%	23.49%	16.32%	23.27%	24.30%	18.76%	22.91%
New construction version	21.82%	29.09%	22.29%	27.17%	21.47%	18.36%	24.18%



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	52.87%	41.98%	54.13%	51.00%
Portfolio B: Modernized version	21.47%	27.63%	22.06%	23.07%
Portfolio C: New construction version	25.66%	30.39%	23.81%	25.93%

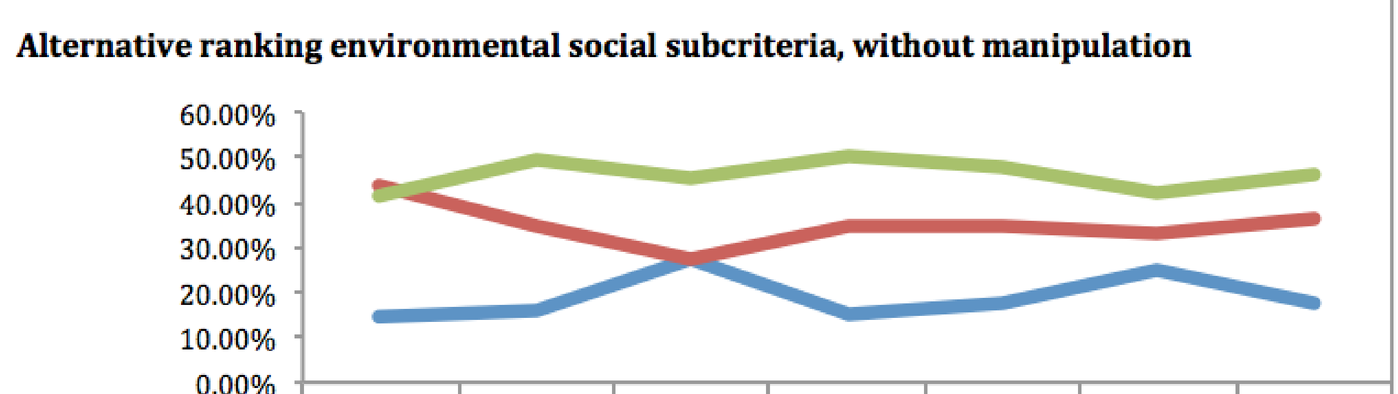
Source: Own analyses

- *Romania:*

Because the environmental social criterion is the dominant criterion with a share of 44.66%, this criterion is important for simulation 1, where the eigenvectors of the extrapolated version of the environmental social subcriteria are influenced with a 700.0% increase.

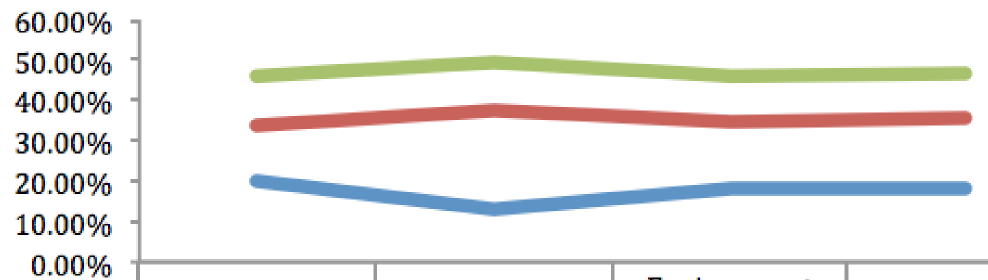
The non-manipulated extrapolated alternative comprises within the total alternative ranking a low share of 17.89%; in the manipulated version of simulation 1, this share increases to 36.78% as shown below (Appendix 144):

Figure 6.25 Simulation 1 of the sensitivity analysis, Romania



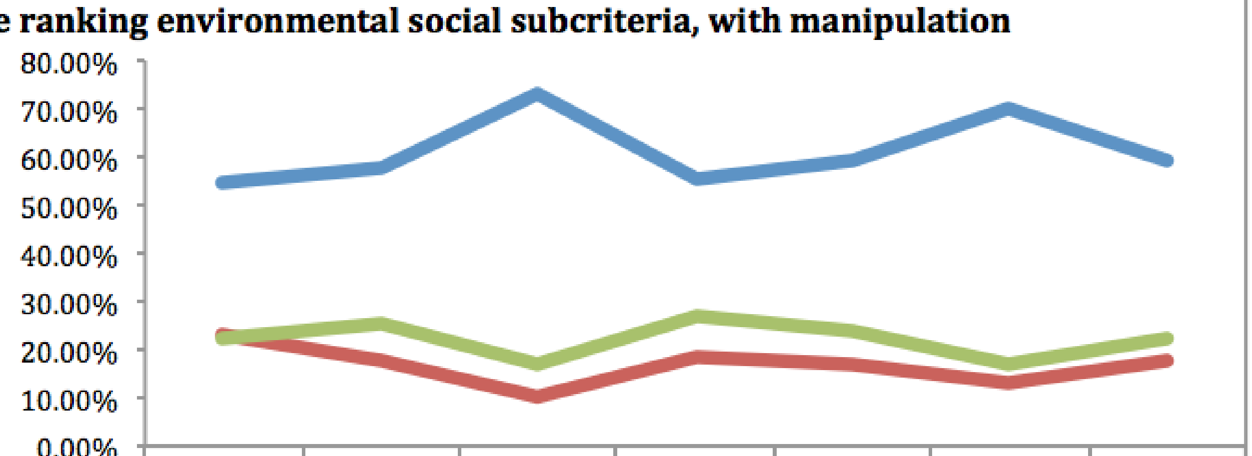
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	14.61%	16.19%	27.61%	14.97%	17.31%	24.73%	17.32%
Modernized version	44.00%	34.45%	27.13%	34.43%	34.83%	33.10%	36.76%
New construction version	41.39%	49.36%	45.26%	50.59%	47.86%	42.17%	45.92%

Alternative ranking in total, without manipulation



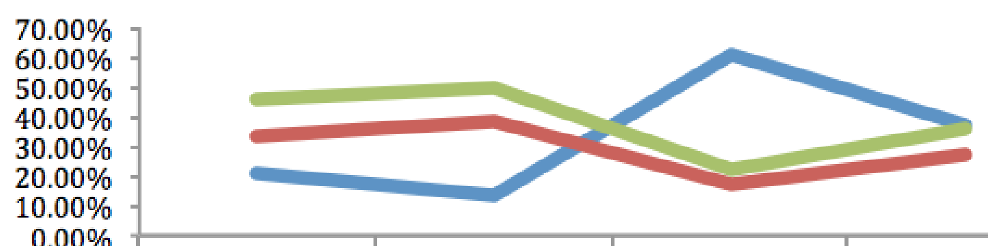
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.29%	13.08%	18.63%	17.89%
Portfolio B: Modernized version	33.63%	37.73%	35.21%	35.28%
Portfolio C: New construction version	46.08%	49.19%	46.16%	46.83%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	54.49%	57.48%	72.75%	55.21%	59.43%	69.70%	59.46%
Modernized version	23.45%	17.48%	10.21%	18.14%	17.09%	13.32%	18.03%
New construction version	22.06%	25.04%	17.04%	26.65%	23.48%	16.98%	22.51%

Alternative ranking in total, with manipulation



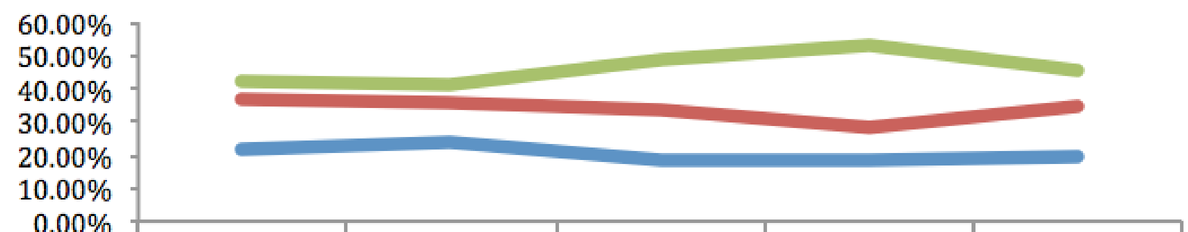
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.29%	13.08%	60.93%	36.78%
Portfolio B: Modernized version	33.63%	37.73%	16.93%	27.12%
Portfolio C: New construction version	46.08%	49.19%	22.13%	36.10%

Source: Own analyses

In simulation 2 all pairwise comparisons in the third level of the hierarchy for the extrapolated alternative are increased by 500.0%. The effect is a significant result for the extrapolated real estate alternative of 51.51%, which is illustrated in the following figure (Appendix 145):

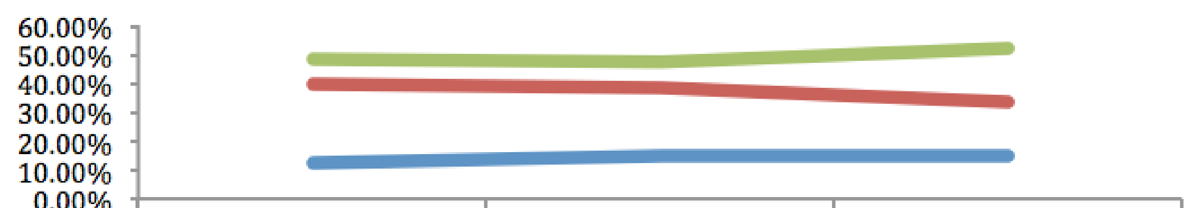
Figure 6.26 Simulation 2 of the sensitivity analysis, Romania

Alternative ranking demographic subcriteria, without manipulation



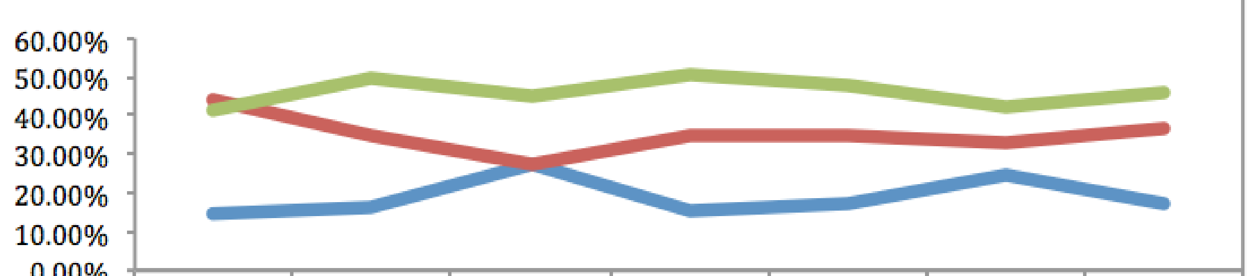
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	21.28%	23.59%	18.34%	18.46%	19.91%
Modernized version	36.52%	35.63%	33.07%	28.26%	34.16%
New construction version	42.20%	40.78%	48.59%	53.28%	45.93%

Alternative ranking space subcriteria, without manipulation



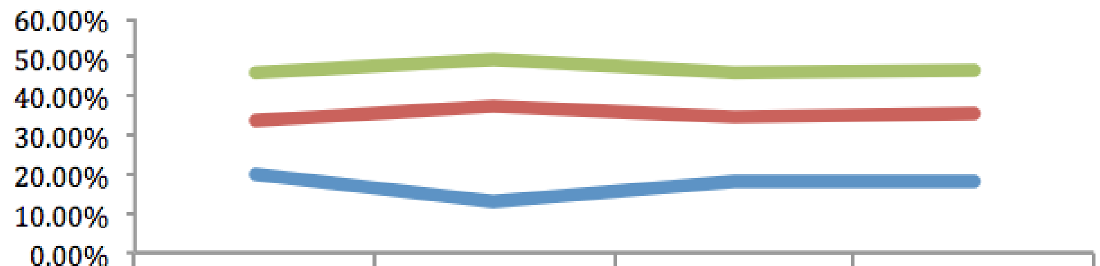
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	11.78%	14.55%	14.49%
Modernized version	39.53%	38.20%	33.09%
New construction version	48.69%	47.25%	52.42%

Alternative ranking environmental social subcriteria, without manipulation



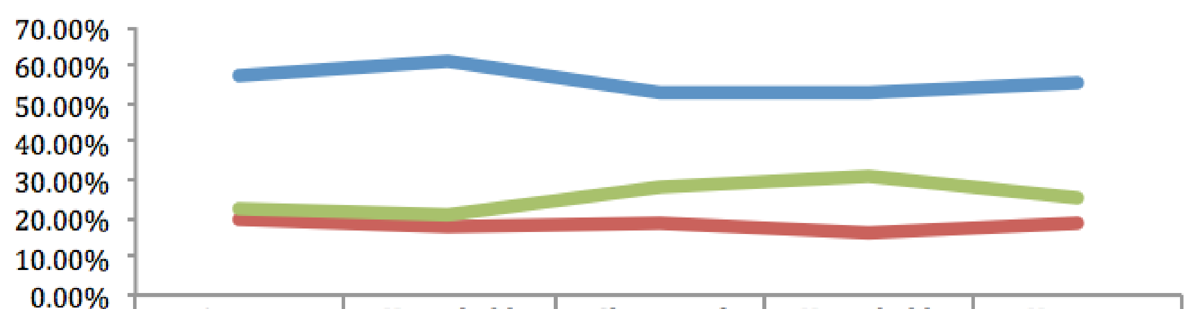
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	14.61%	16.19%	27.61%	14.97%	17.31%	24.73%	17.32%
Modernized version	44.00%	34.45%	27.13%	34.43%	34.83%	33.10%	36.76%
New construction version	41.39%	49.36%	45.26%	50.59%	47.86%	42.17%	45.92%

Alternative ranking in total, without manipulation



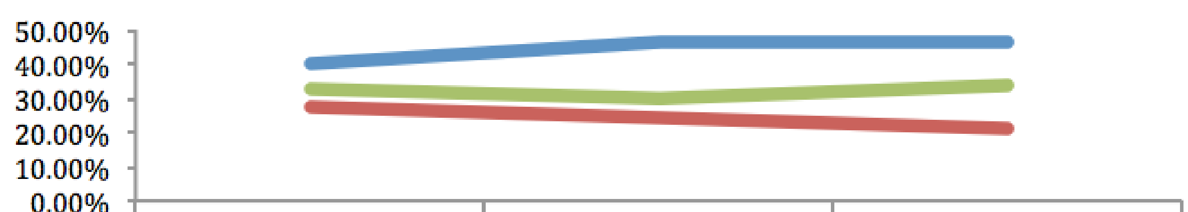
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.29%	13.08%	18.63%	17.89%
Portfolio B: Modernized version	33.63%	37.73%	35.21%	35.28%
Portfolio C: New construction version	46.08%	49.19%	46.16%	46.83%

Alternative ranking demographic subcriteria, with manipulation



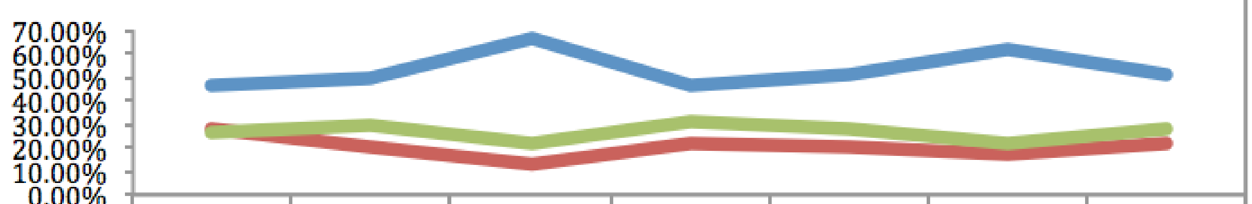
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	57.48%	60.69%	52.90%	53.09%	55.41%
Modernized version	19.73%	18.33%	19.08%	16.26%	19.02%
New construction version	22.80%	20.98%	28.03%	30.65%	25.57%

Alternative ranking space subcriteria, with manipulation



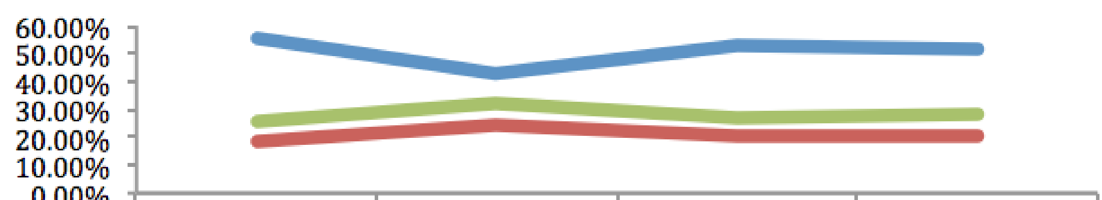
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	40.03%	45.98%	45.86%
Modernized version	26.87%	24.15%	20.95%
New construction version	33.09%	29.87%	33.19%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	46.10%	49.13%	65.60%	46.82%	51.14%	62.16%	51.16%
Modernized version	27.77%	20.91%	12.89%	21.53%	20.58%	16.64%	21.71%
New construction version	26.13%	29.96%	21.51%	31.64%	28.28%	21.20%	27.12%

Alternative ranking in total, with manipulation



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	55.88%	42.83%	52.82%	51.51%
Portfolio B: Modernized version	18.55%	24.85%	20.45%	20.85%
Portfolio C: New construction version	25.57%	32.32%	26.73%	27.64%

Source: Own analyses

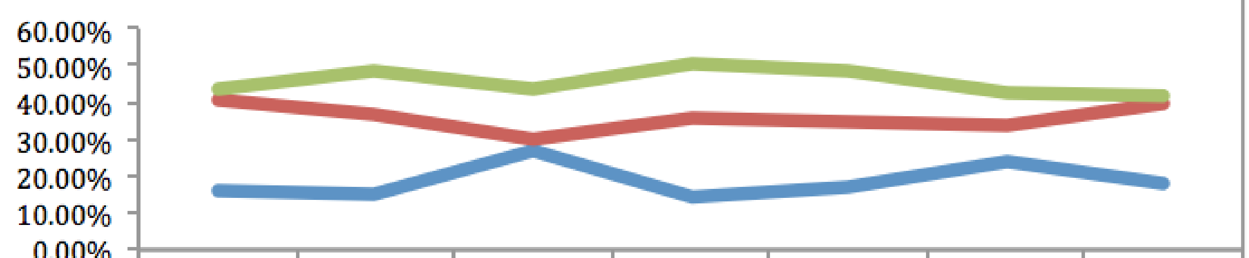
- *Slovakia:*

The environmental social criterion is the main criterion with a share of 42.81%. Therefore, this criterion is essential for simulation 1 with a manipulation of the eigenvectors of the extrapolated version of the environmental social subcriteria through a 750.0% increase.

The extrapolated alternative changes in the real overall alternative ranking from 17.95% towards 36.67% in simulation 1 as demonstrated below (Appendix 146):

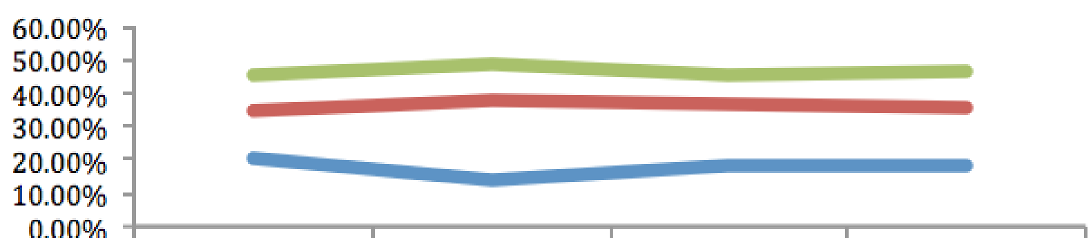
Figure 6.27 Simulation 1 of the sensitivity analysis, Slovakia

Alternative ranking environmental social subcriteria, without manipulation



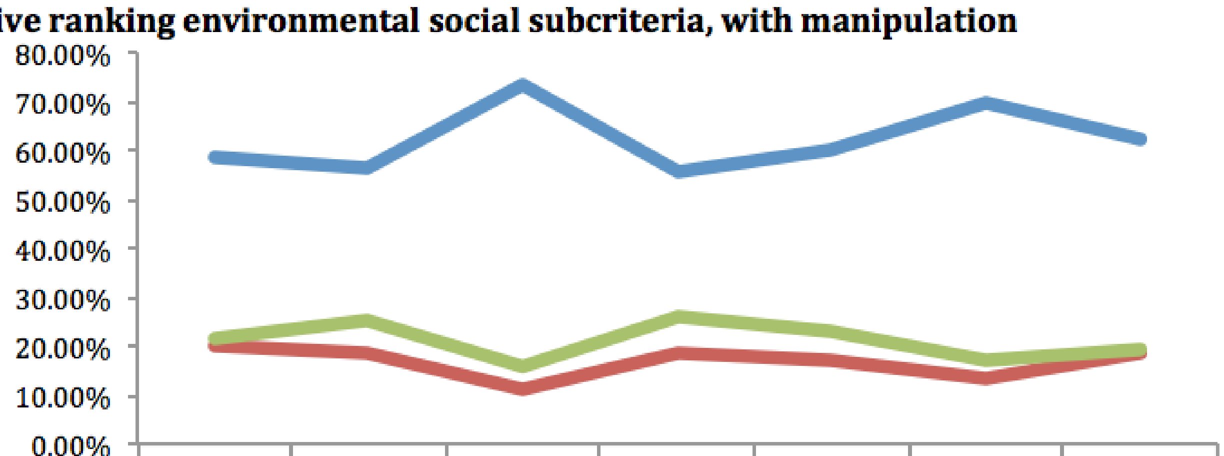
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	15.97%	14.64%	26.76%	14.30%	16.54%	23.58%	18.25%
Modernized version	40.81%	36.67%	29.99%	35.54%	35.10%	33.66%	39.99%
New construction version	43.22%	48.69%	43.24%	50.16%	48.36%	42.76%	41.76%

Alternative ranking in total, without manipulation

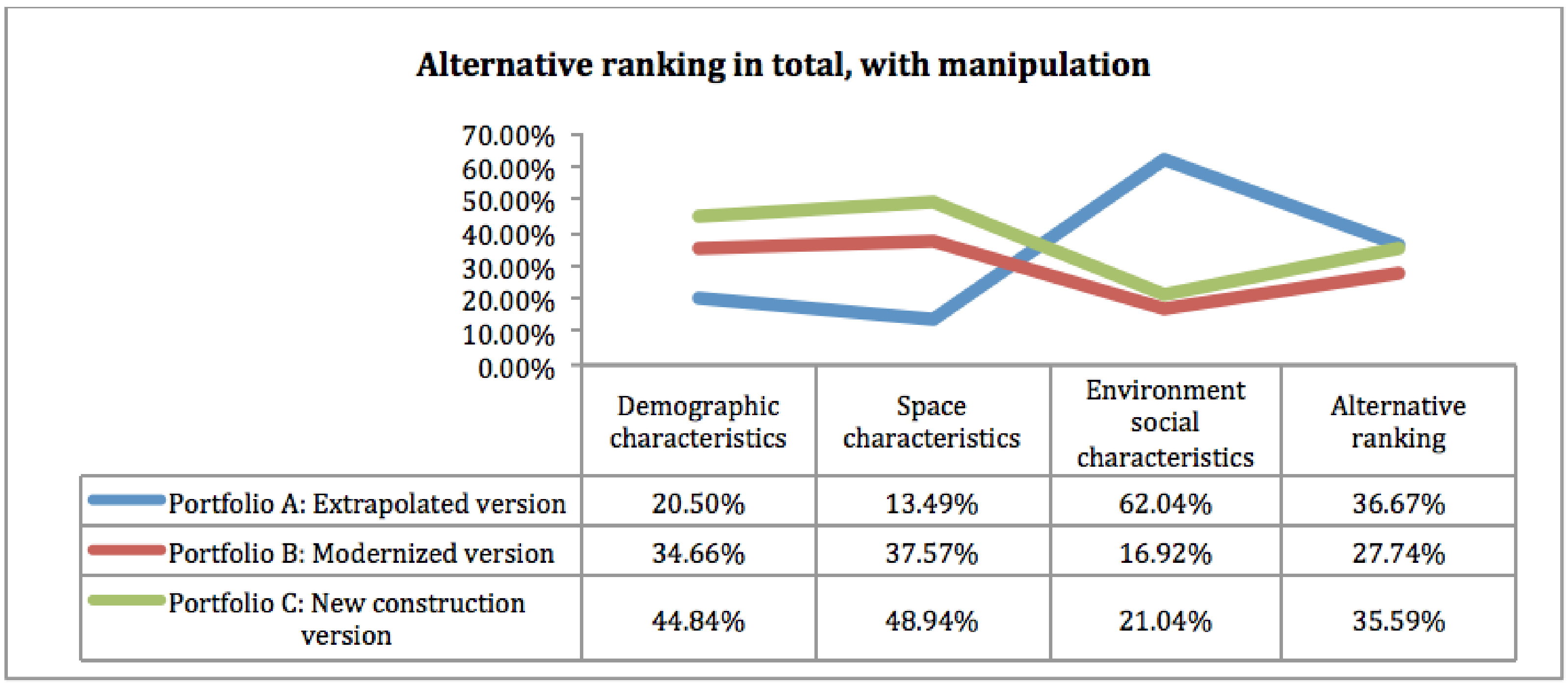


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.50%	13.49%	18.32%	17.95%
Portfolio B: Modernized version	34.66%	37.57%	36.42%	36.09%
Portfolio C: New construction version	44.84%	48.94%	45.26%	45.96%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	58.77%	56.26%	73.27%	55.59%	59.78%	69.83%	62.61%
Modernized version	20.02%	18.79%	10.95%	18.42%	16.91%	13.29%	18.29%
New construction version	21.21%	24.95%	15.78%	25.99%	23.30%	16.88%	19.10%

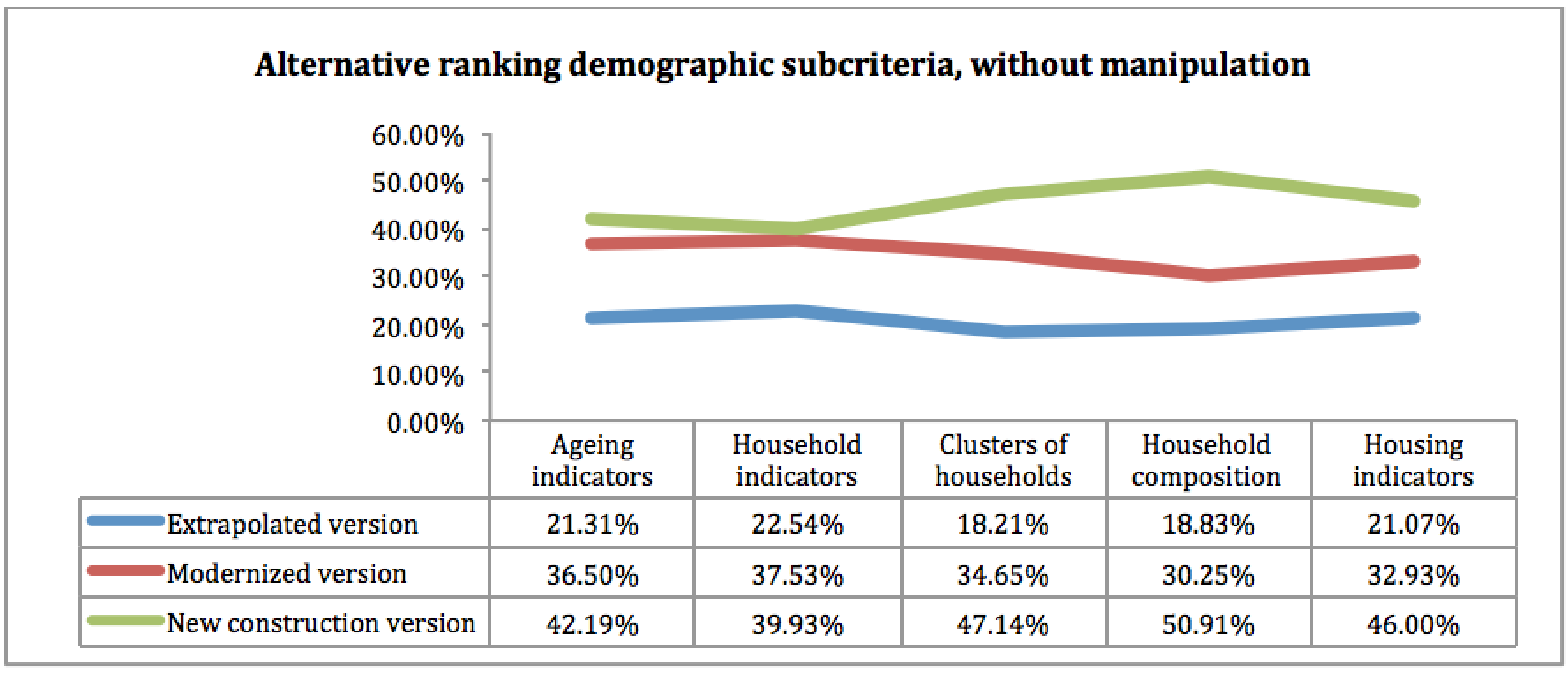


	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.50%	13.49%	62.04%	36.67%
Portfolio B: Modernized version	34.66%	37.57%	16.92%	27.74%
Portfolio C: New construction version	44.84%	48.94%	21.04%	35.59%

Source: Own analyses

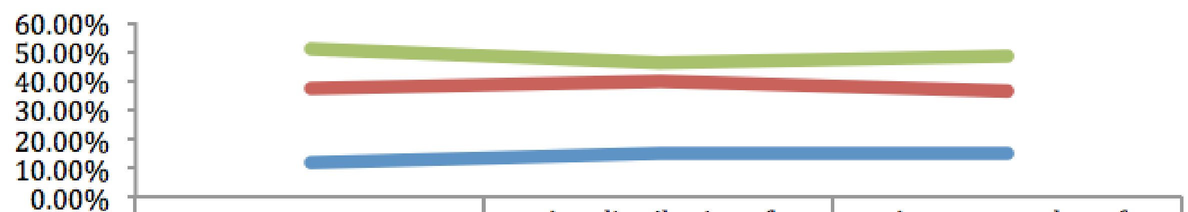
In simulation 2 all pairwise comparisons in the third level of the hierarchy for the extrapolated alternative are increased by 500.0%. The influence is a major effect for the extrapolated real estate alternative of 51.65% as illustrated below (Appendix 147):

Figure 6.28 Simulation 2 of the sensitivity analysis, Slovakia



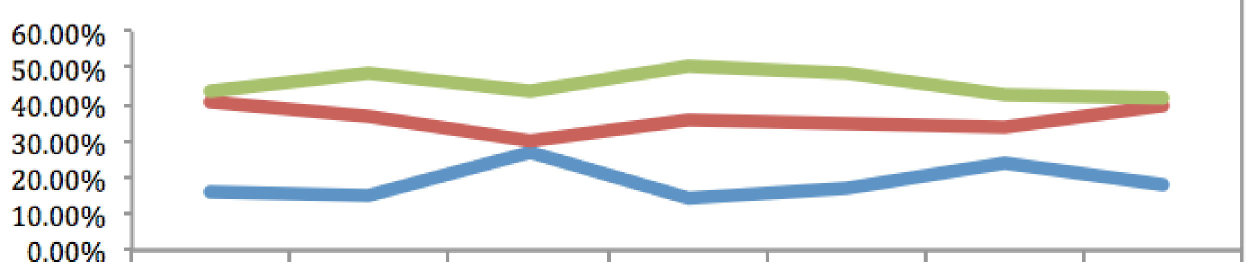
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	21.31%	22.54%	18.21%	18.83%	21.07%
Modernized version	36.50%	37.53%	34.65%	30.25%	32.93%
New construction version	42.19%	39.93%	47.14%	50.91%	46.00%

Alternative ranking space subcriteria, without manipulation



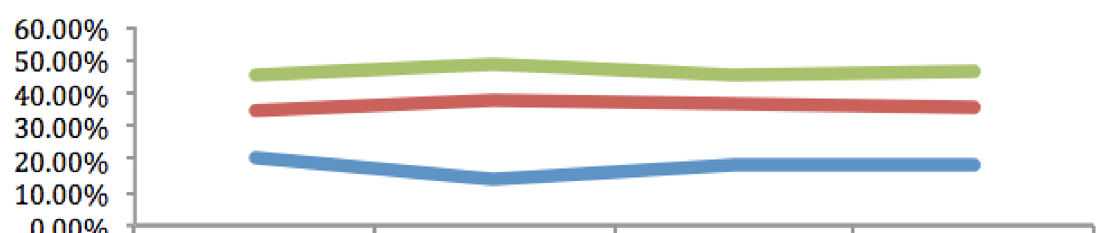
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	11.70%	14.70%	15.40%
Modernized version	37.04%	39.32%	36.25%
New construction version	51.26%	45.98%	48.34%

Alternative ranking environmental social subcriteria, without manipulation



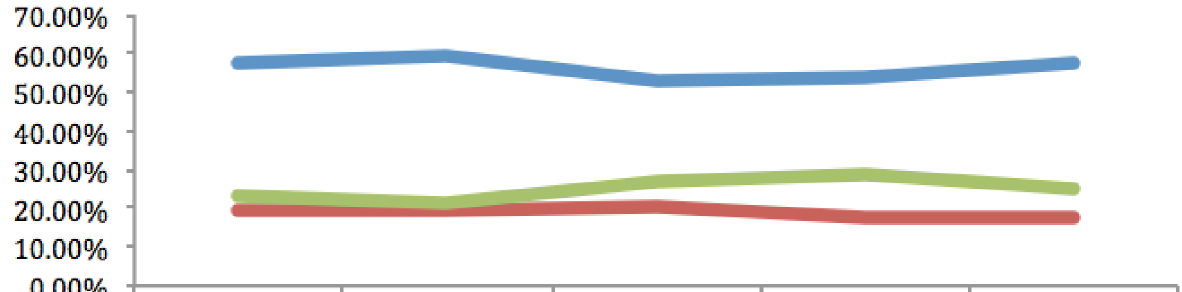
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	15.97%	14.64%	26.76%	14.30%	16.54%	23.58%	18.25%
Modernized version	40.81%	36.67%	29.99%	35.54%	35.10%	33.66%	39.99%
New construction version	43.22%	48.69%	43.24%	50.16%	48.36%	42.76%	41.76%

Alternative ranking in total, without manipulation



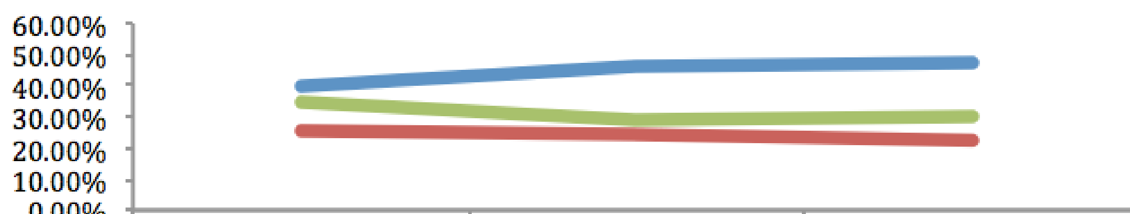
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	20.50%	13.49%	18.32%	17.95%
Portfolio B: Modernized version	34.66%	37.57%	36.42%	36.09%
Portfolio C: New construction version	44.84%	48.94%	45.26%	45.96%

Alternative ranking demographic subcriteria, with manipulation



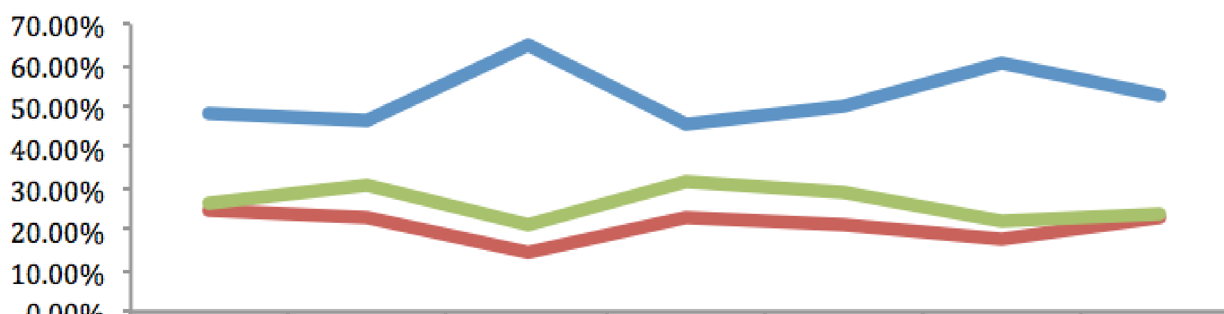
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	57.52%	59.26%	52.68%	53.71%	57.17%
Modernized version	19.70%	19.74%	20.05%	17.26%	17.87%
New construction version	22.77%	21.00%	27.28%	29.04%	24.96%

Alternative ranking space subcriteria, with manipulation



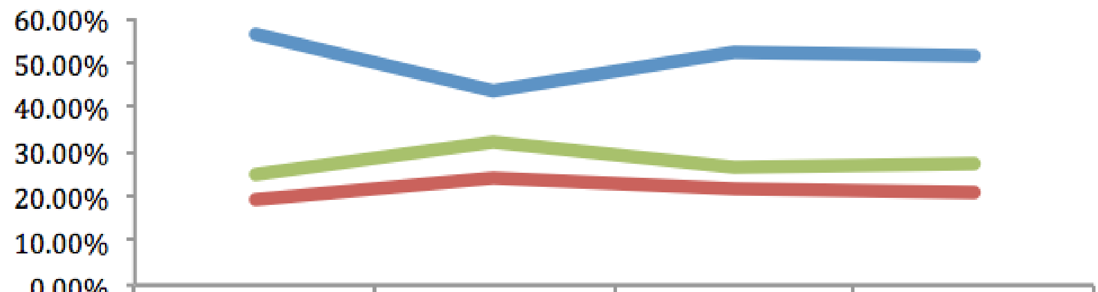
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	39.84%	46.28%	47.65%
Modernized version	25.23%	24.76%	22.43%
New construction version	34.92%	28.96%	29.92%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	48.72%	46.17%	64.63%	45.49%	49.78%	60.68%	52.74%
Modernized version	24.90%	23.13%	14.48%	22.61%	21.12%	17.32%	23.12%
New construction version	26.38%	30.71%	20.89%	31.90%	29.10%	22.00%	24.14%

Alternative ranking in total, with manipulation



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	56.23%	43.65%	52.30%	51.65%
Portfolio B: Modernized version	19.04%	24.44%	21.27%	21.24%
Portfolio C: New construction version	24.73%	31.90%	26.43%	27.11%

Source: Own analyses

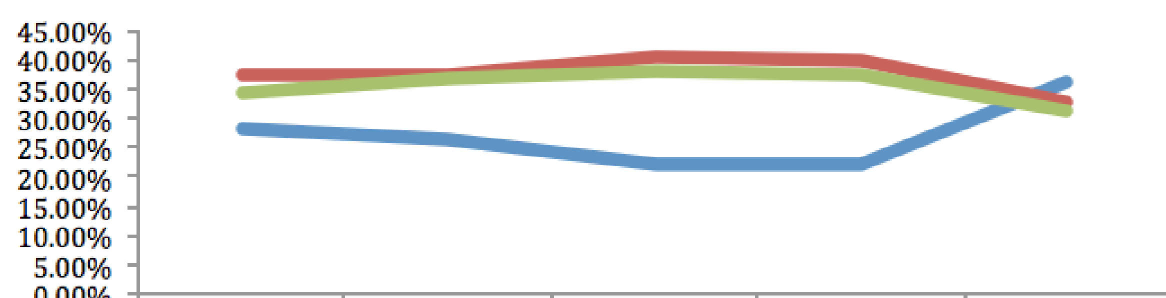
- *Spain:*

In contrast to the other afore-mentioned and analysed countries, for Spain the demographic criterion is the most significant one with a quotation of 43.6%. Therefore, this criterion is the foundation for simulation 1 with an influence of the eigenvectors of the extrapolated version of the demographic subcriteria with a percentage of 200.0%, which is also much lower in comparison to the other countries.

Consequently, the extrapolated alternative transforms in the non-manipulated total alternative ranking from 25.92% to 35.41% in simulation 1 as validated below (Appendix 148):

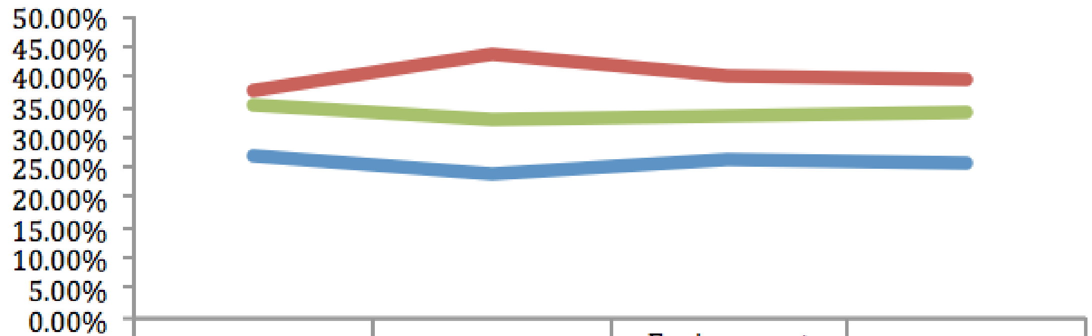
Figure 6.29 Simulation 1 of the sensitivity analysis, Spain

Alternative ranking demographic subcriteria, without manipulation



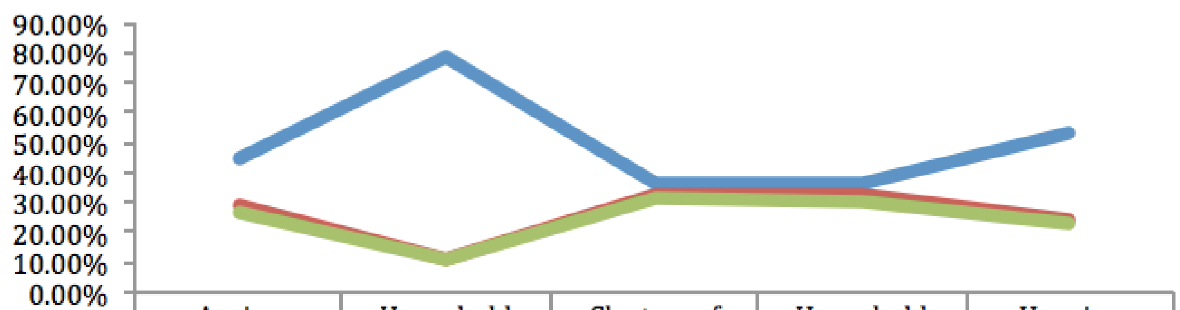
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	28.48%	26.22%	22.09%	22.33%	36.21%
Modernized version	37.33%	37.07%	40.13%	40.03%	32.72%
New construction version	34.19%	36.71%	37.78%	37.64%	31.07%

Alternative ranking in total, without manipulation



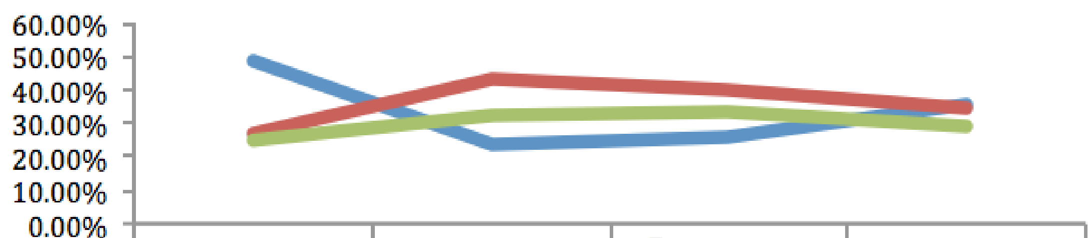
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	26.79%	23.62%	26.35%	25.92%
Portfolio B: Modernized version	37.61%	43.59%	40.07%	39.80%
Portfolio C: New construction version	35.60%	32.79%	33.58%	34.28%

Alternative ranking demographic subcriteria, with manipulation



	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	44.33%	78.04%	36.19%	36.51%	53.17%
Modernized version	29.06%	11.04%	32.87%	32.72%	24.02%
New construction version	26.61%	10.93%	30.94%	30.77%	22.81%

Alternative ranking in total, with manipulation



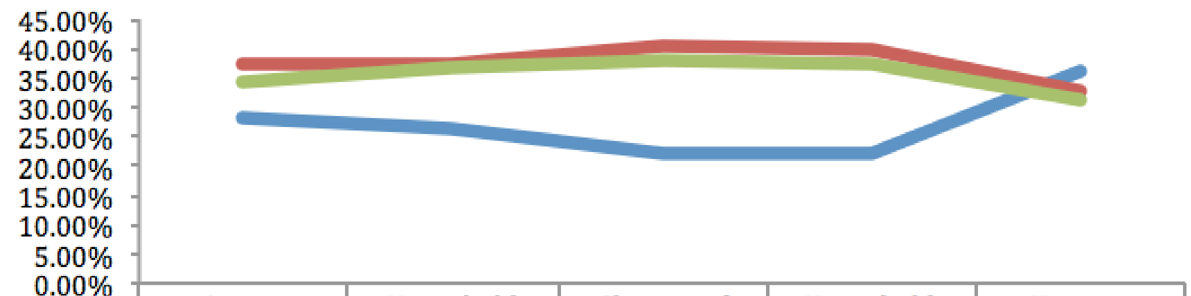
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	48.58%	23.62%	26.35%	35.41%
Portfolio B: Modernized version	26.49%	43.59%	40.07%	34.96%
Portfolio C: New construction version	24.93%	32.79%	33.58%	29.63%

Source: Own analyses

In simulation 2 the pairwise comparisons in the third level of the hierarchy for the extrapolated alternative are increased by 300.0%, which is again smaller than in the other countries. The influence is a main conclusion for the extrapolated real estate alternative of 50.78% as demonstrated in the following figure (Appendix 149):

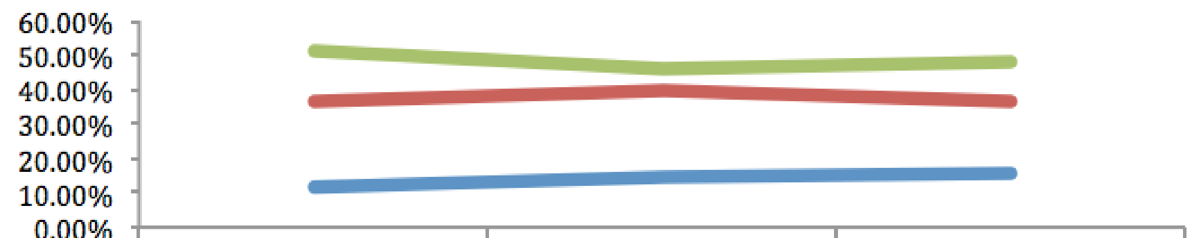
Figure 6.30 Simulation 2 of the sensitivity analysis, Spain

Alternative ranking demographic subcriteria, without manipulation



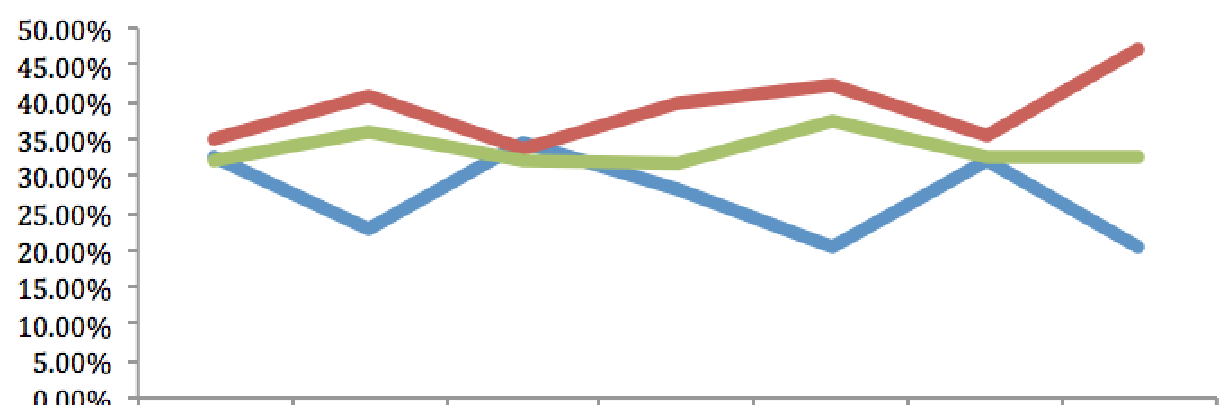
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	28.48%	26.22%	22.09%	22.33%	36.21%
Modernized version	37.33%	37.07%	40.13%	40.03%	32.72%
New construction version	34.19%	36.71%	37.78%	37.64%	31.07%

Alternative ranking space subcriteria, without manipulation



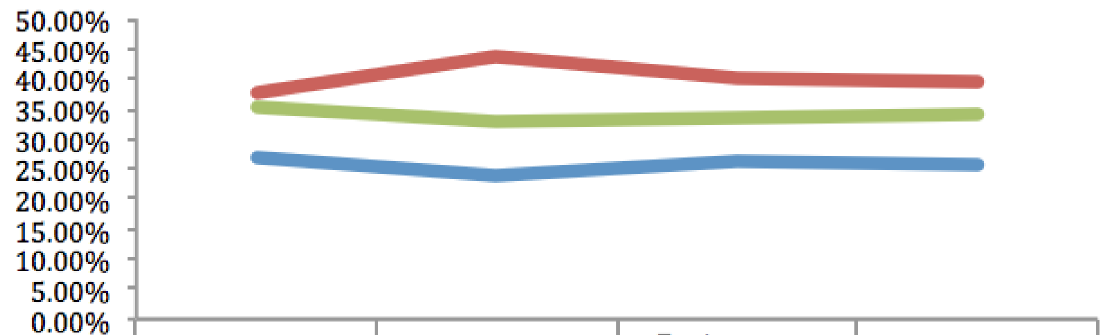
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	11.70%	14.70%	15.40%
Modernized version	37.04%	39.32%	36.25%
New construction version	51.26%	45.98%	48.34%

Alternative ranking environmental social subcriteria, without manipulation



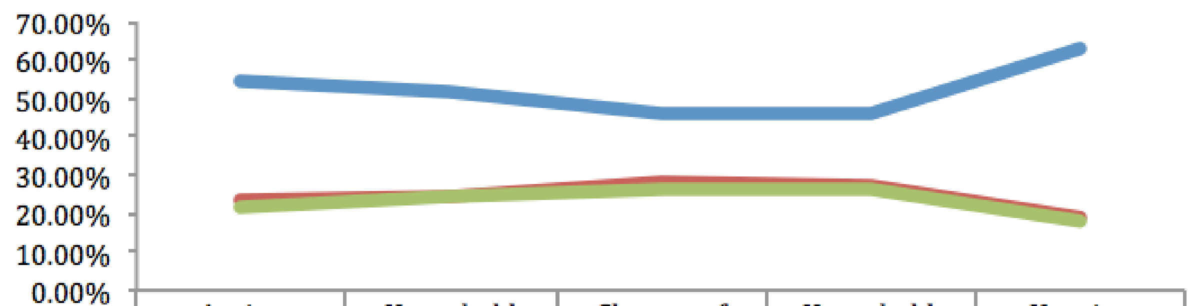
	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	32.71%	22.98%	34.46%	28.34%	20.22%	31.87%	20.38%
Modernized version	35.22%	40.81%	33.69%	39.94%	42.14%	35.68%	47.21%
New construction version	32.07%	36.21%	31.85%	31.72%	37.64%	32.46%	32.41%

Alternative ranking in total, without manipulation



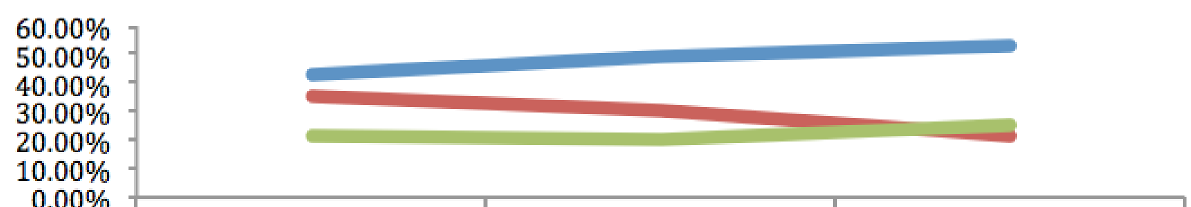
	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	26.79%	23.62%	26.35%	25.92%
Portfolio B: Modernized version	37.61%	43.59%	40.07%	39.80%
Portfolio C: New construction version	35.60%	32.79%	33.58%	34.28%

Alternative ranking demographic subcriteria, with manipulation



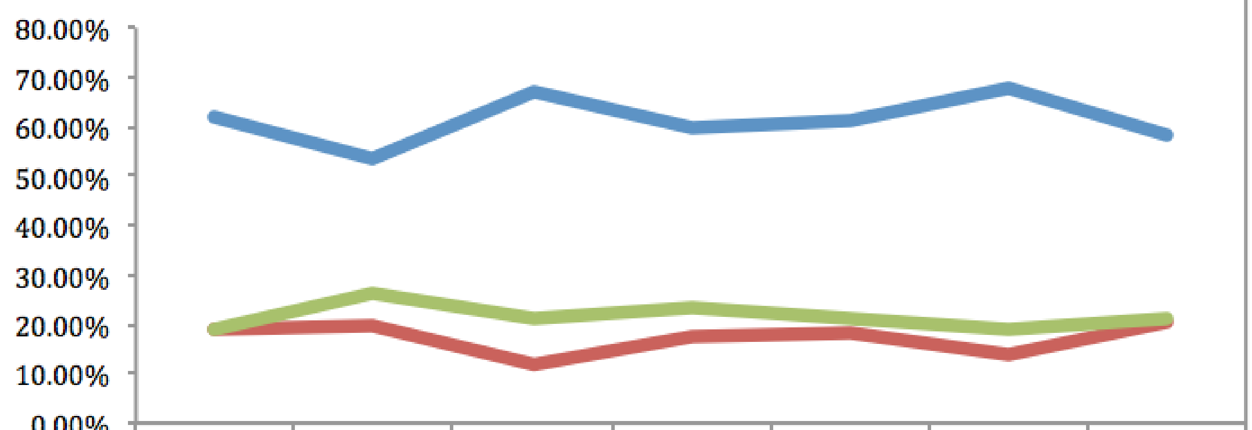
	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators
Extrapolated version	54.43%	51.60%	45.97%	46.31%	63.00%
Modernized version	23.79%	24.32%	27.83%	27.67%	18.98%
New construction version	21.78%	24.08%	26.20%	26.02%	18.02%

Alternative ranking space subcriteria, with manipulation



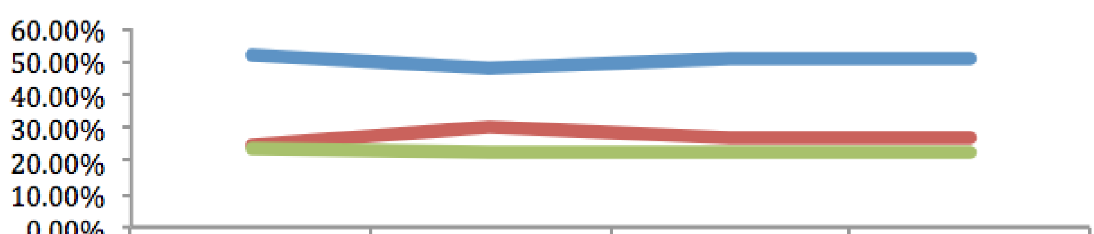
	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling
Extrapolated version	42.46%	48.95%	53.50%
Modernized version	35.87%	30.86%	21.24%
New construction version	21.67%	20.19%	25.26%

Alternative ranking environmental social subcriteria, with manipulation



	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Extrapolated version	62.18%	53.49%	66.72%	59.41%	61.25%	67.73%	58.26%
Modernized version	18.74%	19.91%	11.86%	17.18%	17.93%	13.54%	20.57%
New construction version	19.08%	26.59%	21.41%	23.41%	20.82%	18.73%	21.17%

Alternative ranking in total, with manipulation



	Demographic characteristics	Space characteristics	Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	51.91%	47.93%	51.26%	50.78%
Portfolio B: Modernized version	24.71%	29.85%	26.57%	26.51%
Portfolio C: New construction version	23.38%	22.21%	22.17%	22.71%

Source: Own analyses

Also these analyses demonstrate, as mentioned before, a high robustness of the pairwise comparisons of the interviews. The robustness is illustrated through two simulation procedures. In simulation 1 the extrapolated versions of the category of the key criterion are manipulated to influence the overall ranking and realise the first ranking for the extrapolated version, which is in the real analyses the alternative with the minor and less significant shares. To influence the overall ranking, the eigenvectors of the extrapolated versions are manipulated with multiple real pairwise comparisons that lie between a twofold for Spain and a seven-and-a-half fold for Bulgaria and Slovakia. Nevertheless, simulation 1 also shows that with a change in the total ranking the customisation of real estate assets, especially the modernized and new-construction versions, still has the major share. Consequently the hypotheses of low shares of the extrapolated real estate portfolios and high shares of modernized and new-construction portfolios do not apply anymore.

Simulation 2 embraces modifications of all extrapolated pairwise comparisons in the subcriteria levels demographic, space and environmental social stages. The increases range from 300.0% for Spain to 550.0% for Bulgaria with the consequence of a major share of the extrapolated portfolios in the overall results. With these manipulations, the hypotheses would no longer apply. Nevertheless, also these advances of the pairwise comparisons are very high, which points to a strong manipulation and again shows a strong stability of the pairwise comparisons of the branch specialists. Furthermore, the simulations are not resolved before the third level of the AHP hierarchy with a confirmation of strong and plausible interview results.

To highlight the strategy as well as the performance planning for residential trade and industry economies in Europe, in the following chapter the creation of a holistic model for real estate portfolios is established.

7 Construction of a holistic model for real estate portfolios in Europe

In this chapter, a holistic model for the analysed countries is created with the result of a scoring table that shows the priority ranking of the branch specialists. Moreover, a holistic algorithm is generated as well as a general mediator model.

7.1 Structure of a holistic real estate portfolio system

As stated in the previous chapter, there is a strong focus towards similar variables and tendencies with the result of an important customisation of future real estate assets in all 10 analysed countries. To establish a holistic real estate portfolio system, the following results of the different countries are amalgamated. Therefore, the geometric mean of group decision-making is again determined. This case of group decision-making embraces the various outcomes of the different country effects.

In the first stage, the countries with shrinking populations are amalgamated, namely Bulgaria, Estonia, Germany, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia. As Spain has a growing future population, it is not considered in this first step (Appendix 150).

In the field of the pairwise comparisons of the criteria with relative importance to the overall goal, the environmental social characteristics variable plays the most important role with an eigenvector of 42.82%, followed by the demographic development with a share of 34.43% and space characteristics with 22.74%. The consistency ratio is near the ideal percentage of 0.09% and thus indicates stable results.

In the next level of demographic subcriteria the housing indicators have the highest eigenvector at 21.83%, followed by the variable clusters of households at 21.06%. Nevertheless, the demographic subcriteria eigenvectors are close together with a consistency ratio of 0.12%, which is also on a very low and consistent level as the maximum share for matrixes with five variables is lower than 10.0%.

In the area of space subcriteria, build quality has the most important eigenvector with 48.76%. The variables age distribution of housing stock and average number of rooms per dwelling are at similar levels with shares of 26.92% and 24.32%, respectively. The consistency ratio is 0.0%, thus indicating an ideal ratio.

The environment social subcriteria level analyses the highest eigenvector for income level and economic conditions with eigenvector ratios of 21.84% and 21.62%, respectively. Land area has the lowest share at 7.25% followed by population density at 8.41%. As the consistency ratio is 1.47%, the results are again stable.

The demographic, space and environmental social subcriteria that compare the different alternatives, demonstrate strong preferences for modernized and new construction alternatives in all fields of subcriteria, which indicates clear results of real estate customisations. The consistencies are very stable with ratios between 0.0% and 0.30%.

The overall demographic alternatives ranking illustrates clear outcomes, because the real estate portfolios of the different subcriteria as well as the criteria rankings fall close together. Hence, the demographic ranking shows the strongest preference for new constructions with 41.83%, followed by the modernized option with 37.87% then extrapolated assets with 20.3%.

A similar tendency is apparent when it comes to the total space alternatives. The eigenvectors of the subcriteria alternatives fall close together; therefore, the differences in the criteria ranking play a minor role. The space alternative ranking has a ratio of 45.33% for the new construction, 40.8% for the modernized and a minor share of 13.87% for the extrapolated alternative.

Also in the area of environmental social characteristics, the different criteria eigenvector shares have minor significance as the subcriteria portfolios are again close together. The outcome is a key share of customisation with 43.69% for the new construction real estate assets, 36.94% for the modernized alternative and 19.37% for the extrapolated variant.

Consequently, also the overall alternative ranking shows a high preference for customised future real estate assets. Also in this field, the real estate portfolios comprise low shares of extrapolated assets with the lowest ratio within the space characteristics. The overall ranking sees customisation of real estate portfolios at 81.56% leaving a minor share of extrapolated housings at 18.44% as demonstrated in the following figure:

Table 7.1 Holistic real estate portfolio system, excluding Spain

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	20.30%	13.87%	19.37%	34.43%	Demographic characteristics	18.44%
Portfolio B: Modernized version	37.87%	40.80%	36.94%	22.74%	Space characteristics	38.14%
Portfolio C: New construction version	41.83%	45.33%	43.69%	42.82%	Environment social characteristics	43.42%

Source: Own analyses

The comparisons of the aforementioned holistic portfolio system as well as the analysis of the diverse individual states demonstrate similar trends to the system of Spain. Spain slightly favours the modernized alternative followed by new construction one and has a slightly larger share of extrapolated real estate assets than other countries. Nevertheless, it is nearby the additional tendencies as it also displays strong future population shifts, but with a significant migration rate that results in a growing populace. Consequently, in the second stage of this analysis, a holistic system of real estate portfolios, including Spain, is outlined for all 10 countries (Appendix 151).

The first level of criteria demonstrates a preference for the environmental social variable with an eigenvector share of 41.86%. Also demographic characteristics play a major role with 35.34%. The space characteristics have the least share with 22.8%. At 0.1% the consistency ratio lies near the ideal level.

In the next level of demographic subcriteria, compared with respect to the criterion, the different subcriteria are close together with high preferences for housing indicators and clusters of households. Also in this level the consistency ratio is very low at 0.11%, which indicates stable results.

In the space subcriteria, build quality shows significant outcomes with 47.43% and an ideal consistency ratio of 0.0%.

The environmental social subcriteria embrace high attentions to economic conditions with 21.48% and income level with 21.3%. Population density with 8.6% and land area with 7.45% have a low level of importance. The consistency ratio is 1.34%, which is far lower than the maximum of less than 10.0% and shows a high degree of stability of pairwise comparisons.

Also the subcriteria that compare the relative importance of the alternatives reveal a clear preference for customisation within the modernized and new construction versions for all demographic, space and environmental social subcriteria. With a maximum consistency ratio of 0.29% the results are highly stable.

Consequently, in the overall demographic alternative ranking new construction with 41.3% comes out on top, followed by modernized with 37.8%, then extrapolated assets with 20.9%.

As the space subcriteria portfolios are close together, the high criteria ranking of build quality has only minor significance with a mainly arithmetic mean and overall outcome of 44.02% for new construction, 41.3% for modernized and 14.68% for extrapolated assets.

In the area of environmental social characteristics, the outcome is similar with a strong tendency to the arithmetic mean of 42.72% for new construction, 37.28% for modernized and 20.0% for extrapolated versions.

Therefore, also the overall alternative ranking highlights a key share of new construction future real estate assets at 42.51%, which is just slightly higher than the modernized option at 38.38%, but significantly higher than the extrapolated version at 19.1%. Hence, also this holistic result for all analysed countries reveals a significant preference for future customisation with 80.9% as demonstrated in the following table:

Table 7.2 Holistic real estate portfolio system, including Spain

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	20.90%	14.68%	20.00%	35.34%	Demographic characteristics	**19.10%**
Portfolio B: Modernized version	37.80%	41.30%	37.28%	22.80%	Space characteristics	**38.38%**
Portfolio C: New construction version	41.30%	44.02%	42.72%	41.86%	Environment social characteristics	**42.51%**

Source: Own analyses

Consequently, there is a strong logic of future portfolio structures that is reflected next by establishing an algorithm of the holistic system.

7.2 Algorithm of the holistic system

As analysed earlier, there is a constant systematic to realise the Analytic Hierarchy Process. For a logical establishment of this procedure to reach the overall target of the ideal residential trade and industry portfolio, the holistic system algorithm for all 10 analysed countries is outlined in the following. The algorithm has to be realised for all hierarchy levels, especially the criteria, subcriteria and alternative level in order to reach the overall target as described before. In the first step, ratios reflecting the relative values of quantities a and b within their ratio scales embracing a set of numbers, which are invariant under a similar alteration, have to be established. The relative ratio scale result from pairwise comparisons reciprocal matrixes of decision-makings defined as follows (Saaty and Vargas, 2001):

$$\sum_{j=1}^{n} a_{ij}\omega_j \ = \lambda_{max}\ \omega_i \tag{7.1}$$

With the generality that $a_{ji} = 1/a_{ij}$ respectively $a_{ij}\, a_{ji} = 1$ as the reciprocal property with $a_{ij} > 0$, it has a solution that is normalised in the equation 7.2 (Saaty and Vargas, 2001):

$$\sum_{i=1}^{n} \omega_i \ = 1 \tag{7.2}$$

For the holistic model of real estate valuation, the overall target is to establish an ideal asset portfolio until the year 2050. Therefore, the overall objective of real estate valuation is a portfolio mix of extrapolated, modernized and new construction real estate assets with the following function, in which a the different alternative variables embrace:

$$f(x)\ \boldsymbol{valuation} =$$

$$a_{extrapolated} + a_{modernized} + a_{new\ construction} \tag{7.3}$$

Next the different hierarchy levels have to be established with respect to the overall valuation goal beginning with the criteria level:

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{criteria}}$$

$$= \sum_{j=0.3534}^{n=demographic} a_{ij}\ \omega_j + \sum_{j=0.2280}^{n=space} a_{ij}\ \omega_j + \sum_{j=0.4186}^{n=environment\ social} a_{ij}\ \omega_j \tag{7.4}$$

In this equation n is the quantity of criteria, i the overall eigenvector of 1 or 100%, j the single eigenvector of each criteria, a_{ij} the pairwise comparisons of the variables and ω_j the vectors of weights with a normalisation of the principal right eigenvectors in ω_i. Furthermore, the eigenvector results of each criterion are outlined, which forms the importance of each variable.

In the next stage, the subcriteria level with respect to each criterion is highlighted with an equal equation. The subcriteria level comprises the demographic, space and environmental social equation as analysed below:

$$\sum_{i=1}^{n=5} \omega_{i;\boldsymbol{subcriteria\ demographic}}$$

$$= \sum_{j=0.1980}^{n=ageing\ indicators} a_{ij}\ \omega_j + \sum_{j=0.2060}^{n=household\ indicators} a_{ij}\ \omega_j + \sum_{j=0.2122}^{n=clusters\ of\ households} a_{ij}\ \omega_j$$

$$+ \sum_{j=0.1670}^{n=household\ composition} a_{ij}\ \omega_j + \sum_{j=0.2167}^{n=housing\ indicators} a_{ij}\ \omega_j \tag{7.5}$$

Equation 7.5 summaries the demographic hierarchy level with its different sub-criteria ageing indicators, household indicators, clusters of households, household composition and housing indicators.

The following equation shows space level with its subcriteria build quality, age distribution of housing stock and average number of rooms per dwelling:

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{subcriteria\ space}}$$

$$= \sum_{j=0.4743}^{n=build\ quality} a_{ij}\ \omega_j + \sum_{j=0.2772}^{n=age\ distribution} a_{ij}\ \omega_j + \sum_{j=0.2485}^{n=average\ number\ of\ rooms} a_{ij}\ \omega_j \tag{7.6}$$

Furthermore, the level of environmental social characteristics with its seven variables of population density, income level, land area, supply/ demand, tenure status, levels of rents and economic conditions is shown below:

$$\sum_{i=1}^{n=7} \omega_{i;\boldsymbol{subcriteria\ environment\ social}}$$

$$= \sum_{j=0.0860}^{n=population\ density} a_{ij}\ \omega_j + \sum_{j=0.2130}^{n=income\ level} a_{ij}\ \omega_j + \sum_{j=0.0745}^{n=land\ area} a_{ij}\ \omega_j$$

$$+ \sum_{j=0.1045}^{n=supply/demand} a_{ij}\ \omega_j + \sum_{j=0.1267}^{n=tenure\ status} a_{ij}\ \omega_j$$

$$+ \sum_{j=0.1805}^{n=levels\ of\ rent} a_{ij}\ \omega_j + \sum_{j=0.2148}^{n=economic\ conditions} a_{ij}\ \omega_j \tag{7.7}$$

The third hierarchy level demonstrates the alternative level with pairwise comparisons of the alternatives extrapolated, modernized and new construction with respect to each subcriterion. First, the demographic subcriteria are evaluated in the following equations:

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ demographic:ageing\ indicators}}$$

$$= \sum_{j=0.2273}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3831}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.3897}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.8}$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ demographic{:}household\ indicators}}$$

$$= \sum_{j=0.2185}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3976}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.3838}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.9}$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ demographic:\ clusters\ of\ households}}$$

$$= \sum_{j=0.1902}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3622}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4476}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.10}$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ demographic:\ household\ composition}}$$

$$= \sum_{j=0.1884}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3544}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4572}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.11}$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ demographic:\ housing\ indicators}}$$

$$= \sum_{j=0.2173}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3883}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.3944}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.12}$$

The area of space subcriteria is shown in the following equations:

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ space:\ build\ quality}}$$

$$= \sum_{j=0.1277}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.4378}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4345}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.13}$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ space:\ age\ distribution}}$$

$$= \sum_{j=0.1587}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.4204}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4209}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.14}$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ space:\ average\ number\ of\ rooms}}$$

$$= \sum_{j=0.1701}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3574}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4725}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.15}$$

The additional field in this hierarchy level is the environmental social subcriteria level outlined below:

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ environment\ social:\ population\ density}}$$

$$= \sum_{j=0.1911}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.4134}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.3954}^{n=new\ construction} a_{ij}\ \omega_j \tag{7.16}$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ environment\ social}:\ \boldsymbol{income\ level}}$$

$$= \sum_{j=0.1674}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3749}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4578}^{n=new\ construction} a_{ij}\ \omega_j \qquad (7.17)$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ environment\ social}:\ \boldsymbol{land\ area}}$$

$$= \sum_{j=0.2705}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3105}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4190}^{n=new\ construction} a_{ij}\ \omega_j \qquad (7.18)$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ environment\ social}:\ \boldsymbol{supply/\ demand}}$$

$$= \sum_{j=0.1706}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3709}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4584}^{n=new\ construction} a_{ij}\ \omega_j \qquad (7.19)$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ environment\ social}:\ \boldsymbol{tenure\ status}}$$

$$= \sum_{j=0.1860}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3755}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4385}^{n=new\ construction} a_{ij}\ \omega_j \qquad (7.20)$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ environment\ social}:\ \boldsymbol{levels\ of\ rent}}$$

$$= \sum_{j=0.2556}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.3372}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4072}^{n=new\ construction} a_{ij}\ \omega_j \qquad (7.21)$$

$$\sum_{i=1}^{n=3} \omega_{i;\boldsymbol{alternatives\ subcriteron\ environment\ social:\ economic\ conditions}}$$

$$= \sum_{j=0.1873}^{n=extrapolated} a_{ij}\ \omega_j + \sum_{j=0.4054}^{n=modernized} a_{ij}\ \omega_j + \sum_{j=0.4073}^{n=new\ construction} a_{ij}\ \omega_j$$

(7.22)

To realise the next stage, multiplicative and additive syntheses are essential that are connected analytically through calculation. For realising this synthesis, the constant Π (Pi) is equal to a_i that illustrates the priority of the *i*-th criterion and x_i the priority of the alternative x with a preference for the *i*-th criterion. The equation is thus the following (Saaty and Vargas, 2001):

$$\prod x_i^{a_i} = \sum a_i x_i$$

(7.23)

For the algorithm of the ideal 2050 real estate portfolio, a_i stands for the priority ranking of the subcriteria demographic, space and environmental social characteristics as well as x for the alternatives with respect to the diverse subcriteria. Also in this step there is the necessity to evaluate the different criteria areas of demographic, space and environmental variables. Consequently, the first equation relates to the demographic area as follows:

$$\prod x_i^{a_i};\ \boldsymbol{total\ alternatives\ demographic:\ extrapolated}$$

$$= \sum_{0.0450}^{ageing\ indicators} a_i x_i + \sum_{0.0450}^{household\ indicators} a_i x_i + \sum_{0.0404}^{clusters\ of\ households} a_i x_i$$

$$+ \sum_{0.0315}^{household\ composition} a_i x_i + \sum_{0.0471}^{housing\ indicators} a_i x_i$$

(7.24)

$$\prod x_i^{a_i};\ \boldsymbol{total\ alternatives\ demographic: modernized}$$

$$= \sum_{0.0758}^{ageing\ indicators} a_i x_i + \sum_{0.0819}^{household\ indicators} a_i x_i + \sum_{0.0769}^{clusters\ of\ households} a_i x_i$$

$$+ \sum_{0.0592}^{household\ composition} a_i x_i + \sum_{0.0842}^{housing\ indicators} a_i x_i \tag{7.25}$$

$$\prod x_i^{a_i};\ \boldsymbol{total\ alternatives\ demographic: new\ construction}$$

$$= \sum_{0.0771}^{ageing\ indicators} a_i x_i + \sum_{0.0791}^{household\ indicators} a_i x_i + \sum_{0.0950}^{clusters\ of\ households} a_i x_i$$

$$+ \sum_{0.0764}^{household\ composition} a_i x_i + \sum_{0.0854}^{housing\ indicators} a_i\ x_i \tag{7.26}$$

The second part of the synthesis relates to the criterion space with the following equations:

$$\prod x_i^{a_i};\ \boldsymbol{total\ alternatives\ space: extrapolated}$$

$$= \sum_{0.0605}^{build\ quality} a_i x_i + \sum_{0.0440}^{age\ distribution} a_i\ x_i + \sum_{0.0423}^{average\ number\ of\ rooms} a_i x_i \tag{7.27}$$

$$\prod x_i^{a_i};\ \boldsymbol{total\ alternatives\ space: modernized}$$

$$= \sum_{0.2076}^{build\ quality} a_i x_i + \sum_{0.1165}^{age\ distribution} a_i x_i + \sum_{0.0889}^{average\ number\ of\ rooms} a_i x_i \tag{7.28}$$

$$\prod x_i^{a_i}; \; \boldsymbol{total\,alternatives\;space: \;new\,construction}$$

$$= \sum_{0.2061}^{build\;quality} a_i x_i + \sum_{0.1167}^{age\;distribution} a_i x_i + \sum_{0.1174}^{average\,number\;of\;rooms} a_i x_i \tag{7.29}$$

Also the third field of environmental social characteristics has similar equations:

$$\prod x_i^{a_i}; \; \boldsymbol{total\,alternatives\;environment\;social: \;extrapolated}$$

$$= \sum_{0.0165}^{population\;density} a_i x_i + \sum_{0.0356}^{income\;level} a_i x_i + \sum_{0.0201}^{land\;area} a_i\, x_i$$

$$+ \sum_{0.0178}^{supply/demand} a_i x_i + \sum_{0.0237}^{tenure\;status} a_i\; x_i + \sum_{0.0461}^{levels\;of\;rent} a_i\; x_i$$

$$+ \sum_{0.0402}^{economic\;conditions} a_i\; x_i \tag{7.30}$$

$$\prod x_i^{a_i}; \; \boldsymbol{total\,alternatives\;environment\;social: \;modernized}$$

$$= \sum_{0.0356}^{population\;density} a_i x_i + \sum_{0.0798}^{income\;level} a_i x_i + \sum_{0.0231}^{land\;area} a_i\; x_i$$

$$+ \sum_{0.0388}^{supply/demand} a_i x_i + \sum_{0.0476}^{tenure\;status} a_i\; x_i + \sum_{0.0608}^{levels\;of\;rent} a_i x_i$$

$$+ \sum_{0.0871}^{economic\;conditions} a_i x_i \tag{7.31}$$

$$\prod x_i^{a_i}; \boldsymbol{total\ alternatives\ environment\ social{:}\ new\ construction}$$

$$= \sum_{0.0340}^{population\ density} a_i x_i + \sum_{0.0975}^{income\ level} a_i\ x_i \sum_{0.0312}^{land\ area} a_i\ x_i$$

$$+ \sum_{0.0479}^{supply/demand} a_i x_i + \sum_{0.0556}^{tenure\ status} a_i\ x_i + \sum_{0.0735}^{levels\ of\ rent} a_i x_i$$

$$+ \sum_{0.0875}^{economic\ conditions} a_i x_i \tag{7.32}$$

The outcome is the total valuation of the different criteria for the extrapolated, modernized and new construction alternatives:

$$f(x)\ \boldsymbol{total\ valuation{:}extrapolated}$$

$$= \sum_{0.0738}^{demographic} a_i x_i + \sum_{0.0335}^{space} a_i x_i + \sum_{0.0837}^{environment\ social} a_i x_i \tag{7.33}$$

$$f(x)\ \boldsymbol{total\ valuation{:}modernized}$$

$$= \sum_{0.1336}^{demographic} a_i x_i + \sum_{0.0942}^{space} a_i x_i + \sum_{0.1560}^{environment\ social} a_i x_i \tag{7.34}$$

$$f(x)\ \boldsymbol{total\ valuation{:}new\ construction}$$

$$= \sum_{0.1460}^{demographic} a_i x_i + \sum_{0.1003}^{space} a_i x_i + \sum_{0.1788}^{environment\ social} a_i x_i \tag{7.35}$$

Consequently, the overall result of the valuation of the ideal 2050 residential trade and industry portfolio embraces the following equation, which includes the total priority ranking x of the different alternatives extrapolated, modernized and new construction:

$$f(x)_{\boldsymbol{total\,valuation}}$$

$$= \sum_{0.1910}^{extrapolated} x + \sum_{0.3838}^{modernized} x + \sum_{0.4251}^{new\,construction} x \tag{7.36}$$

Hence, this algorithm offers a guideline for the establishment of the various steps in the calculations of the AHP hierarchy to realise an overall result. Furthermore, it fixes the different eigenvectors as well as the synthesis weights in every single area to handle the different degrees of importance of the variables. For an overview of the weightings as well as various variable rankings, a scoring analysis is outlined next.

7.3 Development of a scoring analysis

The key variable rankings of the pairwise comparisons, realised by the branch experts, are outlined in the following scoring table. Again the AHP calculation as the foundation of the different levels, as mentioned earlier, is illustrated. The variables in the scoring table are now sorted from highest to lowest eigenvector value to realise the importance of the different weightings. The first variables in the left column embrace the criteria, especially demographic, space, and environment social characteristics with respect to the overall valuation goal. The eigenvector weights are outlined in the next column. In the third column the subcriteria level with the relative importance to each criterion is illustrated, again with the subcriteria weighting in the following column. Next the alternatives with the relative preference for each subcriterion and their weightings are highlighted. Finally the relative importance of the subcriteria with respect to the alternatives and the overall alternative ranking are illustrated.

Table 7.3 Holistic scoring analysis, inclusive Spain

Criteria	Weigh-ting	Subcriteria	Weigh-ting	Alternatives	Weigh-ting	Alternative ranking criteria	Weigh-ting	Alternative ranking total	Weigh-ting
Environment social	0.4186								
		Economic conditions	0.2148						
				New con-struction	0.4073				
				Modernized	0.4054				
				Extrapolated	0.1873				
		Income level	0.2130						
				New con-struction	0.4578				
				Modernized	0.3749				
				Extrapolated	0.1674				
		Levels of rent	0.1805						
				New con-struction	0.4072				
				Modernized	0.3372				
				Extrapolated	0.2556				
		Tenure status	0.1267						
				New con-struction	0.4385				
				Modernized	0.3755				
				Extrapolated	0.1860				
		Supply/ de-mand	0.1045						
				New con-struction	0.4584				
				Modernized	0.3709				
				Extrapolated	0.1706				
		Population density	0.0860						
				Modernized	0.4134				
				New con-struction	0.3954				
				Extrapolated	0.1911				
		Land area	0.0745						
				New con-struction	0.4190				
				Modernized	0.3105				
				Extrapolated	0.2705				
						New construction	0.4272		
						Modernized	0.3728		
						Extrapolated	0.2000		

Criteria	Weigh-ting	Subcriteria	Weigh-ting	Alternatives	Weigh-ting	Alternative ranking criteria	Weigh-ting	Alternative ranking total	Weigh-ting
Demo-graphic	0.3534								
		Housing indicators	0.2167						
				New construction	0.3944				
				Modernized	0.3883				
				Extrapolated	0.2173				
		Clusters of house-holds	0.2122						
				New construction	0.4476				
				Modernized	0.3622				
				Extrapolated	0.1902				
		Household indica-tors	0.2060						
				Modernized	0.3976				
				New construction	0.3838				
				Extrapolated	0.2185				
		Ageing indicators	0.1980						
				New construction	0.3897				
				Modernized	0.3831				
				Extrapolated	0.2273				
		Household com-position	0.1670						
				New construction	0.4572				
				Modernized	0.3544				
				Extrapolated	0.1884				
						New construc-tion	0.4130		
						Modernized	0.3780		
Space	0.2280					Extrapolated	0.2090		
		Build quality	0.4743						
				Modernized	0.4378				
				New construction	0.4345				
				Extrapolated	0.1277				
		Age distribution of housing stock	0.2772						
				New construction	0.4209				
				Modernized	0.4204				
				Extrapolated	0.1587				
		Average number of rooms per dwelling	0.2485						
				New construction	0.4725				
				Modernized	0.3574				
				Extrapolated	0.1701				
						New construc-tion	0.4402		
						Modernized	0.4130		
						Extrapolated	0.1468		
								New con-struction	0.4251
								Modernized	0.3838
								Extrapolated	0.1910

Source: Own analyses

The scoring table analyses in a clear way the experts' preferences within the pairwise comparisons. The most important criterion is the environmental social one, followed by the demographic and then the space characteristics. Consequently, from the point of the view of the branch experts, the technical asset quality of real estate assets is less significant than the dynamic supply-and-demand variables of, e.g., economy, environment and population shifts that are consequently the key variables for these housing markets.

Within the environmental social subcriteria level, the key variables are the economic conditions and the income level of the populaces. Population density and land area play a minor role in the expert results. Therefore, the monetary fields such as gross domestic product, unemployment rate or population at risk of poverty and income per capita are the most significant.

The significant demographic subcriteria embrace the housing indicators, e.g., vacant and occupied dwellings, clusters of households, e.g., 1- and 2-person households as well as household indicators – e.g., number of households – with a 63.5% share in total. Less significant variables are ageing indicators, for example children, working age and elderly populations and household composition, for example single adults under 65, single adults aged 65+. The result shows a high preference for the quantitative perspective of demographic development. Consequently, the housing indicators reflect the supply and demand dimension of demographic development; the clusters of households and the household indicators mirror the architectural factor as these variables illustrate the demand for smaller or bigger and more or less housing. The qualitative view of, e.g., ageing clusters to decide on housing facilities and features plays a secondary role. Nevertheless, the eigenvectors of the variables are close together; hence in a detailed analysis, the conclusion also demonstrates a preference for qualitative aspects of demographic development with an overall percentage of 36.5%.

In the area of space characteristics, the main subcriterion is build quality. The subcriteria age distribution of housing stock and average numbers of rooms per dwelling have a minor share per variable. This priority ranking of space characteristics is different to the ranking of demographic development as build quality is a qualitative criterion and includes housing features. In this field the quantitative variables such as age distribution of housing stock and average number of rooms per dwelling play a minor role. In the first analysis, this circumstance could be an objection within the pairwise comparisons. Nevertheless, the overall share of the qualitative subcriteria is 52.57% and results in total in a major share. Moreover, as the subcriteria of the demographic development criterion are nearby, the demographic range of subcriteria is small with percentages of the qualitative variables that are close to the quantitative ones. Another conclusion is the insignificance of the quantity of rooms as the size of the dwelling is substantial for the different household clusters. Therefore, the number of rooms does not testify to the dimensions of the dwelling, because for example a 60m^2 2- or 3-room dwelling could be more demanded for 1- or 2-person households than a 120m^2 1-room dwelling.

Furthermore, the alternative rankings within the demographic, space and environmental social subcriteria illustrate an explicit tendency towards customised real estate assets. In most cases, new construction is ranked highest at 80.0%. Modernized variables appear in only three cases equating to 20.0% of the overall cases, comprise the most significant ranking, especially in the area of population density for the environmental social subcriteria, for the demographic subcriterion household indicators, e.g., number of households and average number of persons per household as well as for build quality as a space subcriterion. The extrapolated version plays a minor role in all circumstances with shares between 12.77% for build quality in the space criterion and 27.05% for land area in the environmental social segment. Consequently, the new construction real estate option is also the key variable for the overall alternative rankings of the subcriteria as well as the criteria with respect to the total objective. The alternative rankings demonstrate strong preferences for the new construction and modernized versions, which indicates a high necessity for future residential trade and industry development in all 10 analysed countries.

In the following sub-chapter, the interrelations of the diverse variables are analysed through a mediation analysis.

7.4 Mediation analysis model for future residential trade and industry assets

As analysed before, there are various variables influencing real estate markets and residential trade and industry asset portfolios. The expert interviews highlight different interrelations between criteria, subcriteria and alternatives. To identify a methodology to detect the relationship between these various variables, a mediation analysis and a resulting model are illustrated below.

For various researchers such as Baron and Kenny (1986) as well as MacKinnon et al. (2007), in a statistical mediation analysis, the independent variables X are substantial predictors, respectively causal variables of the dependent variables Y with a regression of the dependent variables on the independent variables. Consequently, the variables X can be considered as a possible cause of Y. Furthermore, X causes the mediator variables M with the outcome that the independent variables X establish a crucial predictor of the mediator variables M with a regression of the mediator on the independent variables X. The mediator variables M again cause the dependent variables Y. Again the mediator M has to be an important predictor of the dependent variable, while monitoring for the independent variables, with a regression of the dependent variables Y on both the mediator variables M as well as the independent variables X. In total, there are three key approaches to statistical mediation analyses, especially the causal stages, the modifications in the coefficients as well as the effect of the coefficients outlined through the following three equations (Baron and Kenny, 1986; MacKinnon et al., 2000):

$$\Upsilon = i_1 + c\mathrm{X} + e_1 \tag{7.37}$$

In this equation Y is the dependent variable, i_1 is an intercept, c represents the coefficient relating the independent variable, X is the independent variable and e_1 are residuals. Furthermore, a second equation is essential to realise the aforementioned key approaches (Baron and Kenny, 1986; MacKinnon et al., 2000):

$$\mathrm{M} = i_3 + \alpha \mathrm{X} + e_3 \tag{7.38}$$

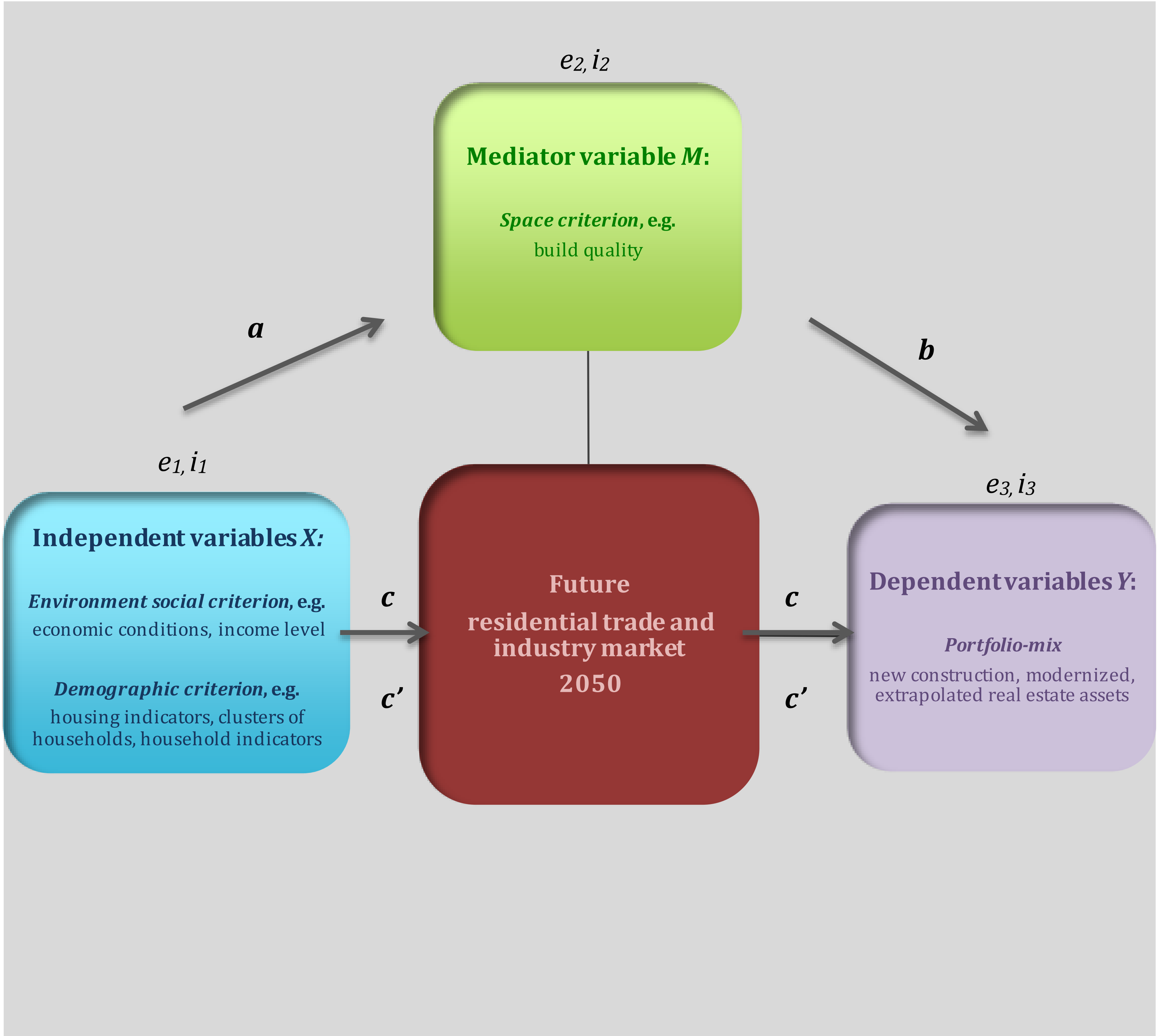
In this equation M is the mediator, i_3 illustrates intercepts, α demonstrates the coefficient connecting the independent variable to the mediator, X is again the independent variable and e_3 establishes the residuals. Additionally, the last equation to establish a mediation analysis is shown below (Baron and Kenny, 1986; MacKinnon et al., 2000):

$$\Upsilon = i_2 + c' \mathrm{X} + \mathscr{b} \mathrm{M} + e_2 \tag{7.39}$$

Again in this equation Υ is the dependent variable, i_2 includes an intercept, c' is the coefficient relating the independent variable to the dependent variable regulated for the mediator, X is the independent variable, $\mathscr{b}$ the coefficient linking the mediator to the dependent variable adjusted for the independent variable, M the mediator and e_2 residuals (Baron and Kenny, 1986; MacKinnon et al., 2000).

In the following mediation model based on the analyses stated earlier, the residential trade and industry market for the future year 2050 is evaluated, again with the different levels of the AHP hierarchy that includes its three criteria demographic, space and environmental social characteristics as well as their subcriteria. Furthermore, the alternatives of the future portfolio mix are outlined. The figure mainly illustrates again the priority ranking of the before-analysed scoring table, related to the interviews of the experts amalgamated for all 10 countries.

Figure 7.1 Mediation model of future residential trade and industry assets



Source: Own analyses

In relation to the aforementioned theoretical mediator analysis, the independent or causal variables *X* are shown in Figure 7.1 together with the criteria areas of environmental social as well as demographic development with its key subcriteria economic conditions and income level as well as housing indicators, clusters of households and household indicators. The mediator variable *M* comprises the third real estate field of space characteristics with the main subcriterion build quality. Furthermore, the dependent variables *Y* contain the portfolio mix with its new construction, modernized and extrapolated real estate assets.

Within the before-stated process of Baron and Kenny (1986), in the first stage a confirmation of an independent variable as a crucial predictor of the dependent variable is required. These two independent criteria environmental social and demographic development comprise eigenvectors with a total share of 77.2% and consequently have a high influence on the real estate portfolio mix; their high level of importance is thus ensured.

In the theoretical continuation, secondly a confirmation of the significance of the independent variable over the mediator is requested. Also this approach is confirmed as the environmental social as well as the demographic characteristics with the above shares of 77.2% are ranked first and second by the experts, while the mediator of space characteristics is third in the criteria ranking.

In the third stage of theoretical mediation development is analysed and there is also a validation of a significant mediator predictor of the dependent variable while directing for the independent variable is demanded. Also this context is established because the evidence of the asset alternatives in the space criterion as the mediator confirm the alternatives ranking of the independent variables environmental social and demographic criteria with a strong correlation to the dependent variables of the ideal portfolio mix in the future year 2050.

Consequently, the independent variables of environmental social and demographic development influence the mediator variable of the space criterion as well as the dependent variables of the portfolio mix. Furthermore, the mediator variable of the space criterion again affects the dependent variables of future real estate assets.

As economic conditions and income level comprise high environmental social subcriteria shares, they relate to the outcome of whether building features, quantities and qualities in the space level have to be adapted and if the portfolio mix embraces basically customised real estates, especially new construction and modernized values or extrapolated assets. As a consequence of a high customisation share of the dependent variables, the branch experts analyse the independent variables of future monetary circumstances optimistically. Otherwise, with a negative view on economic and income conditions, the extrapolated version of the dependent variables would have a much higher priority ranking. Additionally, the experts' pairwise comparisons focus on a high necessity to optimise the space criteria, mainly build quality, which again leads to the outcome that there is a strong importance for realising a future asset customisation of habitations.

Also the demographic criterion as the second independent variable plays a significant role for the mediator of space characteristics and the dependent variables of the 2050 portfolio mix. Although the subcriteria of the demographic shifts are close together, the key subcriteria are housing indicators, clusters of households and household indicators. Consequently, the development of, e.g., vacancy ratios, household sizes and quantity of households is vital for the future asset portfolio in this segment. Also in this context the result is a strong customisation of future real estate assets, because experts realise important shifts of demographic developments. Moreover, as the experts evaluate the mediator of space criterion as insufficient for the future population structures, this independent variable plays a significant role for the mediator variable with the outcome of a strong customisation of future real estate assets in the dependent variables of portfolio mixes.

As analysed before, the mediator of the space criterion influences in an important manner the dependent portfolio asset variables. Because the results of the expert interviews demonstrate an optimistic growth of economic welfare as well as significant demographic shifts in the population structures of all analysed countries, the mediator has to develop, because households as well as general governments are in the view of branch specialists able to afford to adapt housing. Furthermore, buildings have to meet the demands of changing populations, basically to reduce vacancy ratios and also increase the economic welfare of real estate markets.

In conclusion, the 2050 portfolio mix is strongly dependent on the independent variables environmental social and demographic characteristics. Without a development of economic circumstances and substantial demographic shifts, an innovative handling of real estate portfolios would not be required. A stabilisation or decrease of, e.g., economic welfare would hinder a customisation of real estate assets. Constant population structures without demographic development would establish mainly extrapolated housings with no necessity for high shares of new construction or modernized values. The development of the independent variables offers the possibility to evaluate the mediator of space characteristics with an outcome of future space development. Without economic prosperity and demographic movements, an assessment of the space criterion would not be possible, respectively necessary. Within the context of independent variables, the mediator variable embraces a high significance to establish future real estate assets and to contribute to a stabilisation and growth of future real estate assets.

In consequence, the before-analysed equations 7.37-7.39 can be transformed for the mediation model of future residential trade and industry assets as follows:

$$\begin{aligned}
&Portfolio\ mix\ 2050, related\ through\ independent\ variables \\
&= 0.1787_{environment\ social;new\ construction} + 0.1460_{demographic;new\ construction} \\
&+ 0.1561_{environment\ social;modernized} + 0.1335_{demographic;modernized} \\
&+ 0.0837_{environment\ social;extrapolated} + 0.0738_{demographic;extrapolated}
\end{aligned} \tag{7.40}$$

The aforementioned equation demonstrates the shares of the independent variables environmental social and demographic development for the overall alternative result of the dependent variables of the portfolio mix. Therefore, it realises within the mediation model of future residential trade and industry assets the direction of c and c'. Furthermore, in the next step the equation of the mediator criterion is outlined as follows:

$$\begin{aligned}
&Space\ criterion, connecting\ independent\ variables\ to\ mediator \\
&= 0.1004_{space;new\ construction} + 0.0942_{space;modernized} \\
&+ 0.0335_{space;extrapolated}
\end{aligned} \tag{7.41}$$

In this mediator equation, the connection between the independent variables in relation to the mediator is shown. Consequently, the difference between the overall alternative ranking and the ranking of the independent variables is outlined, which results in the ranking of the mediator variable. In the mediation model direction a in the connection to b is reflected. Finally, the subsequent equation illustrates the overall interrelations of all variables:

$$\begin{aligned} &Portfolio\ mix\ 2050, related\ through\ independent\ variables \text{ and mediator} \\ &= 0.1787_{environment\ social;new\ construction} + 0.1460_{demographic;new\ construction} \\ &+ 0.1004_{space;new\ construction} + 0.1561_{environment\ social;modernized} \\ &+ 0.1335_{demographic;modernized} + 0.0942_{space;modernized} \\ &+ 0.0837_{environment\ social;extrapolated} + 0.0738_{demographic;extrapolated} \\ &+ 0.0335_{space;extrapolated} \end{aligned} \tag{7.42}$$

This overall equation highlights the final results of the overall alternative ranking of the dependent variables with direction b, c and c' of the mediation model, which reveals a high necessity for new construction and modernized real estate assets for the future year 2050.

The mediator analysis proofs and again validates the consistency of the interrelations between the different hierarchy levels and variables of the AHP hierarchy and the pairwise comparisons of the branch specialists. Alongside the aforementioned consistency, variances and sensitivity analyses, also this analysis evaluates a high plausibility of the interviews as the empirical results are conducted to the different theoretical preconditions that are satisfied, as mentioned before. Furthermore, this mediator analysis establishes a model for the utilisation of residential trade and industry markets with established variables, as these variables are fixed through the secondary analyses of the Chapters 3 and 4 as well as the primary empirical Chapters 6 and 7 that offer a high level of stability of a continuance of this model and its variables. Finally, the following last chapter summarises the important results. Furthermore, it reflects a critical acclaim of the researches.

8 Summaries and critical acclaim of the research

In this last chapter, that rounds the before mentioned researches of this study, a critical acclaim is highlighted. Furthermore, the most significant results as well as future recommendations are outlined.

8.1 Summary and future recommendations of the research

As mentioned before, there are different analyses in this research to realise a broad and in-depth overview of housing markets in the European Union.

The first secondary analyses are based on statistical databases from various studies and evaluate in detail past to future economic trends from around 1970 to 2050, which are significant for the development of the residential trade and industry. The following main aspects could be evaluated: Transformations of population structures, changes of habitation specifications, movement to urban environment clusters, rise of total housing costs and construction cost indexes, shifting of economic conditions, increase of vacancy levels and age distributions of housing stocks. Consequently a change of real estate assets is necessary in order to safeguard assets in future and correspond to the requirements of occupants, which is also high on the agenda of political and branch alliance federations. With Saaty's AHP methodology an innovative model to forecast future portfolios is generated in this study to respond to the complex needs of the international real estate economy. The model embraces central areas of real estate markets such as demographic, space and environmental social characteristics and illustrates, in contrast to the main existing literature, widespread housing market fields such as the key driver of demographic movements. The executed branch-specialist interview results reflect in accordance with the statistical databases the necessity of real estate development until 2050 with the outcome of essential shifts and high shares of modernized and newly constructed real estate assets in 2050 in all of the 10 analysed countries. This outcome establishes tangible future real estate strategies for countries as a whole.

Furthermore, holistic structures are highlighted that feature an innovative overall algorithm as well as a new scoring model showing the overall priority ranking of the interview outcomes within the amalgamation of all analysed European countries. Additionally, a general mediator model, also constructed in detail for the residential trade and industry sector with the challenges of demographic shifts, is highlighted to facilitate an understanding and analysis of the future interrelations between demographic development, environmental as well as economic conditions and building qualities and quantities.

The implications for future real estate developments are significant. The research confirms a high necessity for innovative portfolio management in all analysed countries to stabilise and develop real estate assets. The secondary market and trend analysis as well as the primary empirical research proof this foundation. The overall result of the empirical research demonstrates an important share of 80.9% of future customisation over all countries, especially the new construction and the modernized alternative, and a low share of 19.1% for extrapolated real estate. Within this framework, the results demonstrate that there is a high significance in countries with demographic shifts. Nevertheless, countries with falling populations show similar tendencies to countries with increasing populations if the demographic development plays a significant role, as illustrated in the context of Spain. As the share for future real estate customisations embraces a strong key percentage, political bodies of the different states, individuals as well as real estate experts within the housing economy sector are responsible for realising the strategies necessary to develop real estate assets and respond to the basic needs of individuals.

8.2 Critical acclaim of the research

As highlighted before, there are different innovative results that embrace the possibility of an understanding and development of future supply and demand developments in housing markets within the European Union.

Nevertheless, research also has to be critically appraised to round off the overall pictures of a study. The critical appraisal pertaining to the present study is described below:

In Chapter 5 that describes the AHP methodology, a general illustration of the criticism towards that kind of methodology is outlined. Furthermore, additionally, also in the empirical part of this research, especially in Chapters 6 and 7, critical points are reflected (e.g. McCaffrey, 2005; Watson and Freeling, 1983). These general issues are developed for the special research in detail.

a. Ambiguity of the quality of questions in the AHP interviews

The interview partners are branch specialists with a high level of knowledge of international real estate markets. They are thus aware of the special circumstances and current situations of the markets. Furthermore, interview guidance was developed for all interviewees in order to provide them with general information about the interviews. In addition, the interviewees were given access to the databases used in the study to allow them to become acquainted with the research context prior to the interview. For the pairwise comparisons the branch specialists were allowed to ask questions to clarify any points they did not understand; these were answered directly during the interviews.

Consequently, any areas of ambiguity were explained to the interviewees, which strengthened the results of the pairwise comparisons.

b. Subjective AHP scales of variables because of individual error

The variables of the AHP hierarchy are based on the theoretical framework of determining factors of the real estate markets as analysed in Chapter 3. Furthermore, these variables are again reflected within the secondary analysis from Chapter 4 that concludes by revealing strong tendencies of future developments in these segments and therefore high necessities for an utilisation of these variables.

The variables of the secondary analysis are also the foundation for the AHP scales that hinder subjectivity and thus individual error. Consequently, the individual error could be minimised.

c. *AHP scales measure individual psychology that can be subject of human error*

The empirical part contains interviews with 15 specialists from different real estate segments. The results of the pairwise comparisons are very similar with clear outcomes of a customisation of future real estate assets, which reduce the human error of the branch specialists. Additionally, within the research various proofs are established of the stability of the results. The consistency ratios in all hierarchy levels and within all pairwise comparisons and synthesis are at an ideal, respectively good and stable level between 0.0% and 10.0%. Moreover, also the variance analyses highlight small variances of the expert results with a minimum of spreads. The sensitivity analyses illustrate a necessity from the third level of the hierarchy with a significant manipulation between 300.0% and 550.0% for changing of the major share to the extrapolated portfolios in the overall results that again demonstrates high stability. Also the mediator analysis demonstrates that the theoretical foundations are concludent to the empirical evaluations with the consequence of main shares of independent variables of environmental social and demographic characteristics as well as important influences of the mediator space criterion to the dependent variables of portfolio mixes.

Consequently, also this criticism could be minimised by the procedure of the research.

d. *Quantity of comparison benches can become extensive with the utilisation of various comparison attributes*

The established AHP model embraces a high quantity of criteria, subcriteria and alternatives. The pairwise comparisons are realised for three criteria, 15 subcriteria and three alternatives. Consequently, the experts had to realise 82 pairwise comparisons per country that includes a broad analysis and priority ranking. Nevertheless, as a result of this high quantity of variables, the interviewees were unable to estimate the overall outcome of their pairwise comparisons that permits a high share of objectivity and reduce subjective manipulations.

Consequently, this criticism is an advantage for the interview structure of this research.

e. *Statistical prognosis for future developments are not safeguarded and can shift into additional directions*

As analysed in Chapter 4, the databases are collected from various research institutes with a high consistency, as these data are mainly from primary analyses. Furthermore, the secondary analysis of this research demonstrates long-term tendencies of 80 years with a strong plausibility of future developments. Additionally, e.g., fertility rates or ageing of populaces are relatively stable variables that can be handled. Nevertheless, there are risks and uncertainties within economic markets and thus they are not fully manageable.

Consequently, for a reduction of risks and uncertainties, various variables, databases and time periods are involved in the empirical studies. Although a variable may develop in another direction, the further variables could mainly balance this change and stabilise the overall result.

f. *Absence of generalisation as a result of limited expert interviews*

Although there are 15 interviewees, the focus of the empirical part was to realise pairwise comparisons with highly specialised branch experts in different economic fields to establish a robust quality of the interviews. The interview results are explicit and the analysis illustrates high consistencies with an assumption that additional interviews would not have demonstrated conflicting results.

Consequently, the results of the branch experts directs to a generalisation of effects.

In consequence, it can be determined that criticism within the dynamic field of residential trade and industry economies as well the AHP methodology is justifiable. Therefore, the important directions of criticism always have to influence and develop research with the effect of a minimisation or avoiding of critical issues within the research. These circumstances were always an objective of this study with an author´s requirement of stable foundations and results to establish an in-depth and widespread understanding of past, current and mainly future real estate economies.

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APPENDIX

Appendix 1 Databases demographic characteristics, past basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population (millions)	8.50	1.40	78.30	10.30	2.40	Europa in Zahlen - Eurostat Jahrbuch 2010 - Eurostat
Natural population development						
Fertility rate	2.17	not available	not available	1.98	not available	Demography report 2010 - Older, more numerous and diverse Europeans - Eurostat
Net migration (thousands)	not available	not available	not available	not available	not available	
Life expectancy at birth						
Males	69.10	not available	67.50	66.30	not available	Demography report 2010 - Older, more numerous and diverse Europeans - Eurostat
Females	73.50	not available	73.60	72.10	not available	Demography report 2010 - Older, more numerous and diverse Europeans - Eurostat
Ageing indicators (% of total population)						
Age 0-14 (children population)	22.82%	22.00%	23.30%	20.89%	21.61%	World Population Prospects - The 2012 Revision - Volume I: Comprehensive Tables - United Nations
Age 15-64 (working age population)	67.54%	66.23%	63.14%	67.54%	66.38%	World Population Prospects - The 2012 Revision - Volume I: Comprehensive Tables - United Nations
Age 65+ (elderly population)	9.64%	11.77%	13.56%	11.57%	12.01%	World Population Prospects - The 2012 Revision - Volume I: Comprehensive Tables - United Nations
Age 80+ (very elderly population)	not available	not available	not available	not available	not available	
Medium age/ years	not available	not available	not available	not available	not available	
Household indicators						
Number of households	2,542,480.00	50,333,000.00	25,008,191.00	2,720,500.00	50,333,000.00	Compendium of Housing Statistics 1971 - United Nations
Average number of persons per households	3.20	3.70	2.81	3.00	3.70	Compendium of Housing Statistics 1971 - United Nations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Clusters of households						
Private households in total	not available	not available	not available	not available	not available	Compendium of Housing Statistics 1971 - United Nations
1-person-households in %	17.00%	not available	22.17%	0.00%	not available	Compendium of Housing Statistics 1971 - United Nations
2-person-households in %	20.70%	not available	28.12%	29.60%	not available	Compendium of Housing Statistics 1971 - United Nations
3-person-households in %	21.60%	not available	22.14%	29.30%	not available	Compendium of Housing Statistics 1971 - United Nations
4- and more-person-households in %	40.60%	not available	27.58%	41.20%	not available	Compendium of Housing Statistics 1971 - United Nations
Household composition in %						
Single adult under 65	not available	not available	not available	not available	not available	
Single adult aged 65+	not available	not available	not available	not available	not available	
Couple both under 65	not available	not available	not available	not available	not available	
Couple, at least one 65+	not available	not available	not available	not available	not available	
Other, no under 18s	not available	not available	not available	not available	not available	
Single adult with children	not available	not available	not available	not available	not available	
2+ adults with children	not available	not available	not available	not available	not available	
Housing indicators						
Housing stock	2,078,000.00	61,658,000.00	25,725,000.00	3,160,000.00	61,658,000.00	Compendium of Housing Statistics 1971 - United Nations
Vacant conventional dwellings (% of total dwelling stock)	2.80%	not available	1.72%	3.40%	not available	Compendium of Housing Statistics 1971 - United Nations
Occupied dwelling stock m2 per person	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Population (millions)	3.10	32.70	20.10	4.50	33.60	Europa in Zahlen - Eurostat Jahrbuch 2010 - Eurostat
Natural population development						
Fertility rate	2.40	not available	not available	2.41	not available	Demography report 2010 - Older, more numerous and diverse Europeans - Eurostat
Net migration (thousands)	not available	not available	not available	not available	not available	
Life expectancy at birth						
Males	66.80	not available	65.80	66.80	not available	Demography report 2010 - Older, more numerous and diverse Europeans - Eurostat
Females	75.00	not available	70.40	73.00	not available	Demography report 2010 - Older, more numerous and diverse Europeans - Eurostat
Ageing indicators (% of total population)						
Age 0-14 (children population)	27.03%	26.89%	25.91%	27.43%	27.89%	World Population Prospects - The 2012 Revision - Volume I: Comprehensive Tables - United Nations
Age 15-64 (working age population)	62.83%	64.86%	65.62%	63.50%	62.45%	World Population Prospects - The 2012 Revision - Volume I: Comprehensive Tables - United Nations
Age 65+ (elderly population)	10.14%	8.25%	8.46%	9.07%	9.66%	World Population Prospects - The 2012 Revision - Volume I: Comprehensive Tables - United Nations
Age 80+ (very elderly population)	not available	not available	not available	not available	not available	
Medium age/ years	not available	not available	not available	not available	not available	
Household indicators						
Number of households	50,333,000.00	not available	5,954,555.00	4,397,579.00	not available	Compendium of Housing Statistics 1971 - United Nations
Average number of persons per households	3.70	3.50	3.20	3.10	4.00	Compendium of Housing Statistics 1971 - United Nations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Clusters of households						
Private households in total	not available	not available	not available	not available	not available	Compendium of Housing Statistics 1971 - United Nations
1-person-households in %	not available	not available	14.20%	14.20%	not available	Compendium of Housing Statistics 1971 - United Nations
2-person-households in %	not available	not available	23.40%	26.80%	not available	Compendium of Housing Statistics 1971 - United Nations
3-person-households in %	not available	not available	23.40%	22.10%	not available	Compendium of Housing Statistics 1971 - United Nations
4- and more-person-households in %	not available	not available	39.10%	36.90%	not available	Compendium of Housing Statistics 1971 - United Nations
Household composition in %						
Single adult under 65	not available	not available	not available	not available	not available	
Single adult aged 65+	not available	not available	not available	not available	not available	
Couple both under 65	not available	not available	not available	not available	not available	
Couple, at least one 65+	not available	not available	not available	not available	not available	
Other, no under 18s	not available	not available	not available	not available	not available	
Single adult with children	not available	not available	not available	not available	not available	
2+ adults with children	not available	not available	not available	not available	not available	
Housing indicators						
Housing stock	61,658,000.00	8,316,000.00	5,380,000.00	3,820,000.00	7,651,000.00	Compendium of Housing Statistics 1971 - United Nations
Vacant conventional dwellings (% of total dwelling stock)	not available	2.60%	2.40%	0.20%	1.20%	Compendium of Housing Statistics 1971 - United Nations
Occupied dwelling stock m2 per person	not available	not available	not available	not available	not available	

Source: Own representation

Appendix 2 Databases demographic characteristics, actual basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population (millions)	7.50	1.30	81.70	10.00	2.20	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Natural population development						
Fertility rate	1.60	1.60	1.40	1.30	1.30	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Net migration (thousands)	-9.90	-0.50	41.00	22.50	-3.40	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Life expectancy at birth						
Males	70.30	69.80	77.60	70.40	68.30	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Females	77.50	80.10	82.70	78.40	78.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Ageing indicators (% of total population)						
Age 0-14 (children population)	13.70%	15.20%	13.40%	14.70%	13.80%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 15-64 (working age population)	68.70%	67.70%	66%	68.60%	68.90%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 65+ (elderly population)	17.60%	17%	20.60%	16.70%	17.30%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 80+ (very elderly population)	3.90%	4.20%	5.10%	4.00%	4.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Medium age/ years	43.00	40.90	45.50	40.60	41.50	World Population Prospects: The 2012 Revision, Volume I: Comprehensive Tables - United Nations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Household indicators						
Number of households	2,900,800.00	548,500.00	40,188,000.00	3,790,600.00	863,400.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average number of persons per households	2.40	2.40	2.00	2.60	2.50	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Clusters of households						
Private households in total	not available	584,000.00	40,076,000.00	3,810,000.00	889,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1-person-households in %	not available	33.00%	39.00%	29.00%	24.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
2-person-households in %	not available	30.00%	34.00%	30.00%	30.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
3-person-households in %	not available	20.00%	13.00%	19.00%	23.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
4- and more-person-households in %	not available	17.00%	14.00%	23.00%	23.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Household composition in %						
Single adult under 65	not available	18.30%	24.40%	11.50%	12.80%	Income and living conditions in Europe - Eurostat
Single adult aged 65+	not available	15.40%	14.00%	12.80%	12.40%	Income and living conditions in Europe - Eurostat
Couple both under 65	not available	11.10%	14.70%	12.80%	8.60%	Income and living conditions in Europe - Eurostat
Couple, at least one 65+	not available	7.80%	14.20%	8.60%	6.50%	Income and living conditions in Europe - Eurostat
Other, no under 18s	not available	19.10%	11.50%	22.60%	25.70%	Income and living conditions in Europe - Eurostat
Single adult with children	not available	4.20%	3.10%	3.20%	4.00%	Income and living conditions in Europe - Eurostat
2+ adults with children	not available	24.20%	18.10%	28.60%	30.10%	Income and living conditions in Europe - Eurostat
Housing indicators						
Housing stock	3,859,460.00	651,000.00	39,268,000.00	4,303,000.00	1,042,000.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Vacant conventional dwellings (% of total dwelling stock)	not available	8.00%	8.00%	5.60%	8.60%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Occupied dwelling stock m2 per person	25.20	29.70	42.90	31.20	27.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Population (millions)	3.30	38.20	21.40	5.40	46.10	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Natural population development						
Fertility rate	1.50	1.40	1.40	1.40	1.40	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Net migration (thousands)	- 13.00	11.70	- 0.20	10.60	79.10	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Life expectancy at birth						
Males	67.70	71.70	70.00	71.60	78.60	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Females	78.70	80.10	77.50	79.10	84.70	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Ageing indicators (% of total population)						
Age 0-14 (children population)	15.00%	15.10%	15.20%	15.30%	15.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 15-64 (working age population)	68.90%	71.30%	69.90%	72.40%	68.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 65+ (elderly population)	16.10%	13.50%	14.90%	12.30%	17.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 80+ (very elderly population)	3.70%	3.40%	3.20%	2.70%	5.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Medium age/ years	39.30	38.80	39.40	38.20	41.40	World Population Prospects: The 2012 Revision, Volume I: Comprehensive Tables - United Nations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Household indicators						
Number of households	1,392,700.00	13,319,200.00	7,395,700.00	1,756,500.00	17,076,300.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average number of persons per households	2.40	2.80	2.90	2.80	2.10	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Clusters of households						
Private households in total	1,354,000.00	13,337,000.00	7,384,000.00	2,072,000.00	16,741,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1-person-households in %	not available	25.00%	18.00%	26.00%	18.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
2-person-households in %	not available	23.00%	27.00%	22.00%	29.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
3-person-households in %	not available	20.00%	23.00%	18.00%	26.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
4- and more-person-households in %	not available	32.00%	33.00%	35.00%	26.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Household composition in %						
Single adult under 65	12.10%	11.30%	not available	11.40%	8.60%	Income and living conditions in Europe - Eurostat
Single adult aged 65+	14.90%	13.40%	not available	13.10%	8.70%	Income and living conditions in Europe - Eurostat
Couple both under 65	9.60%	10%	not available	8.0%	12.20%	Income and living conditions in Europe - Eurostat
Couple, at least one 65+	7.90%	6.60%	not available	7.90%	10.00%	Income and living conditions in Europe - Eurostat
Other, no under 18s	21.90%	24.60%	not available	30.10%	29.20%	Income and living conditions in Europe - Eurostat
Single adult with children	3.80%	1.80%	not available	1.30%	1.10%	Income and living conditions in Europe - Eurostat
2+ adults with children	29.80%	32.40%	not available	28.20%	30.20%	Income and living conditions in Europe - Eurostat
Housing indicators						
Housing stock	1,308,000.00	13,302,000.00	8,329,000.00	1,767,000.00	25,129,000.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Vacant conventional dwellings (% of total dwelling stock)	3.70%	5.30%	not available	11.10%	21.90%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Occupied dwelling stock m2 per person	24.90	24.20	15.00	26.00	33.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Appendix 3 Databases demographic characteristics, future basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population (millions)	5.90	1.20	70.60	9.20	1.80	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Natural population development						
Fertility rate	1.60	1.70	1.50	1.50	1.50	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Net migration (thousands)	3.80	0.80	87.70	22.00	1.90	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Life expectancy at birth						
Males	79.70	79.60	83.60	80.00	78.90	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Females	85.00	86.60	87.80	85.90	85.60	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Ageing indicators (% of total population)						
Age 0-14 (children population)	13.50%	15.00%	12.10%	12.50%	12.30%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 15-64 (working age population)	55.30%	57.10%	55.60%	58.10%	56.60%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 65+ (elderly population)	31.20%	27.90%	32.30%	29.40%	31.20%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 80+ (very elderly population)	10.10%	9.60%	14.50%	9.10%	10.70%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Medium age/ years	48.10	44.40	51.50	46.10	42.70	World Population Prospects: The 2012 Revision, Volume I: Comprehensive Tables - United Nations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Household indicators						
Number of households	3,236,000.00	607,000.00	38,815,000.00	3,946,000.00	839,000.00	Compendium of Human Settlements Statistics 2001 - United Nations
Average number of persons per households	not available	not available	not available	not available	not available	
Clusters of households						
Private households in total	not available	not available	not available	not available	not available	
1-person-households in %	not available	not available	not available	not available	not available	
2-person-households in %	not available	not available	not available	not available	not available	
3-person-households in %	not available	not available	not available	not available	not available	
4- and more-person-households in %	not available	not available	not available	not available	not available	
Household composition in %						
Single adult under 65	not available	not available	not available	not available	not available	
Single adult aged 65+	not available	not available	not available	not available	not available	
Couple both under 65	not available	not available	not available	not available	not available	
Couple, at least one 65+	not available	not available	not available	not available	not available	
Other, no under 18s	not available	not available	not available	not available	not available	
Single adult with children	not available	not available	not available	not available	not available	
2+ adults with children	not available	not available	not available	not available	not available	
Housing indicators						
Housing stock	not available	not available	not available	not available	not available	
Vacant conventional dwellings (% of total dwelling stock)	not available	not available	not available	not available	not available	
Occupied dwelling stock m2 per person	not available	not available	not available	not available	not available	

Source: Own representation

Variables	**Lithuania**	**Poland**	**Romania**	**Slovakia**	**Spain**	**literature**
Population (millions)	2.80	34.50	18.40	5.30	52.70	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Natural population development						
Fertility rate	1.60	1.50	1.50	1.50	1.50	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Net migration (thousands)	2.20	34.20	16.80	9.90	209.70	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Life expectancy at birth						
Males	78.50	80.60	79.80	80.30	84.20	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Females	85.60	86.60	85.10	86.00	89.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Ageing indicators (% of total population)						
Age 0-14 (children population)	14.00%	12.50%	11.90%	12.70%	13.10%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 15-64 (working age population)	58.20%	56.90%	57.00%	57.40%	55.30%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 65+ (elderly population)	27.80%	30.60%	31.10%	29.90%	31.60%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 80+ (very elderly population)	10.20%	9.60%	9.60%	8.80%	11.50%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Medium age/ years	44.20	48.90	48.80	48.20	50.40	2012 Revision, Volume I: Comprehensive Tables - United Nations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Household indicators						
Number of households	1,528,000.00	14,362,000.00	8,288,000.00	2,396,000.00	12,713,000.00	Compendium of Human Settlements Statistics 2001 - United Nations
Average number of persons per households	not available	not available	not available	not available	not available	
Clusters of households						
Private households in total	not available	not available	not available	not available	not available	
1-person-households in %	not available	not available	not available	not available	not available	
2-person-households in %	not available	not available	not available	not available	not available	
3-person-households in %	not available	not available	not available	not available	not available	
4- and more-person-households in %	not available	not available	not available	not available	not available	
Household composition in %						
Single adult under 65	not available	not available	not available	not available	not available	
Single adult aged 65+	not available	not available	not available	not available	not available	
Couple both under 65	not available	not available	not available	not available	not available	
Couple, at least one 65+	not available	not available	not available	not available	not available	
Other, no under 18s	not available	not available	not available	not available	not available	
Single adult with children	not available	not available	not available	not available	not available	
2+ adults with children	not available	not available	not available	not available	not available	
Housing indicators						
Housing stock	not available	not available	not available	not available	not available	
Vacant conventional dwellings (% of total dwelling stock)	not available	not available	not available	not available	not available	
Occupied dwelling stock m2 per person	not available	not available	not available	not available	not available	

Source: Own representation

Appendix 4 Databases space characteristics, past basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Build Quality						
With piped water inside	28.20%	not available	90.59%	36.40%	not available	Compendium of Housing statistics 1971 - United Nations
With toilet flush	11.80%	not available	71.45%	32.70%	not available	Compendium of Housing statistics 1971 - United Nations
Electric lighting	94.80%	not available	not available	92.10%	not available	Compendium of Housing statistics 1971 - United Nations
Fixed bath or shower	8.70%	not available	57.27%	32.20%	not available	Compendium of Housing statistics 1971 - United Nations
Age distribution of housing stock in %						
< 1919	not available	not available	not available	not available	not available	
1919-1945	not available	not available	not available	not available	not available	
1946-1970	not available	not available	not available	not available	not available	
1971-1980	not available	not available	not available	not available	not available	
1981-1990	not available	not available	not available	not available	not available	
1991-2000	not available	not available	not available	not available	not available	
> 2000	not available	not available	not available	not available	not available	
Average number of rooms per dwelling	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Build Quality						
With piped water inside	not available	46.80%	12.30%	49.10%	45.00%	Compendium of Housing statistics 1971 - United Nations
With toilet flush	not available	33.30%	12.20%	39.50%	66.10%	Compendium of Housing statistics 1971 - United Nations
Electric lighting	not available	80.10%	48.60%	97.30%	89.30%	Compendium of Housing statistics 1971 - United Nations
Fixed bath or shower	not available	13.90%	9.60%	33.30%	24.00%	Compendium of Housing statistics 1971 - United Nations
Age distribution of housing stock in %						
< 1919	not available	not available	not available	not available	not available	
1919-1945	not available	not available	not available	not available	not available	
1946-1970	not available	not available	not available	not available	not available	
1971-1980	not available	not available	not available	not available	not available	
1981-1990	not available	not available	not available	not available	not available	
1991-2000	not available	not available	not available	not available	not available	
> 2000	not available	not available	not available	not available	not available	
Average number of rooms per dwelling	not available	not available	not available	not available	not available	

Source: Own representation

Appendix 5 Databases space characteristics, actual basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Build Quality						
With piped water inside	not available	not available	not available	not available	79.70%	Compendium of Housing statistics 2011 - United Nations
With toilet flush	66.20%	not available	not available	86.50%	72.80%	Compendium of Housing statistics 2011 - United Nations
Electric lighting	not available	not available	not available	not available	98.60%	Compendium of Housing statistics 2011 - United Nations
Fixed bath or shower	77.90%	not available	not available	88.80%	67.30%	Compendium of Housing statistics 2011 - United Nations
Age distribution of housing stock in %						
< 1919	not available	9.40%	14.40%	0.00%	13.80%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1919-1945	not available	14.20%	13.60%	20.80%	13.10%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1946-1970	not available	30.00%	46.30%	27.20%	22.10%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1971-1980	not available	21.50%	0.00%	23.10%	19.40%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1981-1990	not available	19.60%	13.20%	17.80%	20.20%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1991-2000	not available	2.00%	9.20%	7.90%	7.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
> 2000	not available	3.30%	3.30%	3.20%	4.40%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average number of rooms per dwelling	not available	3.30	4.40	2.60	2.50	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Build Quality						
With piped water inside	not available	not available	not available	not available	99.30%	Compendium of Housing statistics 2011 - United Nations
With toilet flush	not available	100.00%	not available	not available	not available	Compendium of Housing statistics 2011 - United Nations
Electric lighting	not available	not available	not available	not available	not available	Compendium of Housing statistics 2011 - United Nations
Fixed bath or shower	not available	not available	not available	not available	not available	Compendium of Housing statistics 2011 - United Nations
Age distribution of housing stock in %						
< 1919	6.20%	10.10%	3.90%	3.40%	8.90%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1919-1945	23.30%	13.10%	11.50%	6.60%	4.20%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1946-1970	33.10%	26.90%	37.30%	35.10%	33.50%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1971-1980	17.60%	18.30%	23.80%	25.60%	24.10%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1981-1990	13.50%	18.70%	14.80%	21%	13.60%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1991-2000	6.30%	12.90%	7.30%	6.20%	15.70%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
> 2000	0.00%	0.00%	1.40%	0.60%	0%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average number of rooms per dwelling	2.50	3.70	2.60	3.20	5.10	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Appendix 6 Databases environmental social characteristics, past basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	not available	not available	not available	not available	not available	
Urban clusters in % of population	50.60%	56.30%	43.30%	44.40%	56.30%	Demographic Yearbook 1970 - United Nations
Rural grid cells in % of population	49.40%	43.70%	56.70%	55.60%	43.70%	Demographic Yearbook 1970 - United Nations
Income level						
Share of housing costs in disposable income (%)	not available	not available	not available	not available	not available	
Income per capita	not available	not available	not available	not available	not available	
Number of depedent people (thousands; AWG reference scenario)	not available	not available	not available	not available	not available	
Land area						
Land area in km2	110,912.00	22,402,200.00	355,744.00	93,030.00	22,402,200.00	Demographic Yearbook 1970 - United Nations
Population/ km2 (Density 1970)	77.00	11.00	212.73	111.00	11.00	Demographic Yearbook 1970 - United Nations
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	not available	not available	not available	not available	not available	
Construction cost index (2005=100)	not available	not available	not available	not available	not available	
Average price for one existing dwelling in Euro	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Tenure Status (%)						
Owner occupied	71.00%	not available	not available	62.90%	not available	Compendium of Housing Statistics 1971 - United Nations
Private rent	17.10%	not available	not available	29.60%	not available	Compendium of Housing Statistics 1971 - United Nations
Social rent	not available	not available	not available	not available	not available	Compendium of Housing Statistics 1971 - United Nations
Other	not available	not available	not available	not available	not available	Compendium of Housing Statistics 1971 - United Nations
Levels of rent free market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Economic conditions						
Unemployment rate (%, 15-64)	not available	not available	not available	not available	not available	
Population at-risk-of-poverty in %	not available	not available	not available	not available	not available	
Size of economy (billion USD)	not available	not available	not available	not available	not available	
Value in level of GDP (millions of national currency units)	9,349.80	not available	513,880.00	253,100.00	not available	Compendium of Housing Statistics 1971 - United Nations
Fixed capital formation in total (millions of national currency units)	2,041.00	not available	129,430.00	38,000.00	not available	Compendium of Housing Statistics 1971 - United Nations
Fixed capital formation residential in total (millions of national currency units)	365.00	not available	26,010.00	6,300.00	not available	Compendium of Housing Statistics 1971 - United Nations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	not available	not available	not available	not available	not available	
Urban clusters in % of population	56.30%	52.00%	40.80%	47.60%	42.90%	Demographic Yearbook 1970 - United Nations
Rural grid cells in % of population	43.70%	48.00%	59.20%	52.40%	57.10%	Demographic Yearbook 1970 - United Nations
Income level						
Share of housing costs in disposable income (%)	not available	not available	not available	not available	not available	
Income per capita	not available	not available	not available	not available	not available	
Number of depedent people (thousands; AWG reference scenario)	not available	not available	not available	not available	not available	
Land area						
Land area in km2	22,402,200.00	312,677.00	237,500.00	127,869.00	504,750.00	Demographic Yearbook 1970 - United Nations
Population/ km2 (Density 1970)	11.00	105.00	85.00	113.00	66.00	Demographic Yearbook 1970 - United Nations
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	not available	not available	not available	not available	not available	
Construction cost index (2005=100)	not available	not available	not available	not available	not available	
Average price for one existing dwelling in Euro	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Tenure Status (%)						
Owner occupied	not available	not available	not available	50.40%	45.90%	Compendium of Housing Statistics 1971 - United Nations
Private rent	not available	not available	not available	42.00%	54.10%	Compendium of Housing Statistics 1971 - United Nations
Social rent	not available	not available	not available	not available	not available	Compendium of Housing Statistics 1971 - United Nations
Other	not available	not available	not available	not available	not available	Compendium of Housing Statistics 1971 - United Nations
Levels of rent free market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Economic conditions						
Unemployment rate (%, 15-64)	not available	not available	not available	not available	not available	
Population at-risk-of-poverty in %	not available	not available	not available	not available	not available	
Size of economy (billion USD)	not available	not available	not available	not available	not available	
Value in level of GDP (millions of national currency units)	not available	668,800.00	561.00	189,548.00	1,503,500.00	Compendium of Housing Statistics 1971 - United Nations
Fixed capital formation in total (millions of national currency units)	not available	130,500.00	67,529.00	13,986.00	374,600.00	Compendium of Housing Statistics 1971 - United Nations
Fixed capital formation residential in total (millions of national currency units)	not available	34,000.00	5,498.00	2,534.00	63,200.00	Compendium of Housing Statistics 1971 - United Nations

Source: Own representation

Appendix 7 Databases environmental social characteristics, actual basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	35.00%	32.00%	31.00%	24.00%	35.00%	Focus on territorial typologies - Eurostat
Urban clusters in % of population	26.00%	29.00%	41.00%	33.00%	25.00%	Focus on territorial typologies - Eurostat
Rural grid cells in % of population	39.00%	39.00%	28.00%	43.00%	40.00%	Focus on territorial typologies - Eurostat
Income level						
Share of housing costs in disposable income (%)	18.40%	15.50%	31.00%	23.20%	18.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Income per capita	$ 2,542.00	not available	$ 25,083.00	$ 5,833.00	$ 4,973.00	The World in 2050 - HSBC Global Research
Number of depedent people (thousands; AWG reference scenario)	333.00	95.00	8,408.00	805.00	137.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Land area						
Land area in km2	110,912.00	45,227.00	357,031.00	93,030.00	64,589.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Population/ km2	69.00	30.90	229.90	108.10	36.50	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	165.60	179.00	771.50	244.60	186.20	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Construction cost index (2005=100)	139.90	115.30	111.50	123.10	152.50	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average price for one existing dwelling in Euro	not available	120,000.00	not available	not available	24,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Tenure Status (%)						
Owner occupied	95.60%	96%	42.00%	92.00%	84.90%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Private rent	0.00%	3.00%	53.00%	3.30%	14.70%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Social rent	3.10%	1.00%	5.00%	3.70%	0.40%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Other	1.30%	0.00%	0.00%	0.00%	0.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Levels of rent free market						
Average annual rent for rental dwellings in Euro	not available	not available	4,900.00 €	1,700.00 €	85,000.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Average size m2 for rental dwellings	not available	not available	71.00	51.00	48.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	not available	1,300.00 €	not available	400.00 €	14,000.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average size m2 for rental dwellings	not available	45.00	not available	48.00	51.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Economic conditions						
Unemployment rate (%, 15-64)	10.50%	17.20%	7.20%	11.30%	19.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Population at-risk-of-poverty in %	46.20%	23.40%	20.00%	29.60%	37.40%	Europe in figures - Eurostat yearbook 2012 - Eurostat
Size of economy (billion USD)	$ 19.00	not available	$ 2,058.00	$ 58.00	$ 11.00	The World in 2050 - HSBC Global Research
GDP per capita	1.90%	-0.80%	1.20%	-1.50%	-0.70%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Potential GDP (growth rate)	1.80%	-0.80%	1.20%	0.20%	-1.90%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	32.00%	28.00%	30.00%	17.00%	43.00%	Focus on territorial typologies - Eurostat
Urban clusters in % of population	12.00%	28.00%	21.00%	35.00%	25.00%	Focus on territorial typologies - Eurostat
Rural grid cells in % of population	56.00%	44.00%	49.00%	48.00%	32.00%	Focus on territorial typologies - Eurostat
Income level						
Share of housing costs in disposable income (%)	15.90%	21.10%	25.30%	22.00%	18.60%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Income per capita	$ 5,154.00	$ 6,563.00	$ 2,596.00	$ 8,042.00	$ 15,699.00	The World in 2050 - HSBC Global Research
Number of depedent people (thousands; AWG reference scenario)	280.00	2,424.00	1,317.00	508.00	2,485.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Land area						
Land area in km2	65,300.00	312,685.00	238,391.00	49,035.00	505,124.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Population/ km2	53.90	122.40	93.70	110.10	79.60	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	168.20	250.10	138.40	310.30	363.30	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Construction cost index (2005=100)	116.10	115.80	148.20	116.80	122.30	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average price for one existing dwelling in Euro	not available	not available	not available	not available	233,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Tenure Status (%)						
Owner occupied	91.00%	62.40%	96.00%	92.00%	85.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Private rent	4.00%	8.00%	0.70%	0.40%	11.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Social rent	3.00%	10.00%	2.30%	2.60%	2.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Other	2.00%	19.60%	1.00%	4.00%	2.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Levels of rent free market						
Average annual rent for rental dwellings in Euro	1,100.00 €	not available	not available	not available	5,100.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Average size m2 for rental dwellings	61.00	not available	not available	124.10	74.80	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	100.00 €	not available	not available	not available	1,600.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average size m2 for rental dwellings	44.00	not available	not available	59.80	74.90	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Economic conditions						
Unemployment rate (%, 15-64)	18.10%	9.80%	7.60%	14.40%	20.20%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Population at-risk-of-poverty in %	29.50%	27.80%	43.10%	19.60%	23.40%	Europe in figures - Eurostat yearbook 2012 - Eurostat
Size of economy (billion USD)	$ 17.00	$ 250.00	$ 56.00	$ 44.00	$ 711.00	The World in 2050 - HSBC Global Research
GDP per capita	0.80%	1.90%	2.20%	3.00%	0.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Potential GDP (growth rate)	-0.30%	4.30%	2.00%	3.50%	0.70%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission

Source: Own representation

Appendix 8 Databases environmental social characteristics, future basic years

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	not available	not available	not available	not available	not available	
Urban clusters in % of population	83.41%	80.01%	83.81%	82.14%	78.08%	Urban/ rural division of countries for 2010 - Geohive
Rural grid cells in % of population	16.59%	19.99%	16.19%	17.86%	21.92%	Urban/ rural division of countries for 2010 - Geohive
Income level						
Share of housing costs in disposable income (%)	not available	not available	not available	not available	not available	
Income per capita (constant 2000, USD)	$ 13,154.00	not available	$ 52,683.00	$ 31,966.00	$ 27,143.00	The World in 2050 - HSBC Global Research
Number of depedent people (thousands; AWG reference scenario)	370.00	113.00	9810.00	1002.00	157.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Land area						
Land area in km2	110,912.00	45,227.00	357,031.00	93,030.00	64,589.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Population/ km2	46.00	25.00	203.00	96.00	26.00	Future Population Density - Geohive
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	not available	not available	not available	not available	not available	
Construction cost index (2005=100)	not available	not available	not available	not available	not available	
Average price for one existing dwelling in Euro	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Tenure Status (%)						
Owner occupied	not available	not available	not available	not available	not available	
Private rent	not available	not available	not available	not available	not available	
Social rent	not available	not available	not available	not available	not available	
Other	not available	not available	not available	not available	not available	
Levels of rent free market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	
Economic conditions						
Unemployment rate (%)	7.30%	7.30%	6.10%	7.30%	7.30%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Population at-risk-of-poverty in %	not available	not available	not available	not available	not available	
Size of economy (billion USD)	$ 72.00	not available	$ 3,714.00	$ 295.00	$ 52.00	The World in 2050 - HSBC Global Research
GDP per capita	1.40%	1.10%	1.40%	1.20%	1.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Potential GDP (growth rate)	0.80%	0.90%	0.80%	0.90%	0.30%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	not available	not available	not available	not available	not available	
Urban clusters in % of population	78.73%	73.62%	77.37%	69.32%	86.47%	Urban/ rural division of countries for 2010 - Geohive
Rural grid cells in % of population	21.27%	26.38%	22.63%	30.68%	13.53%	Urban/ rural division of countries for 2010 - Geohive
Income level						
Share of housing costs in disposable income (%)	not available	not available	not available	not available	not available	
Income per capita (constant 2000, USD)	$ 20,955.00	$ 24,547.00	$ 20,357.00	$ 27,639.00	$ 38,111.00	The World in 2050 - HSBC Global Research
Number of depedent people (thousands; AWG reference scenario)	327.00	3349.00	1728.00	797.00	4093.00	Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Land area						
Land area in km2	65,300.00	312,685.00	238,391.00	49,035.00	505,124.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Population/ km2	39.00	109.00	75.00	102.00	96.00	Future Population Density - Geohive
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	not available	not available	not available	not available	not available	
Construction cost index (2005=100)	not available	not available	not available	not available	not available	
Average price for one existing dwelling in Euro	not available	not available	not available	not available	not available	

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Tenure Status (%)						
Owner occupied	not available	not available	not available	not available	not available	
Private rent	not available	not available	not available	not available	not available	
Social rent	not available	not available	not available	not available	not available	
Other	not available	not available	not available	not available	not available	
Levels of rent free market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	not available	not available	not available	not available	not available	
Average size m2 for rental dwellings	not available	not available	not available	not available	not available	
Economic conditions						
Unemployment rate (%)	7.30%	7.30%	7.00%	7.30%	7.30%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European
Population at-risk-of-poverty in %	not available	not available	not available	not available	not available	
Size of economy (billion USD)	$ 59.00	$ 786.00	$ 377.00	$ 145.00	$ 1,954.00	The World in 2050 - HSBC Global Research
GDP per capita	1.20%	1.00%	1.10%	0.90%	1.20%	Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Potential GDP (growth rate)	0.70%	0.50%	0.50%	0.60%	1.20%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European

Source: Own representation

Appendix 9 Interview introduction papers

Enlargement for residential trade and industry portfolio valuation and optimisation within the framework of the demographic development in the European Union

Introduction to the topic:

The current demographic developments in the European Union 27 have been evident ever since they began a few decades ago. Nevertheless, neither the European regimes or the public nor the residential trade and industry noticed this trend for several years. Nowadays this topic is high on the public agenda.

The demographic changes validate the key ensuing tendencies: significant changes in the age structures of the populations of the European Union. The size of the younger generations is falling, while the number of seniors is increasing. The main demographic trends demonstrate low fertility indicators with lowest–low fertility, i.e. below 1.3 children per woman with an average of 1.6 across the European Union. This is still well below the replacement rate of 2.1 children per woman with the result of the young generations shrinking. On the other hand, life expectancy continues to rise, particularly due to improvements at older ages. Since there are large inconsistencies among and within countries, there is the prospect for raising average life spans for the less-advantaged clusters. Populaces, which are presently the oldest, such as Germany's and Italy's, will age quickly for the next twenty years, before stabilising. Some populations that are younger at present, typically in Eastern Europe, will undergo rapid ageing and by 2060 will have the oldest inhabitants in Europe.[1]

The population of the European Union is rising and its inhabitants are getting older. In 2014 the population of the European Union was projected to be 507.4 million, 1.7 million more than the previous year.[2] Nevertheless, although the net migration rate continued to be the core determinant of population development by contributing 63% to the total population growth in the European Union, the population in eight countries was already declining. It is forecast that the number of inhabitants will continue to fall until 2050 in 9 countries: Bulgaria, Germany, Estonia, Latvia, Lithuania, Hungary, Poland, Romania and Slovakia.[3]

Source: Own representation

[1] Cp. Eurostat (2011); p. 27.

[2] Cp. Statista (2014); w.p.

[3] Cp. Eurostat (2011); p. 59 ff.; European Commission (2012); p. 297.

Motivation:

As a result of the demographic developments in the European Union 27 the demand for real estate, primarily properties in the residential trade and industry, is changing and will do so in the future. Consequently the real estate assets vary over the years, especially in the above-mentioned 9 countries of the European Union with declining population rates. Some clusters of residences will become unusable and need to be demolished in certain areas. On the other hand, there will be real estate clusters with the option of modernisation to make them senior-compatible. In urban areas there could be the opportunity to increase the number of real estate assets in order to realise demographic change. To stabilise, protect and develop the real estate assets of European states with declining populations in the residential trade and industry, it is necessary to focus on effective strategies. Therefore, an in-depth assessment of real estate resources is required. Furthermore, strategic measures such as portfolio management tools have to be available to concentrate on strategies for the future in order to hedge these real estate assets in future.

The author:

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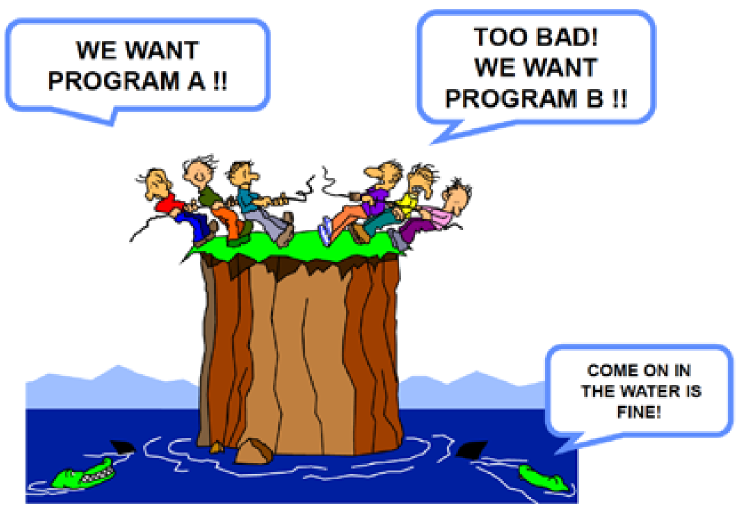
Marion Preuss has also gained theoretical experience from her academic career when studying to obtain her Bachelor of Business Administration as well as Master of Business Administration degrees.

Source: Own representation

The methodology:

Figure 1: Decision Making[4]



„'You can´t compare apples and oranges', so the saying goes. But is this true? Consider a hungry person who likes both apples and oranges and is offered a choice between a large, red, pungent, joicy looking Washington State apple and an even larger, old an shrivelled, pale colored orange with a soft spot. Which one is that person more likely to choose? Let us reverse the situation and offer the same person on the next day a small, deformed, unripe apple with a couple of worm holes and a fresh colored navel orange from California. Which one is he or she more likely to choose now?"[5]

The Analytic Hierarchy Process (AHP) is a decision-making framework with the objective to measure tangible and intangible variables and to solve complex issues. It is created to choose the best alternative for a target evaluated with respect to various different criteria as well as sub-criteria. The decision maker has to realise pairwise comparison assessments to establish priorities for ranking the alternatives.[6]

The pairwise comparisons in the process of AHP are implemented to pairs of consistent elements. The fundamental scale of values shown in the following figure is used to weight the intensities of importance.[7]

Source: Own representation

[4] Expert Choice (w.y.); p. 2.

[5] Saaty; Vargas (2001); p. 1.

[6] Cp. Saaty; Vargas (2001); p. 1.

[7] Cp. Saaty; Vargas (2001); p. 1.

Figure 2 The Fundamental Scale of absolute numbers[8]

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
Reciprocals of about	If activity *a* has one of the above non-zero numbers assigned to it when compared with activity *b*, then *b* has the reciprocal value when compared with *a*	A reasonable assumption
Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining n numerical values to span the matrix

Thanksgiving:

Thank you very much for your help and your support!

Source: Own representation

[8] Saaty (2009); p. 7; own illustration (2014).

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Date of demand: 06.12.2014.

Link: http://de.statista.com/statistik/daten/studie/14035/umfrage/europaeische-union-bevoelkerung-einwohner/

Source: Own representation

Appendix 10 Interview data foundation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population (millions)	7.50	1.30	81.70	10.00	2.20	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Natural population development						
Fertility rate	1.60	1.60	1.40	1.30	1.30	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Net migration (thousands)	- 9.90	- 0.50	41.00	22.50	- 3.40	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Life expectancy at birth						
Males	70.30	69.80	77.60	70.40	68.30	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Females	77.50	80.10	82.70	78.40	78.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Ageing indicators (% of total population)						
Age 0-14 (children population)	13.70%	15.20%	13.40%	14.70%	13.80%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 15-64 (working age population)	68.70%	67.70%	66%	68.60%	68.90%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 65+ (elderly population)	17.60%	17%	20.60%	16.70%	17.30%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 80+ (very elderly population)	3.90%	4.20%	5.10%	4.00%	4.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Medium age/ years	43.00	40.90	45.50	40.60	41.50	World Population Prospects: The 2012 Revision, Volume I: Comprehensive Tables - United Nations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Household indicators						
Number of households	2,900,800.00	548,500.00	40,188,000.00	3,790,600.00	863,400.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average number of persons per households	2.40	2.40	2.00	2.60	2.50	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Clusters of households						
Private households in total	not available	584,000.00	40,076,000.00	3,810,000.00	889,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1-person-households in %	not available	33.00%	39.00%	29.00%	24.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
2-person-households in %	not available	30.00%	34.00%	30.00%	30.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
3-person-households in %	not available	20.00%	13.00%	19.00%	23.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
4- and more-person-households in %	not available	17.00%	14.00%	23.00%	23.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Household composition in %						
Single adult under 65	not available	18.30%	24.40%	11.50%	12.80%	Income and living conditions in Europe - Eurostat
Single adult aged 65+	not available	15.40%	14.00%	12.80%	12.40%	Income and living conditions in Europe - Eurostat
Couple both under 65	not available	11.10%	14.70%	12.80%	8.60%	Income and living conditions in Europe - Eurostat
Couple, at least one 65+	not available	7.80%	14.20%	8.60%	6.50%	Income and living conditions in Europe - Eurostat
Other, no under 18s	not available	19.10%	11.50%	22.60%	25.70%	Income and living conditions in Europe - Eurostat
Single adult with children	not available	4.20%	3.10%	3.20%	4.00%	Income and living conditions in Europe - Eurostat
2+ adults with children	not available	24.20%	18.10%	28.60%	30.10%	Income and living conditions in Europe - Eurostat
Housing indicators						
Housing stock	3,859,460.00	651,000.00	39,268,000.00	4,303,000.00	1,042,000.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Vacant conventional dwellings (% of total dwelling stock)	not available	8.00%	8.00%	5.60%	8.60%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Occupied dwelling stock m2 per person	25.20	29.70	42.90	31.20	27.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Population (millions)	3.30	38.20	21.40	5.40	46.10	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Natural population development						
Fertility rate	1.50	1.40	1.40	1.40	1.40	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Net migration (thousands)	- 13.00	11.70	- 0.20	10.60	79.10	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Life expectancy at birth						
Males	67.70	71.70	70.00	71.60	78.60	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Females	78.70	80.10	77.50	79.10	84.70	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Ageing indicators (% of total population)						
Age 0-14 (children population)	15.00%	15.10%	15.20%	15.30%	15.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 15-64 (working age population)	68.90%	71.30%	69.90%	72.40%	68.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 65+ (elderly population)	16.10%	13.50%	14.90%	12.30%	17.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Age 80+ (very elderly population)	3.70%	3.40%	3.20%	2.70%	5.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Medium age/ years	39.30	38.80	39.40	38.20	41.40	World Population Prospects: The 2012 Revision, Volume I: Comprehensive Tables - United Nations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Household indicators						
Number of households	1,392,700.00	13,319,200.00	7,395,700.00	1,756,500.00	17,076,300.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average number of persons per households	2.40	2.80	2.90	2.80	2.10	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Clusters of households						
Private households in total	1,354,000.00	13,337,000.00	7,384,000.00	2,072,000.00	16,741,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1-person-households in %	not available	25.00%	18.00%	26.00%	18.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
2-person-households in %	not available	23.00%	27.00%	22.00%	29.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
3-person-households in %	not available	20.00%	23.00%	18.00%	26.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
4- and more-person-households in %	not available	32.00%	33.00%	35.00%	26.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Household composition in %						
Single adult under 65	12.10%	11.30%	not available	11.40%	8.60%	Income and living conditions in Europe - Eurostat
Single adult aged 65+	14.90%	13.40%	not available	13.10%	8.70%	Income and living conditions in Europe - Eurostat
Couple both under 65	9.60%	10%	not available	8.0%	12.20%	Income and living conditions in Europe - Eurostat
Couple, at least one 65+	7.90%	6.60%	not available	7.90%	10.00%	Income and living conditions in Europe - Eurostat
Other, no under 18s	21.90%	24.60%	not available	30.10%	29.20%	Income and living conditions in Europe - Eurostat
Single adult with children	3.80%	1.80%	not available	1.30%	1.10%	Income and living conditions in Europe - Eurostat
2+ adults with children	29.80%	32.40%	not available	28.20%	30.20%	Income and living conditions in Europe - Eurostat
Housing indicators						
Housing stock	1,308,000.00	13,302,000.00	8,329,000.00	1,767,000.00	25,129,000.00	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Vacant conventional dwellings (% of total dwelling stock)	3.70%	5.30%	not available	11.10%	21.90%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Occupied dwelling stock m2 per person	24.90	24.20	15.00	26.00	33.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Build Quality						
With piped water inside	not available	not available	not available	not available	79.70%	Compendium of Housing statistics 2011 - United Nations
With toilet flush	66.20%	not available	not available	86.50%	72.80%	Compendium of Housing statistics 2011 - United Nations
Electric lighting	not available	not available	not available	not available	98.60%	Compendium of Housing statistics 2011 - United Nations
Fixed bath or shower	77.90%	not available	not available	88.80%	67.30%	Compendium of Housing statistics 2011 - United Nations
Age distribution of housing stock in %						
< 1919	not available	9.40%	14.40%	0.00%	13.80%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1919-1945	not available	14.20%	13.60%	20.80%	13.10%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1946-1970	not available	30.00%	46.30%	27.20%	22.10%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1971-1980	not available	21.50%	0.00%	23.10%	19.40%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1981-1990	not available	19.60%	13.20%	17.80%	20.20%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1991-2000	not available	2.00%	9.20%	7.90%	7.00%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
> 2000	not available	3.30%	3.30%	3.20%	4.40%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average number of rooms per dwelling	not available	3.30	4.40	2.60	2.50	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Build Quality						
With piped water inside	not available	not available	not available	not available	99.30%	Compendium of Housing statistics 2011 - United Nations
With toilet flush	not available	100.00%	not available	not available	not available	Compendium of Housing statistics 2011 - United Nations
Electric lighting	not available	not available	not available	not available	not available	Compendium of Housing statistics 2011 - United Nations
Fixed bath or shower	not available	not available	not available	not available	not available	Compendium of Housing statistics 2011 - United Nations
Age distribution of housing stock in %						
< 1919	6.20%	10.10%	3.90%	3.40%	8.90%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1919-1945	23.30%	13.10%	11.50%	6.60%	4.20%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1946-1970	33.10%	26.90%	37.30%	35.10%	33.50%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1971-1980	17.60%	18.30%	23.80%	25.60%	24.10%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1981-1990	13.50%	18.70%	14.80%	21%	13.60%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
1991-2000	6.30%	12.90%	7.30%	6.20%	15.70%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
> 2000	0.00%	0.00%	1.40%	0.60%	0%	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average number of rooms per dwelling	2.50	3.70	2.60	3.20	5.10	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	35.00%	32.00%	31.00%	24.00%	35.00%	Focus on territorial typologies - Eurostat
Urban clusters in % of population	26.00%	29.00%	41.00%	33.00%	25.00%	Focus on territorial typologies - Eurostat
Rural grid cells in % of population	39.00%	39.00%	28.00%	43.00%	40.00%	Focus on territorial typologies - Eurostat
Income level						
Share of housing costs in disposable income (%)	18.40%	15.50%	31.00%	23.20%	18.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Income per capita	$ 2,542.00	not available	$ 25,083.00	$ 5,833.00	$ 4,973.00	The World in 2050 - HSBC Global Research
Number of depedent people (thousands; AWG reference scenario)	333.00	95.00	8,408.00	805.00	137.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Land area						
Land area in km2	110,912.00	45,227.00	357,031.00	93,030.00	64,589.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Population/ km2	69.00	30.90	229.90	108.10	36.50	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	165.60	179.00	771.50	244.60	186.20	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Construction cost index (2005=100)	139.90	115.30	111.50	123.10	152.50	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average price for one existing dwelling in Euro	not available	120,000.00	not available	not available	24,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Tenure Status (%)						
Owner occupied	95.60%	96%	42.00%	92.00%	84.90%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Private rent	0.00%	3.00%	53.00%	3.30%	14.70%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Social rent	3.10%	1.00%	5.00%	3.70%	0.40%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Other	1.30%	0.00%	0.00%	0.00%	0.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Levels of rent free market						
Average annual rent for rental dwellings in Euro	not available	not available	4,900.00 €	1,700.00 €	85,000.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Bulgaria	Estonia	Germany	Hungary	Latvia	literature
Average size m2 for rental dwellings	not available	not available	71.00	51.00	48.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	not available	1,300.00 €	not available	400.00 €	14,000.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average size m2 for rental dwellings	not available	45.00	not available	48.00	51.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Economic conditions						
Unemployment rate (%, 15-64)	10.50%	17.20%	7.20%	11.30%	19.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Population at-risk-of-poverty in %	46.20%	23.40%	20.00%	29.60%	37.40%	Europe in figures - Eurostat yearbook 2012 - Eurostat
Size of economy (billion USD)	$ 19.00	not available	$ 2,058.00	$ 58.00	$ 11.00	The World in 2050 - HSBC Global Research
GDP per capita	1.90%	-0.80%	1.20%	-1.50%	-0.70%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Potential GDP (growth rate)	1.80%	-0.80%	1.20%	0.20%	-1.90%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Population density (contiguous grid cells of 1 km2)						
High-density clusters in % of population	32.00%	28.00%	30.00%	17.00%	43.00%	Focus on territorial typologies - Eurostat
Urban clusters in % of population	12.00%	28.00%	21.00%	35.00%	25.00%	Focus on territorial typologies - Eurostat
Rural grid cells in % of population	56.00%	44.00%	49.00%	48.00%	32.00%	Focus on territorial typologies - Eurostat
Income level						
Share of housing costs in disposable income (%)	15.90%	21.10%	25.30%	22.00%	18.60%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Income per capita	$ 5,154.00	$ 6,563.00	$ 2,596.00	$ 8,042.00	$ 15,699.00	The World in 2050 - HSBC Global Research
Number of depedent people (thousands; AWG reference scenario)	280.00	2,424.00	1,317.00	508.00	2,485.00	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Land area						
Land area in km2	65,300.00	312,685.00	238,391.00	49,035.00	505,124.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Population/ km2	53.90	122.40	93.70	110.10	79.60	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Supply/ demand						
Total housing cost in Purchasing Power Standard (PPS)	168.20	250.10	138.40	310.30	363.30	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Construction cost index (2005=100)	116.10	115.80	148.20	116.80	122.30	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Average price for one existing dwelling in Euro	not available	not available	not available	not available	233,000.00	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Tenure Status (%)						
Owner occupied	91.00%	62.40%	96.00%	92.00%	85.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Private rent	4.00%	8.00%	0.70%	0.40%	11.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Social rent	3.00%	10.00%	2.30%	2.60%	2.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Other	2.00%	19.60%	1.00%	4.00%	2.00%	Housing Europe Review 2012 - The nuts and bolts of European social housing systems - CECODHAS
Levels of rent free market						
Average annual rent for rental dwellings in Euro	1,100.00 €	not available	not available	not available	5,100.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations

Source: Own representation

Variables	Lithuania	Poland	Romania	Slovakia	Spain	literature
Average size m2 for rental dwellings	61.00	not available	not available	124.10	74.80	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Levels of rent regulated market						
Average annual rent for rental dwellings in Euro	100.00 €	not available	not available	not available	1,600.00 €	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Average size m2 for rental dwellings	44.00	not available	not available	59.80	74.90	Housing statistics in the European Union 2010 - Ministry of the Interior and Kingdom Relations
Economic conditions						
Unemployment rate (%, 15-64)	18.10%	9.80%	7.60%	14.40%	20.20%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Population at-risk-of-poverty in %	29.50%	27.80%	43.10%	19.60%	23.40%	Europe in figures - Eurostat yearbook 2012 - Eurostat
Size of economy (billion USD)	$ 17.00	$ 250.00	$ 56.00	$ 44.00	$ 711.00	The World in 2050 - HSBC Global Research
GDP per capita	0.80%	1.90%	2.20%	3.00%	0.00%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission
Potential GDP (growth rate)	-0.30%	4.30%	2.00%	3.50%	0.70%	The 2012 Ageing Report - Economic and Budgetary projections for the 27 EU Member States (2010-2060) - European Commission

Source: Own representation

Appendix 11 AHP-survey Matthias Ross – Cluster 1: Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**1**	**1**	0.3333
Space characteristics	1	1	**1**	0.3333
Environment social characteristics	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**5**	**5**	**5**	**1**	0.3846
Household indicators	1/5	1	**1**	**1**	**1/5**	0.0769
Clusters of households	1/5	1	1	**1**	**1/5**	0.0769
Household composition	1/5	1	1	1	**1/5**	0.0769
Housing indicators	1	5	5	5	1	0.3846
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**8**	**1**	0.4706
Age distribution of housing stock	1/8	1	**1/8**	0.0588
Average number of rooms per dwelling	1	8	1	0.4706
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/2**	**3**	**1/2**	**1/4**	**1/9**	**1/5**	0.0521
Income level	2	1	**1**	**1**	**1/2**	**1/9**	**1/3**	0.0620
Land area	1/3	1	1	**1/2**	**1/2**	**1/3**	**1/5**	0.0524
Supply/ demand	2	1	2	1	**1/2**	**1/5**	**1/5**	0.0685
Tenure status	4	2	2	2	1	**1/7**	**1/4**	0.1049
Levels of rent	9	9	3	5	7	1	**1**	0.3816
Economic conditions	5	3	5	5	4	1	1	0.2784
CR	8.33%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1**	0.4000
Portfolio B: Modernized version	1/2	1	**1/2**	0.2000
Portfolio C: New construction version	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/8**	0.0769
Portfolio B: Modernized version	4	1	**1/2**	0.3077
Portfolio C: New construction version	8	2	1	0.6154
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**9**	**2**	0.6264
Portfolio B: Modernized version	1/9	1	**1/4**	0.0724
Portfolio C: New construction version	1/2	4	1	0.3012
CR	0.15%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/6**	0.1000
Portfolio B: Modernized version	3	1	**1/2**	0.3000
Portfolio C: New construction version	6	2	1	0.6000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/9**	**1/5**	0.0660
Portfolio B: Modernized version	9	1	**2**	0.6153
Portfolio C: New construction version	5	1/2	1	0.3187
CR	0.12%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/6**	0.1000
Portfolio B: Modernized version	3	1	**1/2**	0.3000
Portfolio C: New construction version	6	2	1	0.6000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3333	0.3333	0.3333	0.4000	0.3333	0.3846	Ageing indicators	0.3385
Portfolio B: Modernized version	0.3333	0.3333	0.3333	0.2000	0.3333	0.0769	Household indicators	0.3231
Portfolio C: New construction version	0.3333	0.3333	0.3333	0.4000	0.3333	0.0769	Clusters of households	0.3385
						0.0769	Household composition	
						0.3846	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1429	0.3333	0.1429	0.4706	Build Quality	0.1541
Portfolio B: Modernized version	0.2857	0.3333	0.5714	0.0588	Age distribution of housing stock	0.4230
Portfolio C: New construction version	0.5714	0.3333	0.2857	0.4706	Average number of rooms per dwelling	0.4230

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac- teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1429	0.0769	0.6264	0.1000	0.0660	0.3333	0.1000	0.0521	Population density	0.2139
Portfolio B: Modernized version	0.5714	0.3077	0.0724	0.3000	0.6153	0.3333	0.3000	0.0620	Income level	0.3485
Portfolio C: New con- struction version	0.2857	0.6154	0.3012	0.6000	0.3187	0.3333	0.6000	0.0524	Land area	0.4376
								0.0685	Supply/ de- mand	
								0.1049	Tenure status	
								0.3816	Levels of rent	
								0.2784	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3385	0.1541	0.2139	0.3333	Demographic characteristics	**0.2355**
Portfolio B: Modernized version	0.3231	0.4230	0.3485	0.3333	Space characteristics	**0.3648**
Portfolio C: New construction version	0.3385	0.4230	0.4376	0.3333	Environment social characteristics	**0.3997**

Source: Own analyses

Appendix 12 AHP-survey Matthias Ross – Cluster 2: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**1**	**1**	0.3333
Space characteristics	1	1	**1**	0.3333
Environment social characteristics	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**2**	**2**	**2**	**1**	0.2983
Household indicators	1/2	1	**1**	**1**	**2**	0.1883
Clusters of households	1/2	1	1	**1**	**2**	0.1883
Household composition	1/2	1	1	1	**2**	0.1883
Housing indicators	1	1/2	1/2	1/2	1	0.1368
CR	5.55%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**8**	**4**	0.7273
Age distribution of housing stock	1/8	1	**1/2**	0.0909
Average number of rooms per dwelling	1/4	2	1	0.1818
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**2**	**1/5**	**1/2**	**1/4**	**1**	0.0711
Income level	5	1	**2**	**1/2**	**1/2**	**1/3**	**1/2**	0.1197
Land area	1/2	1/2	1	**1/3**	**1/3**	**1/2**	**1/2**	0.0618
Supply/ demand	5	2	3	1	**1**	**1/2**	**1/2**	0.1694
Tenure status	2	2	3	1	1	**1/3**	**1**	0.1460
Levels of rent	4	3	2	2	3	1	**2**	0.2754
Economic conditions	1	2	2	2	1	1/2	1	0.1566
CR	9.39%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**4**	0.6250
Portfolio B: Modernized version	1/3	1	**2**	0.2385
Portfolio C: New construction version	1/4	1/2	1	0.1365
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1**	0.4000
Portfolio B: Modernized version	1/2	1	**1/2**	0.2000
Portfolio C: New construction version	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/2**	0.1168
Portfolio B: Modernized version	5	1	**4**	0.6833
Portfolio C: New construction version	2	1/4	1	0.1998
CR	2.38%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1020
Portfolio B: Modernized version	6	1	**5**	0.7258
Portfolio C: New construction version	2	1/5	1	0.1721
CR	2.81%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**9**	**9**	0.8182
Portfolio B: Modernized version	1/9	1	**1**	0.0909
Portfolio C: New construction version	1/9	1	1	0.0909
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1634
Portfolio B: Modernized version	2	1	**1/2**	0.2970
Portfolio C: New construction version	3	2	1	0.5396
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**3**	0.5396
Portfolio B: Modernized version	1/2	1	**2**	0.2970
Portfolio C: New construction version	1/3	1/2	1	0.1634
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.2000	0.1111	0.6250	0.3333	0.2983	Ageing indicators	0.2815
Portfolio B: Modernized version	0.4000	0.4000	0.4444	0.2385	0.3333	0.1883	Household indicators	0.3688
Portfolio C: New construction version	0.4000	0.4000	0.4444	0.1365	0.3333	0.1883	Clusters of households	0.3496
						0.1883	Household composition	
						0.1368	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.4000	0.1429	0.7273	Build Quality	0.1662
Portfolio B: Modernized version	0.5714	0.2000	0.2857	0.0909	Age distribution of housing stock	0.4857
Portfolio C: New construction version	0.2857	0.4000	0.5714	0.1818	Average number of rooms per dwelling	0.3481

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1168	0.1020	0.8182	0.2000	0.1634	0.5396	0.3333	0.0711	Population density	0.3296
Portfolio B: Modernized version	0.6833	0.7258	0.0909	0.4000	0.2970	0.2970	0.3333	0.1197	Income level	0.3862
Portfolio C: New construction version	0.1998	0.1721	0.0909	0.4000	0.5396	0.1634	0.3333	0.0618	Land area	0.2842
								0.1694	Supply/ demand	
								0.1460	Tenure status	
								0.2754	Levels of rent	
								0.1566	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.2815	0.1662	0.3296	0.3333	Demographic characteristics	**0.2591**
Portfolio B: Modernized version	0.3688	0.4857	0.3862	0.3333	Space characteristics	**0.4136**
Portfolio C: New construction version	0.3496	0.3481	0.2842	0.3333	Environment social characteristics	**0.3273**

Source: Own analyses

Appendix 13 AHP-survey Matthias Ross – Cluster 3: Hungary, Poland

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**1**	**1**	0.3333
Space characteristics	1	1	**1**	0.3333
Environment social characteristics	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**5**	**5**	**5**	**1**	0.4034
Household indicators	1/5	1	**1**	**1**	**1**	0.1269
Clusters of households	1/5	1	1	**1**	**1/5**	0.0807
Household composition	1/5	1	1	1	**1/5**	0.0807
Housing indicators	1	1	5	5	1	0.3083
CR	7.66%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**8**	**1**	0.4706
Age distribution of housing stock	1/8	1	**1/8**	0.0588
Average number of rooms per dwelling	1	8	1	0.4706
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**9**	**1/4**	**1/4**	**1/5**	**1/7**	0.0626
Income level	4	1	**4**	**1**	**1**	**1/2**	**2**	0.1775
Land area	1/9	1/4	1	**1/5**	**1/5**	**1/7**	**1/7**	0.0256
Supply/ demand	4	1	5	1	**1**	**1/2**	**1/2**	0.1377
Tenure status	4	1	5	1	1	**1**	**1/2**	0.1520
Levels of rent	5	2	7	2	1	1	**1**	0.2216
Economic conditions	7	1/2	7	2	2	1	1	0.2230
CR	9.68%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1**	0.4000
Portfolio B: Modernized version	1/2	1	**1/2**	0.2000
Portfolio C: New construction version	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1365
Portfolio B: Modernized version	4	1	**3**	0.6250
Portfolio C: New construction version	2	1/3	1	0.2385
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1365
Portfolio B: Modernized version	4	1	**3**	0.6250
Portfolio C: New construction version	2	1/3	1	0.2385
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/8**	0.0769
Portfolio B: Modernized version	4	1	**1/2**	0.3077
Portfolio C: New construction version	8	2	1	0.6154
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**9**	**2**	0.6394
Portfolio B: Modernized version	1/9	1	**1/3**	0.0813
Portfolio C: New construction version	1/2	3	1	0.2793
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/6**	0.0953
Portfolio B: Modernized version	3	1	**1/3**	0.2499
Portfolio C: New construction version	6	3	1	0.6548
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/9**	**1/5**	0.0629
Portfolio B: Modernized version	9	1	**3**	0.6716
Portfolio C: New construction version	5	1/3	1	0.2654
CR	2.81%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/6**	0.0953
Portfolio B: Modernized version	3	1	**1/3**	0.2499
Portfolio C: New construction version	6	3	1	0.6548
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3333	0.3333	0.3333	0.4000	0.3333	0.4034	Ageing indicators	0.3387
Portfolio B: Modernized version	0.3333	0.3333	0.3333	0.2000	0.3333	0.1269	Household indicators	0.3226
Portfolio C: New construction version	0.3333	0.3333	0.3333	0.4000	0.3333	0.0807	Clusters of households	0.3387
						0.0807	Household composition	
						0.3083	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.3333	0.1365	0.4706	Build Quality	0.1511
Portfolio B: Modernized version	0.2857	0.3333	0.6250	0.0588	Age distribution of housing stock	0.4482
Portfolio C: New construction version	0.5714	0.3333	0.2385	0.4706	Average number of rooms per dwelling	0.4007

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1365	0.0769	0.6394	0.0953	0.0629	0.3333	0.0953	0.0626	Population density	0.1564
Portfolio B: Modernized version	0.6250	0.3077	0.0813	0.2499	0.6716	0.3333	0.2499	0.1775	Income level	0.3619
Portfolio C: New con-struction version	0.2385	0.6154	0.2793	0.6548	0.2654	0.3333	0.6548	0.0256	Land area	0.4817
								0.1377	Supply/ de-mand	
								0.1520	Tenure status	
								0.2216	Levels of rent	
								0.2230	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.3387	0.1511	0.1564	0.3333	Demographic characteristics	**0.2154**
Portfolio B: Modernized version	0.3226	0.4482	0.3619	0.3333	Space characteristics	**0.3776**
Portfolio C: New construction version	0.3387	0.4007	0.4817	0.3333	Environment social characteristics	**0.4071**

Source: Own analyses

Appendix 14 AHP-survey Matthias Ross – Cluster 4: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**2**	**3**	0.5396
Space characteristics	1/2	1	**2**	0.2970
Environment social characteristics	1/3	1/2	1	0.1634
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**3**	**1**	**1/2**	0.2492
Household indicators	1/3	1	**1**	**1/3**	**1**	0.1233
Clusters of households	1/3	1	1	**1/3**	**1/2**	0.0991
Household composition	1	3	3	1	**1**	0.2733
Housing indicators	2	1	2	1	1	0.2551
CR	6.43%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**2**	0.4000
Age distribution of housing stock	1	1	**2**	0.4000
Average number of rooms per dwelling	1/2	1/2	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/2**	**5**	**1**	**1/5**	**2**	**3**	0.1574
Income level	2	1	**2**	**1**	**1/2**	**1**	**2**	0.1514
Land area	1/5	1/2	1	**1/3**	**1/3**	**1/2**	**1/2**	0.0525
Supply/ demand	1	1	3	1	**1/2**	**1**	**1/3**	0.1111
Tenure status	5	2	3	2	1	**3**	**3**	0.3119
Levels of rent	1/2	1	2	1	1/3	1	**1/2**	0.0903
Economic conditions	1/3	1/2	2	3	1/3	2	1	0.1254
CR	9.85%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**2**	0.5000
Portfolio B: Modernized version	1/2	1	**1**	0.2500
Portfolio C: New construction version	1/2	1	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**2**	0.5000
Portfolio B: Modernized version	1/2	1	**1**	0.2500
Portfolio C: New construction version	1/2	1	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**2**	0.5714
Portfolio B: Modernized version	1/4	1	**1/2**	0.1429
Portfolio C: New construction version	1/2	2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**3**	0.5396
Portfolio B: Modernized version	1/2	1	**2**	0.2970
Portfolio C: New construction version	1/3	1/2	1	0.1634
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1**	0.4000
Portfolio B: Modernized version	1/2	1	**1/2**	0.2000
Portfolio C: New construction version	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**3**	0.5396
Portfolio B: Modernized version	1/2	1	**2**	0.2970
Portfolio C: New construction version	1/3	1/2	1	0.1634
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**9**	**9**	0.8182
Portfolio B: Modernized version	1/9	1	**1**	0.0909
Portfolio C: New construction version	1/9	1	1	0.0909
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**4**	0.6250
Portfolio B: Modernized version	1/3	1	**2**	0.2385
Portfolio C: New construction version	1/4	1/2	1	0.1365
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0751
Portfolio B: Modernized version	5	1	**1/2**	0.3332
Portfolio C: New construction version	7	2	1	0.5917
CR	1.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**8**	0.7273
Portfolio B: Modernized version	1/4	1	**2**	0.1818
Portfolio C: New construction version	1/8	1/2	1	0.0909
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5000	0.5000	0.3333	0.7143	0.5714	0.2492	Ageing indicators	0.5603
Portfolio B: Modernized version	0.2500	0.2500	0.3333	0.1429	0.1429	0.1233	Household indicators	0.2016
Portfolio C: New construction version	0.2500	0.2500	0.3333	0.1429	0.2857	0.0991	Clusters of households	0.2381
						0.2733	Household composition	
						0.2551	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.5396	0.3333	0.4000	0.4000	Build Quality	0.4292
Portfolio B: Modernized version	0.2970	0.3333	0.2000	0.4000	Age distribution of housing stock	0.2921
Portfolio C: New construction version	0.1634	0.3333	0.4000	0.2000	Average number of rooms per dwelling	0.2787

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2500	0.5396	0.8182	0.6250	0.0751	0.7273	0.1429	0.1574	Population density	0.3404
Portfolio B: Modernized version	0.2500	0.2970	0.0909	0.2385	0.3332	0.1818	0.4286	0.1514	Income level	0.2897
Portfolio C: New con-struction version	0.5000	0.1634	0.0909	0.1365	0.5917	0.0909	0.4286	0.0525	Land area	0.3699
								0.1111	Supply/ de-mand	
								0.3119	Tenure status	
								0.0903	Levels of rent	
								0.1254	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.5603	0.4292	0.3404	0.5396	Demographic characteristics	**0.4854**
Portfolio B: Modernized version	0.2016	0.2921	0.2897	0.2970	Space characteristics	**0.2429**
Portfolio C: New construction version	0.2381	0.2787	0.3699	0.1634	Environment social characteristics	**0.2717**

Source: Own analyses

Appendix 15 Interview-summary Matthias Ross

Respondent	Prof. Dr. Matthias Ross

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	23.55%	36.48%	39.97%
Estonia	23.55%	36.48%	39.97%
Germany	25.91%	41.36%	32.73%
Hungary	21.54%	37.76%	40.71%
Latvia	23.55%	36.48%	39.97%
Lithuania	23.55%	36.48%	39.97%
Poland	21.54%	37.76%	40.71%
Romania	23.55%	36.48%	39.97%
Slovakia	23.55%	36.48%	39.97%
Spain	48.54%	24.29%	27.17%

Special core fields	Bulgaria, Estonia, Germany, Latvia, Lithuania, Romania, Spain

Source: Own analyses

Appendix 16 AHP-survey Axel Detz – Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**3**	**1**	0.4286
Space characteristics	1/3	1	**1/3**	0.1429
Environment social characteristics	1	3	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/2**	**1/3**	**1/3**	**1/2**	0.0891
Household indicators	2	1	**2**	**2**	**1**	0.2931
Clusters of households	3	1/2	1	**1**	**2**	0.2270
Household composition	3	1/2	1	1	**2**	0.2270
Housing indicators	2	1	1/2	1/2	1	0.1637
CR	5.94%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**2**	**3**	0.5396
Age distribution of housing stock	1/2	1	**2**	0.2970
Average number of rooms per dwelling	1/3	1/2	1	0.1634
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**2**	**1/5**	**1/2**	**1/3**	**1/3**	0.0632
Income level	4	1	**3**	**1**	**2**	**1**	**2**	0.2173
Land area	1/2	1/3	1	**1/2**	**1**	**1/2**	**1/3**	0.0718
Supply/ demand	5	1	2	1	**1/2**	**1/2**	**1/3**	0.1350
Tenure status	2	1/2	1	2	1	**1**	**2**	0.1643
Levels of rent	3	1	2	2	1	1	**1**	0.1732
Economic conditions	3	1/2	3	3	1/2	1	1	0.1753
CR	8.65%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**2**	0.5000
Portfolio B: Modernized version	1/2	1	**1**	0.2500
Portfolio C: New construction version	1/2	1	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1220
Portfolio B: Modernized version	4	1	**2**	0.5584
Portfolio C: New construction version	3	1/2	1	0.3196
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1634
Portfolio B: Modernized version	3	1	**2**	0.5396
Portfolio C: New construction version	2	1/2	1	0.2970
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1220
Portfolio B: Modernized version	3	1	**1/2**	0.3196
Portfolio C: New construction version	4	2	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.0974
Portfolio B: Modernized version	4	1	**1/2**	0.3331
Portfolio C: New construction version	5	2	1	0.5695
CR	2.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1220
Portfolio B: Modernized version	3	1	**1/2**	0.3196
Portfolio C: New construction version	4	2	1	0.5584
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.5000	0.1692	0.1692	0.1220	0.1429	0.0891	Ageing indicators	0.1836
Portfolio B: Modernized version	0.2500	0.4434	0.4434	0.5584	0.4286	0.2931	Household indicators	0.4499
Portfolio C: New construction version	0.2500	0.3874	0.3874	0.3196	0.4286	0.2270	Clusters of households	0.3665
						0.2270	Household composition	
						0.1637	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1260	0.1692	0.2500	0.5396	Build Quality	0.1591
Portfolio B: Modernized version	0.4579	0.3874	0.2500	0.2970	Age distribution of housing stock	0.4030
Portfolio C: New construction version	0.4161	0.4434	0.5000	0.1634	Average number of rooms per dwelling	0.4379

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.2000	0.1260	0.1634	0.1220	0.0974	0.2000	0.1220	0.0632	Population density	0.1402
Portfolio B: Modernized version	0.4000	0.4579	0.5396	0.3196	0.3331	0.4000	0.3196	0.2173	Income level	0.3867
Portfolio C: New con-struction version	0.4000	0.4161	0.2970	0.5584	0.5695	0.4000	0.5584	0.0718	Land area	0.4731
								0.1350	Supply/ de-mand	
								0.1643	Tenure status	
								0.1732	Levels of rent	
								0.1753	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1836	0.1591	0.1402	0.4286	Demographic characteristics	**0.1615**
Portfolio B: Modernized version	0.4499	0.4030	0.3867	0.1429	Space characteristics	**0.4161**
Portfolio C: New construction version	0.3665	0.4379	0.4731	0.4286	Environment social characteristics	**0.4224**

Source: Own analyses

Appendix 17 AHP-survey Axel Detz – Cluster 2: Germany, Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**3**	**2**	0.5499
Space characteristics	1/3	1	**1**	0.2098
Environment social characteristics	1/2	1	1	0.2402
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/3**	**1/2**	**1/3**	**2**	0.1183
Household indicators	3	1	**2**	**1**	**2**	0.2992
Clusters of households	2	1/2	1	**1**	**2**	0.2070
Household composition	3	1	1	1	**3**	0.2780
Housing indicators	1/2	1/2	1/2	1/3	1	0.0975
CR	3.41%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**2**	**2**	0.5000
Age distribution of housing stock	1/2	1	**1**	0.2500
Average number of rooms per dwelling	1/2	1	1	0.2500
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**2**	**1/3**	**1/3**	**1/4**	**1/2**	0.0825
Income level	3	1	**2**	**1**	**1**	**2**	**2**	0.2001
Land area	1/2	1/2	1	**1/2**	**2**	**2**	**2**	0.1492
Supply/ demand	3	1	2	1	**1**	**1**	**2**	0.1807
Tenure status	3	1	1/2	1	1	**1**	**2**	0.1519
Levels of rent	4	1/2	1/2	1	1	1	**2**	0.1496
Economic conditions	2	1/2	1/2	1/2	1/2	1/2	1	0.0861
CR	9.20%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1692	0.1260	0.2000	0.2500	0.2500	0.1183	Ageing indicators	0.1930
Portfolio B: Modernized version	0.3874	0.4161	0.4000	0.2500	0.2500	0.2992	Household indicators	0.3470
Portfolio C: New construction version	0.4434	0.4579	0.4000	0.5000	0.5000	0.2070	Clusters of households	0.4600
						0.2780	Household composition	
						0.0975	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1429	0.1692	0.3333	0.5000	Build Quality	0.1971
Portfolio B: Modernized version	0.5714	0.3874	0.3333	0.2500	Age distribution of housing stock	0.4659
Portfolio C: New construction version	0.2857	0.4434	0.3333	0.2500	Average number of rooms per dwelling	0.3370

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1260	0.1111	0.1692	0.1260	0.1111	0.1429	0.1260	0.0825	Population density	0.1297
Portfolio B: Modernized version	0.4161	0.4444	0.3874	0.4161	0.4444	0.4286	0.4161	0.2001	Income level	0.4236
Portfolio C: New construction version	0.4579	0.4444	0.4434	0.4579	0.4444	0.4286	0.4579	0.1492	Land area	0.4466
								0.1807	Supply/ demand	
								0.1519	Tenure status	
								0.1496	Levels of rent	
								0.0861	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1930	0.1971	0.1297	0.5499	Demographic characteristics	**0.1786**
Portfolio B: Modernized version	0.3470	0.4659	0.4236	0.2098	Space characteristics	**0.3904**
Portfolio C: New construction version	0.4600	0.3370	0.4466	0.2402	Environment social characteristics	**0.4310**

Source: Own analyses

Appendix 18 Interview-summary Axel Detz

Respondent	Axel Detz

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	16.15%	41.61%	42.24%
Estonia	16.15%	41.61%	42.24%
Germany	17.86%	39.04%	43.10%
Hungary	16.15%	41.61%	42.24%
Latvia	16.15%	41.61%	42.24%
Lithuania	16.15%	41.61%	42.24%
Poland	16.15%	41.61%	42.24%
Romania	16.15%	41.61%	42.24%
Slovakia	16.15%	41.61%	42.24%
Spain	17.86%	39.04%	43.10%

Special core fields	Germany, Spain

Source: Own analyses

Appendix 19 AHP-survey Frank Borrmann – Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/6**	**1/6**	0.0769
Space characteristics	6	1	**1**	0.4615
Environment social characteristics	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/3**	**1/3**	**1/3**	**1**	0.0969
Household indicators	3	1	**1**	**1**	**2**	0.2623
Clusters of households	3	1	1	**1**	**2**	0.2623
Household composition	3	1	1	1	**1**	0.2340
Housing indicators	1	1/2	1/2	1	1	0.1446
CR	2.31%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**3**	**6**	0.6667
Age distribution of housing stock	1/3	1	**2**	0.2222
Average number of rooms per dwelling	1/6	1/2	1	0.1111
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**2**	**1/3**	**2**	**1/4**	**1/6**	0.0787
Income level	3	1	**2**	**3**	**2**	**1**	**1**	0.2095
Land area	1/2	1/2	1	**1**	**1**	**1/3**	**1/3**	0.0762
Supply/ demand	3	1/3	1	1	**1**	**1**	**1**	0.1346
Tenure status	1/2	1/2	1	1	1	**1/3**	**1/2**	0.0809
Levels of rent	4	1	3	1	3	1	**1**	0.2050
Economic conditions	6	1	3	1	2	1	1	0.2151
CR	7.00%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.1000
Portfolio B: Modernized version	6	1	**2**	0.6000
Portfolio C: New construction version	3	1/2	1	0.3000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/6**	0.1172
Portfolio B: Modernized version	2	1	**1/2**	0.2684
Portfolio C: New construction version	6	2	1	0.6144
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/6**	0.1172
Portfolio B: Modernized version	2	1	**1/2**	0.2684
Portfolio C: New construction version	6	2	1	0.6144
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/7**	0.0925
Portfolio B: Modernized version	3	1	**1/2**	0.2922
Portfolio C: New construction version	7	2	1	0.6153
CR	0.25%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3333	0.2000	0.3333	0.3333	0.3333	0.0969	Ageing indicators	0.2984
Portfolio B: Modernized version	0.3333	0.4000	0.3333	0.3333	0.3333	0.2623	Household indicators	0.3508
Portfolio C: New construction version	0.3333	0.4000	0.3333	0.3333	0.3333	0.2623	Clusters of households	0.3508
						0.2340	Household composition	
						0.1446	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1000	0.1429	0.2500	0.6667	Build Quality	0.1262
Portfolio B: Modernized version	0.6000	0.2857	0.2500	0.2222	Age distribution of housing stock	0.4913
Portfolio C: New construction version	0.3000	0.5714	0.5000	0.1111	Average number of rooms per dwelling	0.3825

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1692	0.1172	0.3333	0.1172	0.3333	0.1140	0.0925	0.0787	Population density	0.1493
Portfolio B: Modernized version	0.4434	0.2684	0.3333	0.2684	0.3333	0.4054	0.2922	0.2095	Income level	0.3256
Portfolio C: New con-struction version	0.3874	0.6144	0.3333	0.6144	0.3333	0.4806	0.6153	0.0762	Land area	0.5252
								0.1346	Supply/ de-mand	
								0.0809	Tenure status	
								0.2050	Levels of rent	
								0.2151	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.2984	0.1262	0.1493	0.0769	Demographic characteristics	**0.1501**
Portfolio B: Modernized version	0.3508	0.4913	0.3256	0.4615	Space characteristics	**0.4040**
Portfolio C: New construction version	0.3508	0.3825	0.5252	0.4615	Environment social characteristics	**0.4459**

Source: Own analyses

Appendix 20 AHP-survey Frank Borrmann – Cluster 2: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**6**	**1**	0.4615
Space characteristics	1/6	1	**1/6**	0.0769
Environment social characteristics	1	6	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**2**	**2**	**2**	**2**	0.3229
Household indicators	1/2	1	**1/2**	**1/2**	**1/2**	0.1065
Clusters of households	1/2	2	1	**1/2**	**1/2**	0.1405
Household composition	1/2	2	2	1	**1/2**	0.1854
Housing indicators	1/2	2	2	2	1	0.2447
CR	4.40%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/2**	**1/2**	0.2000
Age distribution of housing stock	2	1	**1**	0.4000
Average number of rooms per dwelling	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**2**	**2**	**2**	**2**	**1**	**1/4**	0.1774
Income level	1/2	1	**1**	**1**	**1**	**1**	**1**	0.1213
Land area	1/2	1	1	**1**	**1**	**1**	**1**	0.1213
Supply/ demand	1/2	1	1	1	**1**	**1**	**1**	0.1213
Tenure status	1/2	1	1	1	1	**1**	**1**	0.1213
Levels of rent	1	1	1	1	1	1	**1**	0.1332
Economic conditions	4	1	1	1	1	1	1	0.2040
CR	6.20%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/4**	0.0860
Portfolio B: Modernized version	7	1	**1**	0.4995
Portfolio C: New construction version	4	1	1	0.4145
CR	3.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/6**	0.0924
Portfolio B: Modernized version	4	1	**1**	0.4232
Portfolio C: New construction version	6	1	1	0.4844
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0860	0.1260	0.1260	0.1692	0.1260	0.3229	Ageing indicators	0.1211
Portfolio B: Modernized version	0.4995	0.4579	0.4579	0.4434	0.4579	0.1065	Household indicators	0.4687
Portfolio C: New construction version	0.4145	0.4161	0.4161	0.3874	0.4161	0.1405	Clusters of households	0.4102
						0.1854	Household composition	
						0.2447	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3333	0.2000	0.1429	0.2000	Build Quality	0.2038
Portfolio B: Modernized version	0.3333	0.4000	0.5714	0.4000	Age distribution of housing stock	0.4552
Portfolio C: New construction version	0.3333	0.4000	0.2857	0.4000	Average number of rooms per dwelling	0.3410

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1429	0.1429	0.1429	0.1111	0.1260	0.1140	0.0924	0.1774	Population density	0.1228
Portfolio B: Modernized version	0.2857	0.2857	0.2857	0.4444	0.4161	0.4054	0.4232	0.1213	Income level	0.3648
Portfolio C: New con-struction version	0.5714	0.5714	0.5714	0.4444	0.4579	0.4806	0.4844	0.1213	Land area	0.5124
								0.1213	Supply/ de-mand	
								0.1213	Tenure status	
								0.1332	Levels of rent	
								0.2040	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1211	0.2038	0.1228	0.4615	Demographic characteristics	**0.1283**
Portfolio B: Modernized version	0.4687	0.4552	0.3648	0.0769	Space characteristics	**0.4197**
Portfolio C: New construction version	0.4102	0.3410	0.5124	0.4615	Environment social characteristics	**0.4521**

Source: Own analyses

Appendix 21 AHP-survey Frank Borrmann – Cluster 3: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**2**	**1/7**	0.1349
Space characteristics	1/2	1	**1/8**	0.0813
Environment social characteristics	7	8	1	0.7838
CR	3.39%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**2**	**1**	**3**	0.2832
Household indicators	1	1	**1/2**	**1**	**1/2**	0.1534
Clusters of households	1/2	2	1	**1/2**	**1**	0.1677
Household composition	1	1	2	1	**1**	0.2167
Housing indicators	1/3	2	1	1	1	0.1790
CR	8.78%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**3**	**3**	0.6000
Age distribution of housing stock	1/3	1	**1**	0.2000
Average number of rooms per dwelling	1/3	1	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**2**	**1/5**	**2**	**1/4**	**1/8**	0.0532
Income level	5	1	**5**	**1**	**4**	**1**	**1/2**	0.1907
Land area	1/2	1/5	1	**1/5**	**1**	**1/5**	**1/5**	0.0392
Supply/ demand	5	1	5	1	**5**	**1**	**1**	0.2147
Tenure status	1/2	1/4	1	1/5	1	**1/4**	**1/4**	0.0437
Levels of rent	4	1	5	1	4	1	**1**	0.2012
Economic conditions	8	2	5	1	4	1	1	0.2573
CR	2.44%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1**	0.4000
Portfolio B: Modernized version	1/2	1	**1/2**	0.2000
Portfolio C: New construction version	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1**	0.1667
Portfolio B: Modernized version	4	1	**4**	0.6667
Portfolio C: New construction version	1	1/4	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/9**	0.0592
Portfolio B: Modernized version	7	1	**1**	0.4507
Portfolio C: New construction version	9	1	1	0.4901
CR	0.68%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.4000	0.3333	0.3333	0.3333	0.3333	0.2832	Ageing indicators	0.3522
Portfolio B: Modernized version	0.2000	0.3333	0.3333	0.3333	0.3333	0.1534	Household indicators	0.2956
Portfolio C: New construction version	0.4000	0.3333	0.3333	0.3333	0.3333	0.1677	Clusters of households	0.3522
						0.2167	Household composition	
						0.1790	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1667	0.3333	0.3333	0.6000	Build Quality	0.2333
Portfolio B: Modernized version	0.6667	0.3333	0.3333	0.2000	Age distribution of housing stock	0.5333
Portfolio C: New construction version	0.1667	0.3333	0.3333	0.2000	Average number of rooms per dwelling	0.2333

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.1140	0.2000	0.1140	0.3333	0.1140	0.0592	0.1174
Portfolio B: Modernized version	0.4000	0.4054	0.4000	0.4054	0.3333	0.4054	0.4507	0.4134
Portfolio C: New construction version	0.4000	0.4806	0.4000	0.4806	0.3333	0.4806	0.4901	0.4692

Criteria ranking	**Subcriteria: Environment social characteristics**
0.0532	Population density
0.1907	Income level
0.0392	Land area
0.2147	Supply/ demand
0.0437	Tenure status
0.2012	Levels of rent
0.2573	Economic conditions

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.3522	0.2333	0.1174	0.1349	Demographic characteristics	**0.1585**
Portfolio B: Modernized version	0.2956	0.5333	0.4134	0.0813	Space characteristics	**0.4072**
Portfolio C: New construction version	0.3522	0.2333	0.4692	0.7838	Environment social characteristics	**0.4342**

Source: Own analyses

Appendix 22 Interview-summary Frank Borrmann

Respondent	Prof. Dr. Frank Borrmann

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	15.01%	40.40%	44.59%
Estonia	15.01%	40.40%	44.59%
Germany	12.83%	41.97%	45.21%
Hungary	15.01%	40.40%	44.59%
Latvia	15.01%	40.40%	44.59%
Lithuania	15.01%	40.40%	44.59%
Poland	15.01%	40.40%	44.59%
Romania	15.01%	40.40%	44.59%
Slovakia	15.01%	40.40%	44.59%
Spain	15.85%	40.72%	43.42%

Special core fields	Germany

Source: Own analyses

Appendix 23 AHP-survey Mara Meinel – Cluster 1: Bulgaria, Romania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/5**	**1/4**	0.0974
Space characteristics	5	1	**2**	0.5695
Environment social characteristics	4	1/2	1	0.3331
CR	2.37%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**4**	**4**	**2**	**2**	0.4023
Household indicators	1/4	1	**1**	**1/2**	**1/2**	0.1006
Clusters of households	1/4	1	1	**1/2**	**1**	0.1182
Household composition	1/2	2	2	1	**1**	0.2012
Housing indicators	1/2	2	1	1	1	0.1778
CR	1.33%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**5**	**4**	0.6833
Age distribution of housing stock	1/5	1	**1/2**	0.1168
Average number of rooms per dwelling	1/4	2	1	0.1998
CR	2.38%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**1**	**1**	**1**	**1/3**	**1/3**	0.0672
Income level	5	1	**5**	**5**	**5**	**1**	**1**	0.2946
Land area	1	1/5	1	**1**	**1**	**1/3**	**1/3**	0.0672
Supply/ demand	1	1/5	1	1	**1**	**1/3**	**1/3**	0.0672
Tenure status	1	1/5	1	1	1	**1/3**	**1/3**	0.0672
Levels of rent	3	1	3	3	3	1	**1**	0.2183
Economic conditions	3	1	3	3	3	1	1	0.2183
CR	0.53%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/8**	**1/8**	0.0588
Portfolio B: Modernized version	8	1	**1**	0.4706
Portfolio C: New construction version	8	1	1	0.4706
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/8**	**1/8**	0.0588
Portfolio B: Modernized version	8	1	**1**	0.4706
Portfolio C: New construction version	8	1	1	0.4706
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1/2**	**1**	0.2500
Portfolio B: Modern-ized version	2	1	**2**	0.5000
Portfolio C: New con-struction version	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1**	**1**	0.3333
Portfolio B: Modern-ized version	1	1	**1**	0.3333
Portfolio C: New con-struction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.0909	0.0909	0.0909	0.0909	0.4023	Ageing indicators	0.0909
Portfolio B: Modernized version	0.4545	0.4545	0.4545	0.4545	0.4545	0.1006	Household indicators	0.4545
Portfolio C: New construction version	0.4545	0.4545	0.4545	0.4545	0.4545	0.1182	Clusters of households	0.4545
						0.2012	Household composition	
						0.1778	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0588	0.0588	0.0909	0.6833	Build Quality	0.0652
Portfolio B: Modernized version	0.4706	0.4706	0.4545	0.1168	Age distribution of housing stock	0.4674
Portfolio C: New construction version	0.4706	0.4706	0.4545	0.1998	Average number of rooms per dwelling	0.4674

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0769	0.1260	0.3333	0.3333	0.2500	0.3333	0.1111	0.0672	Population density	0.2009
Portfolio B: Modernized version	0.4615	0.4579	0.3333	0.3333	0.5000	0.3333	0.4444	0.2946	Income level	0.4141
Portfolio C: New con-struction version	0.4615	0.4161	0.3333	0.3333	0.2500	0.3333	0.4444	0.0672	Land area	0.3850
								0.0672	Supply/ de-mand	
								0.0672	Tenure status	
								0.2183	Levels of rent	
								0.2183	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.0909	0.0652	0.2009	0.0974	Demographic characteristics	**0.1129**
Portfolio B: Modernized version	0.4545	0.4674	0.4141	0.5695	Space characteristics	**0.4484**
Portfolio C: New construction version	0.4545	0.4674	0.3850	0.3331	Environment social characteristics	**0.4387**

Source: Own analyses

Appendix 24 AHP-survey Mara Meinel – Cluster 2: Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic character-istics	1	**1/3**	**1/3**	0.1429
Space characteristics	3	1	**1**	0.4286
Environment social characteristics	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**3**	**3**	**3**	0.4286
Household indicators	1/3	1	**1**	**1**	**1**	0.1429
Clusters of households	1/3	1	1	**1**	**1**	0.1429
Household composition	1/3	1	1	1	**1**	0.1429
Housing indicators	1/3	1	1	1	1	0.1429
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/3**	**1**	0.2000
Age distribution of housing stock	3	1	**3**	0.6000
Average number of rooms per dwelling	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**1**	**1**	**1**	**1**	**1**	0.1190
Income level	4	1	**1**	**1**	**1**	**1**	**1**	0.1881
Land area	1	1	1	**1**	**1**	**1**	**1**	0.1386
Supply/ demand	1	1	1	1	**1**	**1**	**1**	0.1386
Tenure status	1	1	1	1	1	**1**	**1**	0.1386
Levels of rent	1	1	1	1	1	1	**1**	0.1386
Economic conditions	1	1	1	1	1	1	1	0.1386
CR	2.65%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.2000	0.2000	0.2000	0.2000	0.2000	0.4286	Ageing indicators	0.2000
Portfolio B: Modernized version	0.4000	0.4000	0.4000	0.4000	0.4000	0.1429	Household indicators	0.4000
Portfolio C: New construction version	0.4000	0.4000	0.4000	0.4000	0.4000	0.1429	Clusters of households	0.4000
						0.1429	Household composition	
						0.1429	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1429	0.0909	0.3333	0.2000	Build Quality	0.1498
Portfolio B: Modernized version	0.4286	0.4545	0.3333	0.6000	Age distribution of housing stock	0.4251
Portfolio C: New construction version	0.4286	0.4545	0.3333	0.2000	Average number of rooms per dwelling	0.4251

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3333	0.2000	0.3333	0.3333	0.3333	0.2000	0.3333	0.1190	Population density	0.2898
Portfolio B: Modernized version	0.3333	0.4000	0.3333	0.3333	0.3333	0.4000	0.3333	0.1881	Income level	0.3551
Portfolio C: New con-struction version	0.3333	0.4000	0.3333	0.3333	0.3333	0.4000	0.3333	0.1386	Land area	0.3551
								0.1386	Supply/ de-mand	
								0.1386	Tenure status	
								0.1386	Levels of rent	
								0.1386	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.2000	0.1498	0.2898	0.1429	Demographic characteristics	**0.2170**
Portfolio B: Modernized version	0.4000	0.4251	0.3551	0.4286	Space characteristics	**0.3915**
Portfolio C: New construction version	0.4000	0.4251	0.3551	0.4286	Environment social characteristics	**0.3915**

Source: Own analyses

Appendix 25 AHP-survey Mara Meinel – Cluster 3: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/5**	**1/3**	0.1095
Space characteristics	5	1	**2**	0.5816
Environment social characteristics	3	1/2	1	0.3090
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**4**	**4**	**4**	**4**	0.5000
Household indicators	1/4	1	**1**	**1**	**1**	0.1250
Clusters of households	1/4	1	1	**1**	**1**	0.1250
Household composition	1/4	1	1	1	**1**	0.1250
Housing indicators	1/4	1	1	1	1	0.1250
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/4**	**1**	0.1667
Age distribution of housing stock	4	1	**4**	0.6667
Average number of rooms per dwelling	1	1/4	1	0.1667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**3**	**3**	**3**	**1**	**1/5**	0.1419
Income level	4	1	**1**	**1**	**2**	**1**	**1/2**	0.1743
Land area	1/3	1	1	**1**	**1**	**1/3**	**1/3**	0.0771
Supply/ demand	1/3	1	1	1	**1**	**1/3**	**1/2**	0.0829
Tenure status	1/3	1/2	1	1	1	**1/3**	**1/3**	0.0659
Levels of rent	1	1	3	3	3	1	**1**	0.1866
Economic conditions	5	2	3	2	3	1	1	0.2713
CR	9.74%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1061
Portfolio B: Modernized version	6	1	**4**	0.7010
Portfolio C: New construction version	2	1/4	1	0.1929
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1061
Portfolio B: Modernized version	6	1	**4**	0.7010
Portfolio C: New construction version	2	1/4	1	0.1929
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1061
Portfolio B: Modernized version	6	1	**4**	0.7010
Portfolio C: New construction version	2	1/4	1	0.1929
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1061
Portfolio B: Modernized version	6	1	**4**	0.7010
Portfolio C: New construction version	2	1/4	1	0.1929
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1061
Portfolio B: Modernized version	6	1	**4**	0.7010
Portfolio C: New construction version	2	1/4	1	0.1929
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2098
Portfolio B: Modernized version	3	1	**2**	0.5499
Portfolio C: New construction version	1	1/2	1	0.2402
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Alternative ranking
Portfolio A: Extrapolated version	0.1061	0.1061	0.1061	0.1061	0.1061	0.1061
Portfolio B: Modernized version	0.7010	0.7010	0.7010	0.7010	0.7010	0.7010
Portfolio C: New construction version	0.1929	0.1929	0.1929	0.1929	0.1929	0.1929

Criteria ranking	**Subcriteria: Demographic characteristics**
0.5000	Ageing indicators
0.1250	Household indicators
0.1250	Clusters of households
0.1250	Household composition
0.1250	Housing indicators

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.3333	0.2098	0.3333	0.1667	Build Quality	0.2510
Portfolio B: Modernized version	0.3333	0.5499	0.3333	0.6667	Age distribution of housing stock	0.4777
Portfolio C: New construction version	0.3333	0.2402	0.3333	0.1667	Average number of rooms per dwelling	0.2713

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.3333	0.2000	0.3333	0.2000	0.0909	0.2500	0.0909	0.1419	Population density	0.2017
Portfolio B: Modernized version	0.3333	0.4000	0.3333	0.4000	0.4545	0.2500	0.4545	0.1743	Income level	0.3758
Portfolio C: New con-struction version	0.3333	0.4000	0.3333	0.4000	0.4545	0.5000	0.4545	0.0771	Land area	0.4224
								0.0829	Supply/ de-mand	
								0.0659	Tenure status	
								0.1866	Levels of rent	
								0.2713	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1061	0.2510	0.2017	0.1095	Demographic characteristics	**0.2199**
Portfolio B: Modernized version	0.7010	0.4777	0.3758	0.5816	Space characteristics	**0.4707**
Portfolio C: New construction version	0.1929	0.2713	0.4224	0.3090	Environment social characteristics	**0.3094**

Source: Own analyses

Appendix 26 Interview-summary Mara Meinel

Respondent	Mara Meinel

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	11.29%	44.84%	43.87%
Estonia	21.70%	39.15%	39.15%
Germany	21.99%	47.07%	30.94%
Hungary	21.70%	39.15%	39.15%
Latvia	21.70%	39.15%	39.15%
Lithuania	21.70%	39.15%	39.15%
Poland	21.70%	39.15%	39.15%
Romania	11.29%	44.84%	43.87%
Slovakia	21.70%	39.15%	39.15%
Spain	21.70%	39.15%	39.15%

Special core fields	Germany, Hungary, Romania, Slovakia, Spain

Source: Own analyses

Appendix 27 AHP-survey Michael Wulf – Cluster 1: Bulgaria, Hungary, Romania, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**6**	**4**	0.7096
Space characteristics	1/6	1	**1**	0.1354
Environment social characteristics	1/4	1	1	0.1550
CR	1.77%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/6**	**1/6**	**5**	**5**	0.1284
Household indicators	6	1	**1**	**6**	**7**	0.3924
Clusters of households	6	1	1	**6**	**7**	0.3924
Household composition	1/5	1/6	1/6	1	**1**	0.0451
Housing indicators	1/5	1/7	1/7	1	1	0.0416
CR	9.52%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/4**	**4**	0.2172
Age distribution of housing stock	4	1	**9**	0.7171
Average number of rooms per dwelling	1/4	1/9	1	0.0658
CR	3.58%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/6**	**5**	**4**	**4**	**3**	**1/5**	0.1176
Income level	6	1	**8**	**6**	**7**	**7**	**6**	0.4832
Land area	1/5	1/8	1	**1**	**1/2**	**1/2**	**1/7**	0.0300
Supply/ demand	1/4	1/6	1	1	**1/4**	**1/3**	**1/8**	0.0297
Tenure status	1/4	1/7	2	4	1	**1**	**1/4**	0.0577
Levels of rent	1/3	1/7	2	3	1	1	**1/3**	0.0575
Economic conditions	5	1/6	7	8	4	3	1	0.2242
CR	9.62%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**4**	0.2628
Portfolio B: Modernized version	3	1	**7**	0.6586
Portfolio C: New construction version	1/4	1/7	1	0.0786
CR	3.13%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**4**	0.2172
Portfolio B: Modernized version	4	1	**9**	0.7170
Portfolio C: New construction version	1/4	1/9	1	0.0658
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1095
Portfolio B: Modernized version	5	1	**2**	0.5816
Portfolio C: New construction version	3	1/2	1	0.3090
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/3**	0.2560
Portfolio B: Modernized version	1/4	1	**1/8**	0.0732
Portfolio C: New construction version	3	8	1	0.6708
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/3**	0.2426
Portfolio B: Modernized version	1/3	1	**1/7**	0.0879
Portfolio C: New construction version	3	7	1	0.6694
CR	0.68%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/5**	0.0836
Portfolio B: Modernized version	6	1	**1**	0.4721
Portfolio C: New construction version	5	1	1	0.4443
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**4**	0.6908
Portfolio B: Modernized version	1/5	1	**1**	0.1488
Portfolio C: New construction version	1/4	1	1	0.1603
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/4**	0.0924
Portfolio B: Modernized version	6	1	**1**	0.4844
Portfolio C: New construction version	4	1	1	0.4232
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**6**	0.7500
Portfolio B: Modernized version	1/6	1	**1**	0.1250
Portfolio C: New construction version	1/6	1	1	0.1250
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**7**	0.7641
Portfolio B: Modernized version	1/6	1	**1**	0.1210
Portfolio C: New construction version	1/7	1	1	0.1149
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7**	**8**	0.7891
Portfolio B: Modernized version	1/7	1	**1**	0.1078
Portfolio C: New construction version	1/8	1	1	0.1031
CR	0.19%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.2628	0.2172	0.1095	0.2560	0.2426	0.1284	Ageing indicators	0.1836
Portfolio B: Modernized version	0.6586	0.7170	0.5816	0.0732	0.0879	0.3924	Household indicators	0.6011
Portfolio C: New construction version	0.0786	0.0658	0.3090	0.6708	0.6694	0.3924	Clusters of households	0.2153
						0.0451	Household composition	
						0.0416	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0836	0.6908	0.0924	0.2172	Build Quality	0.5196
Portfolio B: Modernized version	0.4721	0.1488	0.4844	0.7171	Age distribution of housing stock	0.2411
Portfolio C: New construction version	0.4443	0.1603	0.4232	0.0658	Average number of rooms per dwelling	0.2393

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1111	0.7500	0.7641	0.1260	0.1429	0.0769	0.7891	0.1176	Population density	0.5917
Portfolio B: Modernized version	0.4444	0.1250	0.1210	0.4579	0.4286	0.4615	0.1078	0.4832	Income level	0.2054
Portfolio C: New con-struction version	0.4444	0.1250	0.1149	0.4161	0.4286	0.4615	0.1031	0.0300	Land area	0.2029
								0.0297	Supply/ de-mand	
								0.0577	Tenure status	
								0.0575	Levels of rent	
								0.2242	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives:
Total ranking

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1836	0.5196	0.5917	0.7096	Demographic characteristics	**0.2923**
Portfolio B: Modernized version	0.6011	0.2411	0.2054	0.1354	Space characteristics	**0.4911**
Portfolio C: New construction version	0.2153	0.2393	0.2029	0.1550	Environment social characteristics	**0.2166**

Source: Own analyses

Appendix 28 AHP-survey Michael Wulf – Cluster 2: Estonia, Latvia, Lithuania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**6**	**5**	0.7324
Space characteristics	1/6	1	**1**	0.1297
Environment social characteristics	1/5	1	1	0.1378
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/5**	**1/4**	**3**	**5**	0.1535
Household indicators	5	1	**1**	**4**	**5**	0.3837
Clusters of households	4	1	1	**3**	**4**	0.3308
Household composition	1/3	1/4	1/3	1	**1**	0.0722
Housing indicators	1/5	1/5	1/4	1	1	0.0597
CR	9.29%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**4**	**5**	0.6908
Age distribution of housing stock	1/4	1	**1**	0.1603
Average number of rooms per dwelling	1/5	1	1	0.1488
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/6**	**5**	**4**	**1/5**	**1/4**	**1/6**	0.0633
Income level	6	1	**7**	**6**	**5**	**4**	**5**	0.4269
Land area	1/5	1/7	1	**1**	**1/6**	**1/5**	**1/5**	0.0281
Supply/ demand	1/4	1/6	1	1	**1/5**	**1/4**	**1/6**	0.0307
Tenure status	5	1/5	6	5	1	**1**	**1**	0.1518
Levels of rent	4	1/4	5	4	1	1	**1**	0.1388
Economic conditions	6	1/5	5	6	1	1	1	0.1603
CR	9.77%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**5**	0.6908
Portfolio B: Modernized version	1/4	1	**1**	0.1603
Portfolio C: New construction version	1/5	1	1	0.1488
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/4**	0.1005
Portfolio B: Modernized version	5	1	**1**	0.4665
Portfolio C: New construction version	4	1	1	0.4330
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/6**	0.0924
Portfolio B: Modernized version	4	1	**1**	0.4232
Portfolio C: New construction version	6	1	1	0.4844
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**4**	0.6667
Portfolio B: Modernized version	1/4	1	**1**	0.1667
Portfolio C: New construction version	1/4	1	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/8**	0.0626
Portfolio B: Modernized version	7	1	**1**	0.4583
Portfolio C: New construction version	8	1	1	0.4791
CR	0.19%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**3**	0.6337
Portfolio B: Modernized version	1/4	1	**1**	0.1744
Portfolio C: New construction version	1/3	1	1	0.1919
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/4**	0.2000
Portfolio B: Modernized version	1/3	1	**1/9**	0.0734
Portfolio C: New construction version	4	9	1	0.7267
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**4**	0.6908
Portfolio B: Modernized version	1/5	1	**1**	0.1488
Portfolio C: New construction version	1/4	1	1	0.1603
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**4**	0.6667
Portfolio B: Modernized version	1/4	1	**1**	0.1667
Portfolio C: New construction version	1/4	1	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**6**	0.7324
Portfolio B: Modernized version	1/5	1	**1**	0.1378
Portfolio C: New construction version	1/6	1	1	0.1297
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.6908	0.1005	0.1005	0.0924	0.1260	0.1535	Ageing indicators	0.1921
Portfolio B: Modernized version	0.1603	0.4665	0.4330	0.4232	0.4579	0.3837	Household indicators	0.4048
Portfolio C: New construction version	0.1488	0.4330	0.4665	0.4844	0.4161	0.3308	Clusters of households	0.4031
						0.0722	Household composition	
						0.0597	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0716	0.6667	0.0626	0.6908	Build Quality	0.1657
Portfolio B: Modernized version	0.4523	0.1667	0.4583	0.1603	Age distribution of housing stock	0.4074
Portfolio C: New construction version	0.4761	0.1667	0.4791	0.1488	Average number of rooms per dwelling	0.4270

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.7143	0.6337	0.2000	0.6908	0.6667	0.0778	0.7324	0.0633	Population density	0.5720
Portfolio B: Modernized version	0.1429	0.1744	0.0734	0.1488	0.1667	0.4353	0.1378	0.4269	Income level	0.1979
Portfolio C: New con-struction version	0.1429	0.1919	0.7267	0.1603	0.1667	0.4869	0.1297	0.0281	Land area	0.2300
								0.0307	Supply/ de-mand	
								0.1518	Tenure status	
								0.1388	Levels of rent	
								0.1603	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1921	0.1657	0.5720	0.7324	Demographic characteristics	**0.2410**
Portfolio B: Modernized version	0.4048	0.4074	0.1979	0.1297	Space characteristics	**0.3766**
Portfolio C: New construction version	0.4031	0.4270	0.2300	0.1378	Environment social characteristics	**0.3824**

Source: Own analyses

Appendix 29 AHP-survey Michael Wulf – Cluster 3: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**4**	**3**	0.6337
Space characteristics	1/4	1	**1**	0.1744
Environment social characteristics	1/3	1	1	0.1919
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/4**	**1/5**	**1/4**	**1/6**	0.0509
Household indicators	4	1	**1**	**1**	**1**	0.2297
Clusters of households	5	1	1	**1**	**1**	0.2398
Household composition	4	1	1	1	**1**	0.2297
Housing indicators	6	1	1	1	1	0.2500
CR	0.42%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**7**	**8**	0.7891
Age distribution of housing stock	1/7	1	**1**	0.1078
Average number of rooms per dwelling	1/8	1	1	0.1031
CR	0.19%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/6**	**5**	**1/6**	**4**	**1/6**	**1/4**	0.0734
Income level	6	1	**5**	**1**	**4**	**1**	**1**	0.2152
Land area	1/5	1/5	1	**1/5**	**1**	**1/6**	**1/6**	0.0324
Supply/ demand	6	1	5	1	**5**	**1**	**1**	0.2204
Tenure status	1/4	1/4	1	1/5	1	**1/4**	**1/4**	0.0390
Levels of rent	6	1	6	1	4	1	**1**	0.2195
Economic conditions	4	1	6	1	4	1	1	0.2000
CR	6.59%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**5**	0.7324
Portfolio B: Modernized version	1/6	1	**1**	0.1297
Portfolio C: New construction version	1/5	1	1	0.1378
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**3**	0.2000
Portfolio B: Modernized version	4	1	**9**	0.7266
Portfolio C: New construction version	1/3	1/9	1	0.0734
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**3**	0.2308
Portfolio B: Modernized version	3	1	**9**	0.6923
Portfolio C: New construction version	1/3	1/9	1	0.0769
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**4**	0.2499
Portfolio B: Modernized version	3	1	**9**	0.6813
Portfolio C: New construction version	1/4	1/9	1	0.0688
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**4**	0.2172
Portfolio B: Modernized version	4	1	**9**	0.7171
Portfolio C: New construction version	1/4	1/9	1	0.0658
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/3**	0.2560
Portfolio B: Modernized version	1/4	1	**1/8**	0.0732
Portfolio C: New construction version	3	8	1	0.6708
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**4**	0.2172
Portfolio B: Modernized version	4	1	**9**	0.7171
Portfolio C: New construction version	1/4	1/9	1	0.0658
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**4**	0.6908
Portfolio B: Modernized version	1/5	1	**1**	0.1488
Portfolio C: New construction version	1/4	1	1	0.1603
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**6**	0.4844
Portfolio B: Modernized version	1	1	**4**	0.4232
Portfolio C: New construction version	1/6	1/4	1	0.0924
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/8**	0.0672
Portfolio B: Modernized version	6	1	**1**	0.4440
Portfolio C: New construction version	8	1	1	0.4887
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**7**	0.7641
Portfolio B: Modernized version	1/6	1	**1**	0.1210
Portfolio C: New construction version	1/7	1	1	0.1149
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/3**	0.2560
Portfolio B: Modernized version	1/4	1	**1/8**	0.0732
Portfolio C: New construction version	3	8	1	0.6708
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.7324	0.2000	0.7143	0.2308	0.2499	0.0509	Ageing indicators	0.3700
Portfolio B: Modernized version	0.1297	0.7266	0.1429	0.6923	0.6813	0.2297	Household indicators	0.5370
Portfolio C: New construction version	0.1378	0.0734	0.1429	0.0769	0.0688	0.2398	Clusters of households	0.0930
						0.2297	Household composition	
						0.2500	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2172	0.7143	0.2560	0.7891	Build Quality	0.2748
Portfolio B: Modernized version	0.7171	0.1429	0.0732	0.1078	Age distribution of housing stock	0.5888
Portfolio C: New construction version	0.0658	0.1429	0.6708	0.1031	Average number of rooms per dwelling	0.1365

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.2172	0.6908	0.4844	0.0672	0.0716	0.7641	0.2560	0.0734	Population density	0.4169
Portfolio B: Modernized version	0.7171	0.1488	0.4232	0.4440	0.4523	0.1210	0.0732	0.2152	Income level	0.2551
Portfolio C: New con-struction version	0.0658	0.1603	0.0924	0.4887	0.4761	0.1149	0.6708	0.0324	Land area	0.3280
								0.2204	Supply/ de-mand	
								0.0390	Tenure status	
								0.2195	Levels of rent	
								0.2000	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.3700	0.2748	0.4169	0.6337	Demographic characteristics	**0.3624**
Portfolio B: Modernized version	0.5370	0.5888	0.2551	0.1744	Space characteristics	**0.4920**
Portfolio C: New construction version	0.0930	0.1365	0.3280	0.1919	Environment social characteristics	**0.1457**

Source: Own analyses

Appendix 30 AHP-survey Michael Wulf – Cluster 4: Poland

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**6**	**5**	0.7324
Space characteristics	1/6	1	**1**	0.1297
Environment social characteristics	1/5	1	1	0.1378
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/6**	**1/7**	**1/4**	**1/4**	0.0460
Household indicators	6	1	**1**	**1**	**1**	0.2428
Clusters of households	7	1	1	**2**	**1**	0.2906
Household composition	4	1	1/2	1	**1**	0.1960
Housing indicators	4	1	1	1	1	0.2246
CR	1.49%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**5**	**6**	0.7324
Age distribution of housing stock	1/5	1	**1**	0.1378
Average number of rooms per dwelling	1/6	1	1	0.1297
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**4**	**4**	**4**	**3**	**1/4**	0.1887
Income level	3	1	**2**	**3**	**4**	**3**	**2**	0.2814
Land area	1/4	1/2	1	**1**	**1/2**	**1**	**1**	0.0872
Supply/ demand	1/4	1/3	1	1	**1**	**1**	**1/3**	0.0665
Tenure status	1/4	1/4	2	1	1	**1**	**1/3**	0.0746
Levels of rent	1/3	1/3	1	1	1	1	**1/2**	0.0734
Economic conditions	4	1/2	1	3	3	2	1	0.2282
CR	9.93%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/6**	0.0924
Portfolio B: Modernized version	4	1	**1**	0.4232
Portfolio C: New construction version	6	1	1	0.4844
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**6**	0.7324
Portfolio B: Modernized version	1/5	1	**1**	0.1378
Portfolio C: New construction version	1/6	1	1	0.1297
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/6**	0.0924
Portfolio B: Modernized version	4	1	**1**	0.4232
Portfolio C: New construction version	6	1	1	0.4844
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**4**	0.6908
Portfolio B: Modernized version	1/5	1	**1**	0.1488
Portfolio C: New construction version	1/4	1	1	0.1603
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**7**	0.7641
Portfolio B: Modernized version	1/6	1	**1**	0.1210
Portfolio C: New construction version	1/7	1	1	0.1149
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/3**	0.2499
Portfolio B: Modernized version	1/4	1	**1/9**	0.0688
Portfolio C: New construction version	3	9	1	0.6813
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**4**	0.6667
Portfolio B: Modernized version	1/4	1	**1**	0.1667
Portfolio C: New construction version	1/4	1	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**4**	0.6908
Portfolio B: Modernized version	1/5	1	**1**	0.1488
Portfolio C: New construction version	1/4	1	1	0.1603
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**6**	0.7500
Portfolio B: Modernized version	1/6	1	**1**	0.1250
Portfolio C: New construction version	1/6	1	1	0.1250
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.7143	0.0716	0.0924	0.0716	0.0909	0.0460	Ageing indicators	0.1116
Portfolio B: Modernized version	0.1429	0.4523	0.4232	0.4523	0.4545	0.2428	Household indicators	0.4301
Portfolio C: New construction version	0.1429	0.4761	0.4844	0.4761	0.4545	0.2906	Clusters of households	0.4583
						0.1960	Household composition	
						0.2246	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0778	0.7324	0.0924	0.7324	Build Quality	0.1699
Portfolio B: Modernized version	0.4353	0.1378	0.4232	0.1378	Age distribution of housing stock	0.3927
Portfolio C: New construction version	0.4869	0.1297	0.4844	0.1297	Average number of rooms per dwelling	0.4374

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.6908	0.7641	0.2499	0.6667	0.6908	0.0716	0.7500	0.1887	Population density	0.6395
Portfolio B: Modernized version	0.1488	0.1210	0.0688	0.1667	0.1488	0.4523	0.1250	0.2814	Income level	0.1520
Portfolio C: New construction version	0.1603	0.1149	0.6813	0.1667	0.1603	0.4761	0.1250	0.0872	Land area	0.2085
								0.0665	Supply/ demand	
								0.0746	Tenure status	
								0.0734	Levels of rent	
								0.2282	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1116	0.1699	0.6395	0.7324	Demographic characteristics	**0.1919**
Portfolio B: Modernized version	0.4301	0.3927	0.1520	0.1297	Space characteristics	**0.3869**
Portfolio C: New construction version	0.4583	0.4374	0.2085	0.1378	Environment social characteristics	**0.4212**

Source: Own analyses

Appendix 31 AHP-survey Michael Wulf – Cluster 5: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**6**	**6**	0.7500
Space characteristics	1/6	1	**1**	0.1250
Environment social characteristics	1/6	1	1	0.1250
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/5**	**1/5**	**1/4**	**1/5**	0.0485
Household indicators	5	1	**1**	**1**	**1**	0.2311
Clusters of households	5	1	1	**2**	**1**	0.2767
Household composition	4	1	1/2	1	**2**	0.2353
Housing indicators	5	1	1	1/2	1	0.2084
CR	3.73%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**5**	**6**	0.7324
Age distribution of housing stock	1/5	1	**1**	0.1378
Average number of rooms per dwelling	1/6	1	1	0.1297
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**5**	**7**	**4**	**3**	**5**	**1/7**	0.2257
Income level	1/5	1	**1/2**	**1**	**1/2**	**1**	**1/5**	0.0504
Land area	1/7	2	1	**1/2**	**1/3**	**1/2**	**1/7**	0.0438
Supply/ demand	1/4	1	2	1	**1/2**	**1**	**1/4**	0.0632
Tenure status	1/3	2	3	2	1	**1/2**	**1/3**	0.0916
Levels of rent	1/5	1	2	1	2	1	**1/5**	0.0765
Economic conditions	7	5	7	4	3	5	1	0.4489
CR	9.91%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**4**	0.6908
Portfolio B: Modernized version	1/5	1	**1**	0.1488
Portfolio C: New construction version	1/4	1	1	0.1603
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/5**	0.0836
Portfolio B: Modernized version	6	1	**1**	0.4721
Portfolio C: New construction version	5	1	1	0.4443
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**6**	0.7324
Portfolio B: Modernized version	1/5	1	**1**	0.1378
Portfolio C: New construction version	1/6	1	1	0.1297
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**7**	0.7641
Portfolio B: Modernized version	1/6	1	**1**	0.1210
Portfolio C: New construction version	1/7	1	1	0.1149
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/4**	0.2051
Portfolio B: Modernized version	1/3	1	**1/8**	0.0783
Portfolio C: New construction version	4	8	1	0.7167
CR	1.77%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**4**	0.6667
Portfolio B: Modernized version	1/4	1	**1**	0.1667
Portfolio C: New construction version	1/4	1	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/8**	0.0672
Portfolio B: Modernized version	6	1	**1**	0.4440
Portfolio C: New construction version	8	1	1	0.4887
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/8**	0.0626
Portfolio B: Modernized version	7	1	**1**	0.4583
Portfolio C: New construction version	8	1	1	0.4791
CR	0.19%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Alternative ranking
Portfolio A: Extrapolated version	0.7143	0.0778	0.0778	0.0716	0.6908	0.2350
Portfolio B: Modernized version	0.1429	0.4353	0.4353	0.4523	0.1488	0.3654
Portfolio C: New construction version	0.1429	0.4869	0.4869	0.4761	0.1603	0.3996

Criteria ranking	Subcriteria: Demographic characteristics
0.0485	Ageing indicators
0.2311	Household indicators
0.2767	Clusters of households
0.2353	Household composition
0.2084	Housing indicators

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0836	0.7324	0.0716	0.7324	Build Quality	0.1715
Portfolio B: Modernized version	0.4721	0.1378	0.4523	0.1378	Age distribution of housing stock	0.4235
Portfolio C: New construction version	0.4443	0.1297	0.4761	0.1297	Average number of rooms per dwelling	0.4050

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.7143	0.7641	0.2051	0.6667	0.0672	0.0626	0.7143	0.2257	Population density	0.5824
Portfolio B: Modernized version	0.1429	0.1210	0.0783	0.1667	0.4440	0.4583	0.1429	0.0504	Income level	0.1921
Portfolio C: New construction version	0.1429	0.1149	0.7167	0.1667	0.4887	0.4791	0.1429	0.0438	Land area	0.2255
								0.0632	Supply/ demand	
								0.0916	Tenure status	
								0.0765	Levels of rent	
								0.4489	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2350	0.1715	0.5824	0.7500	Demographic characteristics	**0.2705**
Portfolio B: Modernized version	0.3654	0.4235	0.1921	0.1250	Space characteristics	**0.3510**
Portfolio C: New construction version	0.3996	0.4050	0.2255	0.1250	Environment social characteristics	**0.3785**

Source: Own analyses

Appendix 32 Interview-summary Michael Wulf

Respondent	Michael Wulf

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	29.23%	49.11%	21.66%
Estonia	24.10%	37.66%	38.24%
Germany	36.24%	49.20%	14.57%
Hungary	29.23%	49.11%	21.66%
Latvia	24.10%	37.66%	38.24%
Lithuania	24.10%	37.66%	38.24%
Poland	19.19%	38.69%	42.12%
Romania	29.23%	49.11%	21.66%
Slovakia	29.23%	49.11%	21.66%
Spain	27.05%	35.10%	37.85%

Special core fields	Germany, Spain

Source: Own analyses

Appendix 33 AHP-survey Berit Jalas – Cluster 1: Bulgaria, Romania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/6**	**1/6**	0.0769
Space characteristics	6	1	**1**	0.4615
Environment social characteristics	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1**	**1**	0.2000
Household indicators	1	1	**1**	**1**	**1**	0.2000
Clusters of households	1	1	1	**1**	**1**	0.2000
Household composition	1	1	1	1	**1**	0.2000
Housing indicators	1	1	1	1	1	0.2000
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**1**	0.3333
Age distribution of housing stock	1	1	**1**	0.3333
Average number of rooms per dwelling	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**1/3**	**3**	**1**	**5**	**1/5**	0.1143
Income level	3	1	**1**	**3**	**2**	**3**	**1**	0.2019
Land area	3	1	1	**3**	**3**	**4**	**1**	0.2217
Supply/ demand	1/3	1/3	1/3	1	**1/3**	**2**	**1/3**	0.0613
Tenure status	1	1/2	1/3	3	1	**1/2**	**1/2**	0.0928
Levels of rent	1/5	1/3	1/4	1/2	2	1	**1/5**	0.0609
Economic conditions	5	1	1	3	2	5	1	0.2471
CR	9.57%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0667	0.0667	0.0667	0.0667	0.0667	0.2000	Ageing indicators	0.0667
Portfolio B: Modernized version	0.4667	0.4667	0.4667	0.4667	0.4667	0.2000	Household indicators	0.4667
Portfolio C: New construction version	0.4667	0.4667	0.4667	0.4667	0.4667	0.2000	Clusters of households	0.4667
						0.2000	Household composition	
						0.2000	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0667	0.0667	0.0667	0.3333	Build Quality	0.0667
Portfolio B: Modernized version	0.4667	0.4667	0.4667	0.3333	Age distribution of housing stock	0.4667
Portfolio C: New construction version	0.4667	0.4667	0.4667	0.3333	Average number of rooms per dwelling	0.4667

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.0667	0.0769	0.0769	0.0769	0.0769	0.1260	0.0769	0.1143	Population density	0.0787
Portfolio B: Modernized version	0.4667	0.4615	0.4615	0.4615	0.4615	0.4161	0.4615	0.2019	Income level	0.4594
Portfolio C: New con-struction version	0.4667	0.4615	0.4615	0.4615	0.4615	0.4579	0.4615	0.2217	Land area	0.4619
								0.0613	Supply/ de-mand	
								0.0928	Tenure status	
								0.0609	Levels of rent	
								0.2471	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0667	0.0667	0.0787	0.0769	Demographic characteristics	**0.0722**
Portfolio B: Modernized version	0.4667	0.4667	0.4594	0.4615	Space characteristics	**0.4633**
Portfolio C: New construction version	0.4667	0.4667	0.4619	0.4615	Environment social characteristics	**0.4645**

Source: Own analyses

Appendix 34 AHP-survey Berit Jalas – Cluster 2: Estonia, Latvia, Lithuania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/3**	**1/3**	0.1429
Space characteristics	3	1	**1**	0.4286
Environment social characteristics	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1**	**1**	0.2000
Household indicators	1	1	**1**	**1**	**1**	0.2000
Clusters of households	1	1	1	**1**	**1**	0.2000
Household composition	1	1	1	1	**1**	0.2000
Housing indicators	1	1	1	1	1	0.2000
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**1**	0.3333
Age distribution of housing stock	1	1	**1**	0.3333
Average number of rooms per dwelling	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**1/3**	**3**	**1**	**5**	**1/5**	0.1238
Income level	3	1	**1**	**3**	**3**	**3**	**1**	0.2192
Land area	3	1	1	**3**	**3**	**3**	**1**	0.2192
Supply/ demand	1/3	1/3	1/3	1	**1/2**	**1**	**1/3**	0.0562
Tenure status	1	1/3	1/3	2	1	**1**	**1**	0.0978
Levels of rent	1/5	1/3	1/3	1	1	1	**1**	0.0779
Economic conditions	5	1	1	3	1	1	1	0.2059
CR	9.98%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0769	0.0769	0.0769	0.0769	0.0769	0.2000	Ageing indicators	0.0769
Portfolio B: Modernized version	0.4615	0.4615	0.4615	0.4615	0.4615	0.2000	Household indicators	0.4615
Portfolio C: New construction version	0.4615	0.4615	0.4615	0.4615	0.4615	0.2000	Clusters of households	0.4615
						0.2000	Household composition	
						0.2000	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0667	0.0667	0.0667	0.3333	Build Quality	0.0667
Portfolio B: Modernized version	0.4667	0.4667	0.4667	0.3333	Age distribution of housing stock	0.4667
Portfolio C: New construction version	0.4667	0.4667	0.4667	0.3333	Average number of rooms per dwelling	0.4667

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.0667	0.0769	0.0769	0.0769	0.0769	0.1260	0.0769	0.1238	Population density	0.0795
Portfolio B: Modernized version	0.4667	0.4615	0.4615	0.4615	0.4615	0.4161	0.4615	0.2192	Income level	0.4586
Portfolio C: New con-struction version	0.4667	0.4615	0.4615	0.4615	0.4615	0.4579	0.4615	0.2192	Land area	0.4619
								0.0562	Supply/ de-mand	
								0.0978	Tenure status	
								0.0779	Levels of rent	
								0.2059	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0769	0.0667	0.0795	0.1429	Demographic characteristics	**0.0736**
Portfolio B: Modernized version	0.4615	0.4667	0.4586	0.4286	Space characteristics	**0.4625**
Portfolio C: New construction version	0.4615	0.4667	0.4619	0.4286	Environment social characteristics	**0.4639**

Source: Own analyses

Appendix 35 AHP-survey Berit Jalas – Cluster 3: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**5**	**1**	0.4545
Space characteristics	1/5	1	**1/5**	0.0909
Environment social characteristics	1	5	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1**	**1**	0.2000
Household indicators	1	1	**1**	**1**	**1**	0.2000
Clusters of households	1	1	1	**1**	**1**	0.2000
Household composition	1	1	1	1	**1**	0.2000
Housing indicators	1	1	1	1	1	0.2000
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**6**	**1**	0.4615
Age distribution of housing stock	1/6	1	**1/6**	0.0769
Average number of rooms per dwelling	1	6	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**1/6**	**1/3**	**1**	**3**	**1/4**	0.0654
Income level	4	1	**1**	**1**	**3**	**3**	**1**	0.1927
Land area	6	1	1	**2**	**5**	**5**	**1**	0.2636
Supply/ demand	3	1	1/2	1	**2**	**4**	**1**	0.1650
Tenure status	1	1/3	1/5	1/2	1	**1/2**	**1/2**	0.0611
Levels of rent	1/3	1/3	1/5	1/4	2	1	**1/5**	0.0534
Economic conditions	4	1	1	1	2	5	1	0.1988
CR	5.00%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1**	0.1250
Portfolio B: Modernized version	6	1	**6**	0.7500
Portfolio C: New construction version	1	1/6	1	0.1250
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1**	0.1250
Portfolio B: Modernized version	6	1	**6**	0.7500
Portfolio C: New construction version	1	1/6	1	0.1250
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1**	0.1250
Portfolio B: Modernized version	6	1	**6**	0.7500
Portfolio C: New construction version	1	1/6	1	0.1250
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1**	0.1250
Portfolio B: Modernized version	6	1	**6**	0.7500
Portfolio C: New construction version	1	1/6	1	0.1250
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1**	0.1250
Portfolio B: Modernized version	6	1	**6**	0.7500
Portfolio C: New construction version	1	1/6	1	0.1250
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1429
Portfolio B: Modernized version	5	1	**5**	0.7143
Portfolio C: New construction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1429
Portfolio B: Modernized version	5	1	**5**	0.7143
Portfolio C: New construction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1/5**	**1**	0.1429
Portfolio B: Modern-ized version	5	1	**5**	0.7143
Portfolio C: New con-struction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1**	0.1667
Portfolio B: Modernized version	4	1	**4**	0.6667
Portfolio C: New construction version	1	1/4	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1**	0.1250
Portfolio B: Modernized version	6	1	**6**	0.7500
Portfolio C: New construction version	1	1/6	1	0.1250
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1429
Portfolio B: Modernized version	5	1	**5**	0.7143
Portfolio C: New construction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1047
Portfolio B: Modernized version	5	1	**3**	0.6370
Portfolio C: New construction version	3	1/3	1	0.2583
CR	3.72%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1095
Portfolio B: Modernized version	5	1	**2**	0.5816
Portfolio C: New construction version	3	1/2	1	0.3090
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1488
Portfolio B: Modernized version	5	1	**4**	0.6908
Portfolio C: New construction version	1	1/4	1	0.1603
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.1000
Portfolio B: Modernized version	6	1	**2**	0.6000
Portfolio C: New construction version	3	1/2	1	0.3000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1250	0.1250	0.1250	0.1250	0.1250	0.2000	Ageing indicators	0.1250
Portfolio B: Modernized version	0.7500	0.7500	0.7500	0.7500	0.7500	0.2000	Household indicators	0.7500
Portfolio C: New construction version	0.1250	0.1250	0.1250	0.1250	0.1250	0.2000	Clusters of households	0.1250
						0.2000	Household composition	
						0.2000	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1429	0.1429	0.1429	0.4615	Build Quality	0.1429
Portfolio B: Modernized version	0.7143	0.7143	0.7143	0.0769	Age distribution of housing stock	0.7143
Portfolio C: New construction version	0.1429	0.1429	0.1429	0.4615	Average number of rooms per dwelling	0.1429

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1667	0.1250	0.1429	0.1047	0.1095	0.1488	0.1000	0.0654	Population density	0.1244
Portfolio B: Modernized version	0.6667	0.7500	0.7143	0.6370	0.5816	0.6908	0.6000	0.1927	Income level	0.6732
Portfolio C: New con-struction version	0.1667	0.1250	0.1429	0.2583	0.3090	0.1603	0.3000	0.2636	Land area	0.2023
								0.1650	Supply/ de-mand	
								0.0611	Tenure status	
								0.0534	Levels of rent	
								0.1988	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1250	0.1429	0.1244	0.4545	Demographic characteristics	**0.1264**
Portfolio B: Modernized version	0.7500	0.7143	0.6732	0.0909	Space characteristics	**0.7118**
Portfolio C: New construction version	0.1250	0.1429	0.2023	0.4545	Environment social characteristics	**0.1618**

Source: Own analyses

Appendix 36 AHP-survey Berit Jalas – Cluster 4: Hungary, Poland, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/3**	**1/3**	0.1429
Space characteristics	3	1	**1**	0.4286
Environment social characteristics	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	1	1	1	1	0.2000
Household indicators	1	1	1	1	1	0.2000
Clusters of households	1	1	1	1	1	0.2000
Household composition	1	1	1	1	1	0.2000
Housing indicators	1	1	1	1	1	0.2000
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**1**	0.3333
Age distribution of housing stock	1	1	**1**	0.3333
Average number of rooms per dwelling	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**1/3**	**3**	**1**	**5**	**1/5**	0.1135
Income level	3	1	**1**	**5**	**4**	**3**	**1/2**	0.1954
Land area	3	1	1	**6**	**3**	**2**	**1**	0.2036
Supply/ demand	1/3	1/5	1/6	1	**1**	**1/2**	**1/7**	0.0363
Tenure status	1	1/4	1/3	1	1	**1/5**	**1/7**	0.0484
Levels of rent	1/5	1/3	1/2	2	5	1	**1/5**	0.0835
Economic conditions	5	2	1	7	7	5	1	0.3194
CR	9.94%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modern-ized version	6	1	**1**	0.4615
Portfolio C: New con-struction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modern-ized version	6	1	**1**	0.4615
Portfolio C: New con-struction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/6**	0.0769
Portfolio B: Modernized version	6	1	**1**	0.4615
Portfolio C: New construction version	6	1	1	0.4615
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.0769	0.0769	0.0769	0.0769	0.0769	0.2000	Ageing indicators	0.0769
Portfolio B: Modernized version	0.4615	0.4615	0.4615	0.4615	0.4615	0.2000	Household indicators	0.4615
Portfolio C: New construction version	0.4615	0.4615	0.4615	0.4615	0.4615	0.2000	Clusters of households	0.4615
						0.2000	Household composition	
						0.2000	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.0769	0.0769	0.0769	0.3333	Build Quality	0.0769
Portfolio B: Modernized version	0.4615	0.4615	0.4615	0.3333	Age distribution of housing stock	0.4615
Portfolio C: New construction version	0.4615	0.4615	0.4615	0.3333	Average number of rooms per dwelling	0.4615

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Alternative ranking
Portfolio A: Extrapolated version	0.0667	0.0769	0.0769	0.0769	0.0769	0.1260	0.0769	0.0799
Portfolio B: Modernized version	0.4667	0.4615	0.4615	0.4615	0.4615	0.4161	0.4615	0.4583
Portfolio C: New construction version	0.4667	0.4615	0.4615	0.4615	0.4615	0.4579	0.4615	0.4618

Criteria ranking	Subcriteria: Environment social characteristics
0.1135	Population density
0.1954	Income level
0.2036	Land area
0.0363	Supply/ demand
0.0484	Tenure status
0.0835	Levels of rent
0.3194	Economic conditions

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0769	0.0769	0.0799	0.1429	Demographic characteristics	**0.0782**
Portfolio B: Modernized version	0.4615	0.4615	0.4583	0.4286	Space characteristics	**0.4602**
Portfolio C: New construction version	0.4615	0.4615	0.4618	0.4286	Environment social characteristics	**0.4617**

Source: Own analyses

Appendix 37 AHP-survey Berit Jalas – Cluster 5: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**2**	**1**	0.4000
Space characteristics	1/2	1	**1/2**	0.2000
Environment social characteristics	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1**	**1**	0.2000
Household indicators	1	1	**1**	**1**	**1**	0.2000
Clusters of households	1	1	1	**1**	**1**	0.2000
Household composition	1	1	1	1	**1**	0.2000
Housing indicators	1	1	1	1	1	0.2000
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**3**	**1**	0.4286
Age distribution of housing stock	1/3	1	**1/3**	0.1429
Average number of rooms per dwelling	1	3	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/2**	**1/4**	**1/3**	**3**	**3**	**1/4**	0.0968
Income level	2	1	**1**	**1**	**3**	**2**	**1**	0.1733
Land area	4	1	1	**1**	**4**	**3**	**1**	0.2160
Supply/ demand	3	1	1	1	**3**	**3**	**1**	0.1954
Tenure status	1/3	1/3	1/4	1/3	1	**1**	**1/3**	0.0539
Levels of rent	1/3	1/2	1/3	1/3	1	1	**1/2**	0.0648
Economic conditions	4	1	1	1	3	2	1	0.1998
CR	4.08%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1**	0.2500
Portfolio B: Modernized version	2	1	**2**	0.5000
Portfolio C: New construction version	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	Ageing indicators	0.2000
Portfolio B: Modernized version	0.6000	0.6000	0.6000	0.6000	0.6000	0.2000	Household indicators	0.6000
Portfolio C: New construction version	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	Clusters of households	0.2000
						0.2000	Household composition	
						0.2000	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.2000	0.2000	0.4286	Build Quality	0.2000
Portfolio B: Modernized version	0.6000	0.6000	0.6000	0.1429	Age distribution of housing stock	0.6000
Portfolio C: New construction version	0.2000	0.2000	0.2000	0.4286	Average number of rooms per dwelling	0.2000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.2500	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.0968	Population density	0.2048
Portfolio B: Modernized version	0.5000	0.6000	0.6000	0.6000	0.6000	0.6000	0.6000	0.1733	Income level	0.5903
Portfolio C: New con-struction version	0.2500	0.2000	0.2000	0.2000	0.2000	0.2000	0.2000	0.2160	Land area	0.2048
								0.1954	Supply/ de-mand	
								0.0539	Tenure status	
								0.0648	Levels of rent	
								0.1998	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.2000	0.2048	0.4000	Demographic characteristics	**0.2019**
Portfolio B: Modernized version	0.6000	0.6000	0.5903	0.2000	Space characteristics	**0.5961**
Portfolio C: New construction version	0.2000	0.2000	0.2048	0.4000	Environment social characteristics	**0.2019**

Source: Own analyses

Appendix 38 Interview-summary Berit Jalas

Respondent	Berit Jalas

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	7.22%	46.33%	46.45%
Estonia	7.36%	46.25%	46.39%
Germany	12.64%	71.18%	16.18%
Hungary	7.82%	46.02%	46.17%
Latvia	7.36%	46.25%	46.39%
Lithuania	7.36%	46.25%	46.39%
Poland	7.82%	46.02%	46.17%
Romania	7.22%	46.33%	46.45%
Slovakia	7.82%	46.02%	46.17%
Spain	20.19%	59.61%	20.19%

Special core fields	Germany

Source: Own analyses

Appendix 39 AHP-survey Richard Winter – Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Romania, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**5**	**1/3**	0.2718
Space characteristics	1/5	1	**1/8**	0.0670
Environment social characteristics	3	8	1	0.6612
CR	4.27%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/4**	**1/3**	**1/5**	**1/3**	0.0642
Household indicators	4	1	**1**	**1**	**1**	0.2371
Clusters of households	3	1	1	**1**	**1**	0.2244
Household composition	5	1	1	1	**1**	0.2499
Housing indicators	3	1	1	1	1	0.2244
CR	0.67%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**3**	**3**	0.6000
Age distribution of housing stock	1/3	1	**1**	0.2000
Average number of rooms per dwelling	1/3	1	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**4**	**3**	**1/3**	**1/3**	**1/6**	0.0858
Income level	5	1	**5**	**4**	**1**	**1**	**1**	0.2225
Land area	1/4	1/5	1	**1**	**1/4**	**1/4**	**1/5**	0.0404
Supply/ demand	1/3	1/4	1	1	**1/3**	**1**	**1/2**	0.0693
Tenure status	3	1	4	3	1	**1**	**2**	0.2122
Levels of rent	3	1	4	1	1	1	**1**	0.1680
Economic conditions	6	1	5	2	1/2	1	1	0.2019
CR	8.91%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/6**	0.1000
Portfolio B: Modernized version	3	1	**1/2**	0.3000
Portfolio C: New construction version	6	2	1	0.6000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1/4**	0.1998
Portfolio B: Modernized version	1/2	1	**1/5**	0.1168
Portfolio C: New construction version	4	5	1	0.6833
CR	2.38%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/3**	0.2583
Portfolio B: Modernized version	1/3	1	**1/5**	0.1047
Portfolio C: New construction version	3	5	1	0.6370
CR	3.72%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/3**	0.2583
Portfolio B: Modernized version	1/3	1	**1/5**	0.1047
Portfolio C: New construction version	3	5	1	0.6370
CR	3.72%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/4**	0.2172
Portfolio B: Modernized version	1/4	1	**1/9**	0.0658
Portfolio C: New construction version	4	9	1	0.7171
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.3196	0.3196	0.3196	0.3196	0.3196	0.0642	Ageing indicators	0.3196
Portfolio B: Modernized version	0.1220	0.1220	0.1220	0.1220	0.1220	0.2371	Household indicators	0.1220
Portfolio C: New construction version	0.5584	0.5584	0.5584	0.5584	0.5584	0.2244	Clusters of households	0.5584
						0.2499	Household composition	
						0.2244	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3196	0.0909	0.1429	0.6000	Build Quality	0.2385
Portfolio B: Modernized version	0.1220	0.4545	0.4286	0.2000	Age distribution of housing stock	0.2498
Portfolio C: New construction version	0.5584	0.4545	0.4286	0.2000	Average number of rooms per dwelling	0.5117

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac- teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.1000	0.1998	0.2583	0.2583	0.2172	0.1429	0.0858	Population density	0.1806
Portfolio B: Modernized version	0.4286	0.3000	0.1168	0.1047	0.1047	0.0658	0.4286	0.2225	Income level	0.2353
Portfolio C: New con- struction version	0.4286	0.6000	0.6833	0.6370	0.6370	0.7171	0.4286	0.0404	Land area	0.5841
								0.0693	Supply/ de- mand	
								0.2122	Tenure status	
								0.1680	Levels of rent	
								0.2019	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.3196	0.2385	0.1806	0.2718	Demographic characteristics	**0.2223**
Portfolio B: Modernized version	0.1220	0.2498	0.2353	0.0670	Space characteristics	**0.2055**
Portfolio C: New construction version	0.5584	0.5117	0.5841	0.6612	Environment social characteristics	**0.5723**

Source: Own analyses

Appendix 40 AHP-survey Richard Winter, Susanne Gentz – Cluster 2: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/4**	**1/5**	0.1005
Space characteristics	4	1	**1**	0.4330
Environment social characteristics	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**3**	**1/3**	**4**	0.2806
Household indicators	1/3	1	**1**	**1/3**	**1**	0.1026
Clusters of households	1/3	1	1	**1/4**	**1/2**	0.0842
Household composition	3	3	4	1	**2**	0.4058
Housing indicators	1/4	1	2	1/2	1	0.1269
CR	6.49%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**5**	**4**	0.6908
Age distribution of housing stock	1/5	1	**1**	0.1488
Average number of rooms per dwelling	1/4	1	1	0.1603
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**5**	**1**	**1/2**	**1/3**	**1/2**	0.0884
Income level	5	1	**5**	**4**	**2**	**2**	**2**	0.3176
Land area	1/5	1/5	1	**1/5**	**1/5**	**1/4**	**1/2**	0.0343
Supply/ demand	1	1/4	5	1	**3**	**3**	**3**	0.2069
Tenure status	2	1/2	5	1/3	1	**1**	**1**	0.1197
Levels of rent	3	1/2	4	1/3	1	1	**1**	0.1267
Economic conditions	2	1/2	2	1/3	1	1	1	0.1065
CR	9.36%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/6**	0.0836
Portfolio B: Modernized version	5	1	**1**	0.4443
Portfolio C: New construction version	6	1	1	0.4721
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4445
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/6**	0.0924
Portfolio B: Modernized version	4	1	**1**	0.4232
Portfolio C: New construction version	6	1	1	0.4844
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**3**	0.2000
Portfolio B: Modernized version	4	1	**9**	0.7267
Portfolio C: New construction version	1/3	1/9	1	0.0734
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**4**	0.2172
Portfolio B: Modernized version	4	1	**9**	0.7171
Portfolio C: New construction version	1/4	1/9	1	0.0658
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/4**	0.1005
Portfolio B: Modernized version	5	1	**1**	0.4665
Portfolio C: New construction version	4	1	1	0.4330
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/4**	0.2000
Portfolio B: Modernized version	1/3	1	**1/9**	0.0734
Portfolio C: New construction version	4	9	1	0.7267
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1140
Portfolio B: Modernized version	5	1	**1**	0.4806
Portfolio C: New construction version	3	1	1	0.4054
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1172
Portfolio B: Modernized version	6	1	**2**	0.6144
Portfolio C: New construction version	2	1/2	1	0.2684
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/4**	0.2172
Portfolio B: Modernized version	1/4	1	**1/9**	0.0658
Portfolio C: New construction version	4	9	1	0.7171
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/2**	0.1283
Portfolio B: Modernized version	5	1	**2**	0.5954
Portfolio C: New construction version	2	1/2	1	0.2764
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0836	0.1111	0.1005	0.0924	0.2000	0.2806	Ageing indicators	0.1062
Portfolio B: Modernized version	0.4443	0.4445	0.4330	0.4232	0.7267	0.1026	Household indicators	0.4706
Portfolio C: New construction version	0.4721	0.4444	0.4665	0.4844	0.0734	0.0842	Clusters of households	0.4232
						0.4058	Household composition	
						0.1269	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.2172	0.1005	0.2000	0.6908	Build Quality	0.1970
Portfolio B: Modernized version	0.7171	0.4665	0.0734	0.1488	Age distribution of housing stock	0.5766
Portfolio C: New construction version	0.0658	0.4330	0.7267	0.1603	Average number of rooms per dwelling	0.2264

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.3196	0.0909	0.1140	0.1172	0.2172	0.1429	0.1283	0.0884	Population density	0.1430
Portfolio B: Modernized version	0.1220	0.4545	0.4806	0.6144	0.0658	0.4286	0.5954	0.3176	Income level	0.4243
Portfolio C: New construction version	0.5584	0.4545	0.4054	0.2684	0.7171	0.4286	0.2764	0.0343	Land area	0.4327
								0.2069	Supply/ demand	
								0.1197	Tenure status	
								0.1267	Levels of rent	
								0.1065	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1062	0.1970	0.1430	0.1005	Demographic characteristics	**0.1627**
Portfolio B: Modernized version	0.4706	0.5766	0.4243	0.4330	Space characteristics	**0.4949**
Portfolio C: New construction version	0.4232	0.2264	0.4327	0.4665	Environment social characteristics	**0.3424**

Source: Own analyses

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Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic character-istics	1	**5**	**1/2**	0.3420
Space characteristics	1/5	1	**1/6**	0.0811
Environment social characteristics	2	6	1	0.5769
CR	2.80%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/5**	**1/4**	**1/5**	**1/3**	0.0570
Household indicators	5	1	**1**	**1**	**1**	0.2442
Clusters of households	4	1	1	**1**	**1**	0.2329
Household composition	5	1	1	1	**1**	0.2442
Housing indicators	3	1	1	1	1	0.2216
CR	0.64%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**5**	**3**	0.6370
Age distribution of housing stock	1/5	1	**1/3**	0.1047
Average number of rooms per dwelling	1/3	3	1	0.2583
CR	3.72%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**2**	**1/2**	**1/2**	**1/4**	**1/5**	0.0820
Income level	3	1	**1**	**1**	**1**	**1**	**1**	0.1557
Land area	1/2	1	1	**1**	**1**	**1**	**1**	0.1283
Supply/ demand	2	1	1	1	**1**	**1**	**1**	0.1448
Tenure status	2	1	1	1	1	**1**	**1**	0.1448
Levels of rent	4	1	1	1	1	1	**1**	0.1667
Economic conditions	5	1	1	1	1	1	1	0.1777
CR	6.02%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/4**	0.1005
Portfolio B: Modernized version	5	1	**1**	0.4665
Portfolio C: New construction version	4	1	1	0.4330
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1**	0.2500
Portfolio B: Modernized version	2	1	**2**	0.5000
Portfolio C: New construction version	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2000
Portfolio B: Modernized version	3	1	**3**	0.6000
Portfolio C: New construction version	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**2**	0.5000
Portfolio B: Modernized version	1/2	1	**1**	0.2500
Portfolio C: New construction version	1/2	1	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.2000	0.1692	0.1260	0.2000	0.0570	Ageing indicators	0.1748
Portfolio B: Modernized version	0.4000	0.4000	0.4434	0.4579	0.4000	0.2442	Household indicators	0.4243
Portfolio C: New construction version	0.4000	0.4000	0.3874	0.4161	0.4000	0.2329	Clusters of households	0.4010
						0.2442	Household composition	
						0.2216	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1005	0.1692	0.2000	0.6370	Build Quality	0.1334
Portfolio B: Modernized version	0.4665	0.4434	0.4000	0.1047	Age distribution of housing stock	0.4469
Portfolio C: New construction version	0.4330	0.3874	0.4000	0.2583	Average number of rooms per dwelling	0.4197

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1260	0.1111	0.2500	0.1429	0.2000	0.5000	0.1692	0.0820	Population density	0.2228
Portfolio B: Modernized version	0.4579	0.4444	0.5000	0.5714	0.6000	0.2500	0.4434	0.1557	Income level	0.4610
Portfolio C: New con-struction version	0.4161	0.4444	0.2500	0.2857	0.2000	0.2500	0.3874	0.1283	Land area	0.3162
								0.1448	Supply/ de-mand	
								0.1448	Tenure status	
								0.1667	Levels of rent	
								0.1777	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1748	0.1334	0.2228	0.3420	Demographic characteristics	**0.1991**
Portfolio B: Modernized version	0.4243	0.4469	0.4610	0.0811	Space characteristics	**0.4473**
Portfolio C: New construction version	0.4010	0.4197	0.3162	0.5769	Environment social characteristics	**0.3536**

Source: Own analyses

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Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/5**	**3**	0.1782
Space characteristics	5	1	**9**	0.7514
Environment social characteristics	1/3	1/9	1	0.0704
CR	2.82%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**1/2**	**1/3**	**2**	0.1767
Household indicators	1/3	1	**1/4**	**1**	**1**	0.1176
Clusters of households	2	4	1	**1**	**4**	0.3281
Household composition	3	1	1	1	**4**	0.2956
Housing indicators	1/2	1	1/4	1/4	1	0.0820
CR	9.32%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**3**	**3**	0.6000
Age distribution of housing stock	1/3	1	**1**	0.2000
Average number of rooms per dwelling	1/3	1	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**2**	**4**	**4**	**1/2**	**1/3**	**1/4**	0.1337
Income level	1/2	1	**1**	**1**	**1**	**1**	**1**	0.1217
Land area	1/4	1	1	**1**	**1/4**	**1/4**	**1/4**	0.0548
Supply/ demand	1/4	1	1	1	**1/5**	**1/5**	**1/5**	0.0506
Tenure status	2	1	4	5	1	**1**	**1**	0.1956
Levels of rent	3	1	4	5	1	1	**1**	0.2131
Economic conditions	4	1	4	5	1	1	1	0.2305
CR	8.50%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**3**	0.2499
Portfolio B: Modernized version	3	1	**6**	0.6548
Portfolio C: New construction version	1/3	1/6	1	0.0953
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**3**	0.5499
Portfolio B: Modernized version	1/2	1	**1**	0.2402
Portfolio C: New construction version	1/3	1	1	0.2099
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**3**	0.2583
Portfolio B: Modernized version	3	1	**5**	0.6370
Portfolio C: New construction version	1/3	1/5	1	0.1047
CR	3.72%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**3**	0.3090
Portfolio B: Modernized version	2	1	**5**	0.5816
Portfolio C: New construction version	1/3	1/5	1	0.1095
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**5**	0.6908
Portfolio B: Modernized version	1/4	1	**1**	0.1603
Portfolio C: New construction version	1/5	1	1	0.1488
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**2**	0.2385
Portfolio B: Modernized version	3	1	**4**	0.6250
Portfolio C: New construction version	1/2	1/4	1	0.1365
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**3**	0.2426
Portfolio B: Modernized version	3	1	**7**	0.6694
Portfolio C: New construction version	1/3	1/7	1	0.0879
CR	0.68%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**4**	0.6667
Portfolio B: Modernized version	1/4	1	**1**	0.1667
Portfolio C: New construction version	1/4	1	1	0.1667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**5**	0.6586
Portfolio B: Modernized version	1/3	1	**1**	0.1852
Portfolio C: New construction version	1/5	1	1	0.1562
CR	2.81%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**2**	0.5714
Portfolio B: Modernized version	1/4	1	**1/2**	0.1429
Portfolio C: New construction version	1/2	2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**2**	0.2970
Portfolio B: Modernized version	2	1	**3**	0.5396
Portfolio C: New construction version	1/2	1/3	1	0.1634
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**2**	0.2970
Portfolio B: Modernized version	2	1	**3**	0.5396
Portfolio C: New construction version	1/2	1/3	1	0.1634
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**2**	0.5816
Portfolio B: Modernized version	1/5	1	**1/3**	0.1095
Portfolio C: New construction version	1/2	3	1	0.3090
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2499	0.5499	0.2583	0.3090	0.6908	0.1767	Ageing indicators	0.3416
Portfolio B: Modernized version	0.6548	0.2402	0.6370	0.5816	0.1603	0.1176	Household indicators	0.5380
Portfolio C: New construction version	0.0953	0.2099	0.1047	0.1095	0.1488	0.3281	Clusters of households	0.1204
						0.2956	Household composition	
						0.0820	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.2385	0.2426	0.6667	0.6000	Build Quality	0.3250
Portfolio B: Modernized version	0.6250	0.6694	0.1667	0.2000	Age distribution of housing stock	0.5422
Portfolio C: New construction version	0.1365	0.0879	0.1667	0.2000	Average number of rooms per dwelling	0.1328

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.6586	0.1429	0.5714	0.2970	0.2970	0.5816	0.1429	0.1337	Population density	0.3667
Portfolio B: Modernized version	0.1852	0.5714	0.1429	0.5396	0.5396	0.1095	0.5714	0.1217	Income level	0.3900
Portfolio C: New construction version	0.1562	0.2857	0.2857	0.1634	0.1634	0.3090	0.2857	0.0548	Land area	0.2432
								0.0506	Supply/ demand	
								0.1956	Tenure status	
								0.2131	Levels of rent	
								0.2305	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.3416	0.3250	0.3667	0.1782	Demographic characteristics	**0.3309**
Portfolio B: Modernized version	0.5380	0.5422	0.3900	0.7514	Space characteristics	**0.5308**
Portfolio C: New construction version	0.1204	0.1328	0.2432	0.0704	Environment social characteristics	**0.1384**

Source: Own analyses

Appendix 43 Interview-summary Richard Winter, Susanne Gentz

Respondent	Richard Winter, Susanne Gentz

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	22.23%	20.55%	57.23%
Estonia	22.23%	20.55%	57.23%
Germany	16.27%	49.49%	34.24%
Hungary	22.23%	20.55%	57.23%
Latvia	22.23%	20.55%	57.23%
Lithuania	22.23%	20.55%	57.23%
Poland	19.91%	44.73%	35.36%
Romania	22.23%	20.55%	57.23%
Slovakia	22.23%	20.55%	57.23%
Spain	33.09%	53.08%	13.84%

Special core fields	Germany, Poland, Spain

Source: Own analyses

Appendix 44 AHP-survey Özgür Öner – Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**5**	**5**	0.7143
Space characteristics	1/5	1	**1**	0.1429
Environment social characteristics	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**6**	**5**	**5**	**1/4**	0.2861
Household indicators	1/6	1	**1**	**1**	**1/5**	0.0673
Clusters of households	1/5	1	1	**1**	**1/5**	0.0691
Household composition	1/5	1	1	1	**1/5**	0.0691
Housing indicators	4	5	5	5	1	0.5084
CR	6.09%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**6**	**6**	0.7500
Age distribution of housing stock	1/6	1	**1**	0.1250
Average number of rooms per dwelling	1/6	1	1	0.1250
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**3**	**3**	**1/3**	**1/5**	**1/4**	0.0869
Income level	3	1	**3**	**1**	**3**	**1**	**1**	0.2089
Land area	1/3	1/3	1	**1**	**1/3**	**1/3**	**1/4**	0.0515
Supply/ demand	1/3	1	1	1	**1/3**	**1/3**	**1/4**	0.0696
Tenure status	3	1/3	3	3	1	**1**	**1**	0.1658
Levels of rent	5	1	3	3	1	1	**1**	0.2065
Economic conditions	4	1	4	4	1	1	1	0.2109
CR	8.76%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/5**	0.0836
Portfolio B: Modernized version	6	1	**1**	0.4721
Portfolio C: New construction version	5	1	1	0.4443
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.0836	0.1111	0.1111	0.1111	0.0909	0.2861	Ageing indicators	0.0930
Portfolio B: Modernized version	0.4721	0.4444	0.4444	0.4444	0.4545	0.0673	Household indicators	0.4575
Portfolio C: New construction version	0.4443	0.4444	0.4444	0.4444	0.4545	0.0691	Clusters of households	0.4495
						0.0691	Household composition	
						0.5084	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.0909	0.1111	0.7500	Build Quality	0.0934
Portfolio B: Modernized version	0.4545	0.4545	0.4444	0.1250	Age distribution of housing stock	0.4533
Portfolio C: New construction version	0.4545	0.4545	0.4444	0.1250	Average number of rooms per dwelling	0.4533

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1111	0.1111	0.0909	0.1111	0.1111	0.7143	0.1111	0.0869	Population density	0.2346
Portfolio B: Modernized version	0.4444	0.4444	0.4545	0.4444	0.4444	0.1429	0.4444	0.2089	Income level	0.3827
Portfolio C: New construction version	0.4444	0.4444	0.4545	0.4444	0.4444	0.1429	0.4444	0.0515	Land area	0.3827
								0.0696	Supply/ demand	
								0.1658	Tenure status	
								0.2065	Levels of rent	
								0.2109	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.0930	0.0934	0.2346	0.7143	Demographic characteristics	**0.1133**
Portfolio B: Modernized version	0.4575	0.4533	0.3827	0.1429	Space characteristics	**0.4462**
Portfolio C: New construction version	0.4495	0.4533	0.3827	0.1429	Environment social characteristics	**0.4405**

Source: Own analyses

Appendix 45 AHP-survey Özgür Öner – Cluster 2: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**5**	**1/3**	0.2654
Space characteristics	1/5	1	**1/9**	0.0629
Environment social characteristics	3	9	1	0.6716
CR	2.81%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**7**	**2**	**3**	**7**	0.4509
Household indicators	1/7	1	**1/7**	**1/5**	**1/7**	0.0341
Clusters of households	1/2	7	1	**1**	**3**	0.2203
Household composition	1/3	5	1	1	**3**	0.1935
Housing indicators	1/7	7	1/3	1/3	1	0.1011
CR	8.63%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/2**	**2**	0.2970
Age distribution of housing stock	2	1	**3**	0.5396
Average number of rooms per dwelling	1/2	1/3	1	0.1634
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**4**	**4**	**6**	**5**	**5**	**2**	0.4057
Income level	1/4	1	**1**	**2**	**1**	**1**	**3**	0.1200
Land area	1/4	1	1	**2**	**1**	**1**	**3**	0.1200
Supply/ demand	1/6	1/2	1/2	1	**1**	**1**	**2**	0.0805
Tenure status	1/5	1	1	1	1	**1**	**3**	0.1065
Levels of rent	1/5	1	1	1	1	1	**3**	0.1065
Economic conditions	1/2	1/3	1/3	1/2	1/3	1/3	1	0.0608
CR	5.98%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**2**	0.1349
Portfolio B: Modernized version	7	1	**8**	0.7838
Portfolio C: New construction version	1/2	1/8	1	0.0813
CR	3.39%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**3**	0.2499
Portfolio B: Modernized version	3	1	**6**	0.6548
Portfolio C: New construction version	1/3	1/6	1	0.0953
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1634
Portfolio B: Modernized version	3	1	**2**	0.5396
Portfolio C: New construction version	2	1/2	1	0.2970
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**8**	**7**	0.7891
Portfolio B: Modernized version	1/8	1	**1**	0.1031
Portfolio C: New construction version	1/7	1	1	0.1078
CR	0.19%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6**	**6**	0.7500
Portfolio B: Modernized version	1/6	1	**1**	0.1250
Portfolio C: New construction version	1/6	1	1	0.1250
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**8**	**8**	0.8000
Portfolio B: Modernized version	1/8	1	**1**	0.1000
Portfolio C: New construction version	1/8	1	1	0.1000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1349	0.2499	0.1634	0.1692	0.1692	0.4509	Ageing indicators	0.1552
Portfolio B: Modernized version	0.7838	0.6548	0.5396	0.4434	0.4434	0.0341	Household indicators	0.6253
Portfolio C: New construction version	0.0813	0.0953	0.2970	0.3874	0.3874	0.2203	Clusters of households	0.2195
						0.1935	Household composition	
						0.1011	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1692	0.1692	0.1692	0.2970	Build Quality	0.1692
Portfolio B: Modernized version	0.4434	0.4434	0.4434	0.5396	Age distribution of housing stock	0.4434
Portfolio C: New construction version	0.3874	0.3874	0.3874	0.1634	Average number of rooms per dwelling	0.3874

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1692	0.1692	0.1260	0.1429	0.7891	0.7500	0.8000	0.4057	Population density	0.3281
Portfolio B: Modernized version	0.4434	0.4434	0.4579	0.5714	0.1031	0.1250	0.1000	0.1200	Income level	0.3644
Portfolio C: New con-struction version	0.3874	0.3874	0.4161	0.2857	0.1078	0.1250	0.1000	0.1200	Land area	0.3074
								0.0805	Supply/ de-mand	
								0.1065	Tenure status	
								0.1065	Levels of rent	
								0.0608	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1552	0.1692	0.3281	0.2654	Demographic characteristics	**0.2722**
Portfolio B: Modernized version	0.6253	0.4434	0.3644	0.0629	Space characteristics	**0.4387**
Portfolio C: New construction version	0.2195	0.3874	0.3074	0.6716	Environment social characteristics	**0.2891**

Source: Own analyses

Appendix 46 AHP-survey Özgür Öner – Cluster 3: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**4**	**4**	0.6667
Space characteristics	1/4	1	**1**	0.1667
Environment social characteristics	1/4	1	1	0.1667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**1/2**	**2**	**1/4**	0.1601
Household indicators	1/3	1	**1/3**	**1/3**	**1/4**	0.0643
Clusters of households	2	3	1	**1**	**1**	0.2414
Household composition	1/2	3	1	1	**1/4**	0.1413
Housing indicators	4	4	1	4	1	0.3929
CR	7.72%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/3**	**1/3**	0.1429
Age distribution of housing stock	3	1	**1**	0.4286
Average number of rooms per dwelling	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**3**	**1/3**	**1/3**	**1/4**	**1/5**	**3**	0.0935
Income level	1/3	1	**1/3**	**1/3**	**1/2**	**1/4**	**1**	0.0576
Land area	3	3	1	**1**	**1**	**1**	**3**	0.1913
Supply/ demand	3	3	1	1	**1**	**1**	**2**	0.1811
Tenure status	4	2	1	1	1	**1**	**3**	0.1960
Levels of rent	5	4	1	1	1	1	**1**	0.2031
Economic conditions	1/3	1	1/3	1/2	1/3	1	1	0.0773
CR	7.73%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4285
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**2**	0.5000
Portfolio B: Modernized version	1/2	1	**1**	0.2500
Portfolio C: New construction version	1/2	1	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1111	0.1429	0.1260	0.1260	0.1692	0.1601	Ageing indicators	0.1417
Portfolio B: Modernized version	0.4444	0.4285	0.4579	0.4579	0.4434	0.0643	Household indicators	0.4482
Portfolio C: New construction version	0.4444	0.4286	0.4161	0.4161	0.3874	0.2414	Clusters of households	0.4101
						0.1413	Household composition	
						0.3929	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.5000	0.1429	0.1429	Build Quality	0.3041
Portfolio B: Modernized version	0.4000	0.2500	0.4286	0.4286	Age distribution of housing stock	0.3480
Portfolio C: New construction version	0.4000	0.2500	0.4286	0.4286	Average number of rooms per dwelling	0.3480

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1692	0.1692	0.1692	0.2000	0.1692	0.7143	0.1692	0.0935	Population density	0.2855
Portfolio B: Modernized version	0.4434	0.4434	0.4434	0.4000	0.4434	0.1429	0.4434	0.0576	Income level	0.3745
Portfolio C: New construction version	0.3874	0.3874	0.3874	0.4000	0.3874	0.1429	0.3874	0.1913	Land area	0.3400
								0.1811	Supply/ demand	
								0.1960	Tenure status	
								0.2031	Levels of rent	
								0.0773	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1417	0.3041	0.2855	0.6667	Demographic characteristics	**0.1927**
Portfolio B: Modernized version	0.4482	0.3480	0.3745	0.1667	Space characteristics	**0.4192**
Portfolio C: New construction version	0.4101	0.3480	0.3400	0.1667	Environment social characteristics	**0.3881**

Source: Own analyses

Appendix 47 Interview-summary Özgür Öner

Respondent	Dr. Özgür Öner

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	11.33%	44.62%	44.05%
Estonia	11.33%	44.62%	44.05%
Germany	27.22%	43.87%	28.91%
Hungary	11.33%	44.62%	44.05%
Latvia	11.33%	44.62%	44.05%
Lithuania	11.33%	44.62%	44.05%
Poland	11.33%	44.62%	44.05%
Romania	11.33%	44.62%	44.05%
Slovakia	11.33%	44.62%	44.05%
Spain	19.27%	41.92%	38.81%

Special core fields	Germany, Poland, Romania

Source: Own analyses

Appendix 48 AHP-survey Alice Pittini – Cluster 1: Bulgaria, Romania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/3**	**1/2**	0.1692
Space characteristics	3	1	**1**	0.4434
Environment social characteristics	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1/3**	**1/3**	0.1311
Household indicators	1	1	**1**	**2**	**1**	0.2283
Clusters of households	1	1	1	**1**	**1**	0.1878
Household composition	3	1/2	1	1	**1**	0.2156
Housing indicators	3	1	1	1	1	0.2371
CR	7.36%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**3**	0.4286
Age distribution of housing stock	1	1	**3**	0.4286
Average number of rooms per dwelling	1/3	1/3	1	0.1429
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**1**	**1**	**1/3**	**2**	**1/5**	0.0846
Income level	3	1	**3**	**3**	**1**	**1**	**1**	0.2023
Land area	1	1/3	1	**1**	**1/3**	**1**	**1/3**	0.0761
Supply/ demand	1	1/3	1	1	**1/3**	**1**	**1/3**	0.0761
Tenure status	3	1	3	3	1	**3**	**1**	0.2282
Levels of rent	1/2	1	1	1	1/3	1	**1/2**	0.0942
Economic conditions	5	1	3	3	1	2	1	0.2385
CR	3.53%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1429
Portfolio B: Modernized version	5	1	**5**	0.7143
Portfolio C: New construction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1140
Portfolio B: Modernized version	5	1	**1**	0.4806
Portfolio C: New construction version	3	1	1	0.4054
CR	2.80%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/5**	0.0836
Portfolio B: Modernized version	6	1	**1**	0.4721
Portfolio C: New construction version	5	1	1	0.4443
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/5**	0.0836
Portfolio B: Modernized version	6	1	**1**	0.4721
Portfolio C: New construction version	5	1	1	0.4443
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/5**	0.0836
Portfolio B: Modernized version	6	1	**1**	0.4721
Portfolio C: New construction version	5	1	1	0.4443
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**2**	0.2970
Portfolio B: Modernized version	2	1	**3**	0.5396
Portfolio C: New construction version	1/2	1/3	1	0.1634
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/4**	0.1005
Portfolio B: Modernized version	5	1	**1**	0.4665
Portfolio C: New construction version	4	1	1	0.4330
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.2000	0.1692	0.1692	0.1140	0.1311	Ageing indicators	0.1597
Portfolio B: Modernized version	0.7143	0.4000	0.4434	0.4434	0.4806	0.2283	Household indicators	0.4779
Portfolio C: New construction version	0.1429	0.4000	0.3874	0.3874	0.4054	0.1878	Clusters of households	0.3625
						0.2156	Household composition	
						0.2371	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0836	0.0836	0.0836	0.4286	Build Quality	0.0836
Portfolio B: Modernized version	0.4721	0.4721	0.4721	0.4286	Age distribution of housing stock	0.4721
Portfolio C: New construction version	0.4443	0.4443	0.4443	0.1429	Average number of rooms per dwelling	0.4443

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac- teristics	Alternative ranking
Portfolio A: Extrapolated version	0.2000	0.2970	0.2000	0.2000	0.1692	0.3333	0.1005	0.0846	Population density	0.2014
Portfolio B: Modernized version	0.4000	0.5396	0.4000	0.4000	0.4434	0.3333	0.4665	0.2023	Income level	0.4477
Portfolio C: New con- struction version	0.4000	0.1634	0.4000	0.4000	0.3874	0.3333	0.4330	0.0761	Land area	0.3509
								0.0761	Supply/ de- mand	
								0.2282	Tenure status	
								0.0942	Levels of rent	
								0.2385	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1597	0.0836	0.2014	0.1692	Demographic characteristics	**0.1421**
Portfolio B: Modernized version	0.4779	0.4721	0.4477	0.4434	Space characteristics	**0.4636**
Portfolio C: New construction version	0.3625	0.4443	0.3509	0.3874	Environment social characteristics	**0.3942**

Source: Own analyses

Appendix 49 AHP-survey Alice Pittini – Cluster 2: Estonia, Latvia, Lithuania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1/3**	**1**	0.2000
Space characteristics	3	1	**3**	0.6000
Environment social characteristics	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/3**	**1/2**	**1/2**	**1/2**	0.1018
Household indicators	3	1	**1**	**1**	**1**	0.2398
Clusters of households	2	1	1	**1**	**1**	0.2195
Household composition	2	1	1	1	**1**	0.2195
Housing indicators	2	1	1	1	1	0.2195
CR	0.45%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**1**	0.3333
Age distribution of housing stock	1	1	**1**	0.3333
Average number of rooms per dwelling	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1**	**1**	**1/2**	**1/2**	**1/2**	**1/3**	0.0925
Income level	1	1	**1**	**1**	**1**	**1**	**1**	0.1404
Land area	1	1	1	**1**	**1**	**1**	**1**	0.1404
Supply/ demand	2	1	1	1	**1**	**1**	**1**	0.1534
Tenure status	2	1	1	1	1	**1**	**1**	0.1534
Levels of rent	2	1	1	1	1	1	**1**	0.1534
Economic conditions	3	1	1	1	1	1	1	0.1664
CR	1.51%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1429
Portfolio B: Modernized version	5	1	**5**	0.7143
Portfolio C: New construction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/2**	0.1283
Portfolio B: Modernized version	5	1	**2**	0.5954
Portfolio C: New construction version	2	1/2	1	0.2764
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/2**	0.1283
Portfolio B: Modernized version	5	1	**2**	0.5954
Portfolio C: New construction version	2	1/2	1	0.2764
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/2**	0.1283
Portfolio B: Modernized version	5	1	**2**	0.5954
Portfolio C: New construction version	2	1/2	1	0.2764
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.1000
Portfolio B: Modernized version	6	1	**2**	0.6000
Portfolio C: New construction version	3	1/2	1	0.3000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/4**	0.0924
Portfolio B: Modernized version	6	1	**1**	0.4844
Portfolio C: New construction version	4	1	1	0.4232
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/4**	0.0924
Portfolio B: Modernized version	6	1	**1**	0.4844
Portfolio C: New construction version	4	1	1	0.4232
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/4**	0.1005
Portfolio B: Modernized version	5	1	**1**	0.4665
Portfolio C: New construction version	4	1	1	0.4330
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1**	0.2500
Portfolio B: Modernized version	2	1	**2**	0.5000
Portfolio C: New construction version	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.1283	0.1283	0.1283	0.1000	0.1018	Ageing indicators	0.1236
Portfolio B: Modernized version	0.7143	0.5954	0.5954	0.5954	0.6000	0.2398	Household indicators	0.6085
Portfolio C: New construction version	0.1429	0.2764	0.2764	0.2764	0.3000	0.2195	Clusters of households	0.2680
						0.2195	Household composition	
						0.2195	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0924	0.0924	0.2000	0.3333	Build Quality	0.1283
Portfolio B: Modernized version	0.4844	0.4844	0.4000	0.3333	Age distribution of housing stock	0.4563
Portfolio C: New construction version	0.4232	0.4232	0.4000	0.3333	Average number of rooms per dwelling	0.4154

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1005	0.2500	0.2000	0.1429	0.1429	0.2500	0.1260	0.0925	Population density	0.1756
Portfolio B: Modernized version	0.4665	0.5000	0.4000	0.5714	0.5714	0.2500	0.4579	0.1404	Income level	0.4594
Portfolio C: New construction version	0.4330	0.2500	0.4000	0.2857	0.2857	0.5000	0.4161	0.1404	Land area	0.3649
								0.1534	Supply/ demand	
								0.1534	Tenure status	
								0.1534	Levels of rent	
								0.1664	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1236	0.1283	0.1756	0.2000	Demographic characteristics	**0.1368**
Portfolio B: Modernized version	0.6085	0.4563	0.4594	0.6000	Space characteristics	**0.4873**
Portfolio C: New construction version	0.2680	0.4154	0.3649	0.2000	Environment social characteristics	**0.3758**

Source: Own analyses

Appendix 50 AHP-survey Alice Pittini – Cluster 3: Hungary

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**2**	**1**	0.4000
Space characteristics	1/2	1	**1/2**	0.2000
Environment social characteristics	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1**	**1/2**	0.1747
Household indicators	1	1	**1**	**1**	**1**	0.1977
Clusters of households	1	1	1	**1**	**1**	0.1977
Household composition	1	1	1	1	**1**	0.1977
Housing indicators	2	1	1	1	1	0.2322
CR	1.32%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**1/2**	0.2500
Age distribution of housing stock	1	1	**1/2**	0.2500
Average number of rooms per dwelling	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1**	**1/2**	**1/3**	**1/2**	**1/2**	**1**	0.0925
Income level	1	1	**1**	**1**	**1**	**1**	**1**	0.1404
Land area	2	1	1	**1**	**1**	**1**	**1**	0.1534
Supply/ demand	3	1	1	1	**1**	**1**	**1**	0.1664
Tenure status	2	1	1	1	1	**1**	**1**	0.1534
Levels of rent	2	1	1	1	1	1	**1**	0.1534
Economic conditions	1	1	1	1	1	1	1	0.1404
CR	1.51%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1**	0.1667
Portfolio B: Modernized version	4	1	**4**	0.6667
Portfolio C: New construction version	1	1/4	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1667	0.1429	0.1429	0.1429	0.1429	0.1747	Ageing indicators	0.1470
Portfolio B: Modernized version	0.6667	0.5714	0.5714	0.5714	0.5714	0.1977	Household indicators	0.5881
Portfolio C: New construction version	0.1667	0.2857	0.2857	0.2857	0.2857	0.1977	Clusters of households	0.2649
						0.1977	Household composition	
						0.2322	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1260	0.2500	0.1692	0.2500	Build Quality	0.1786
Portfolio B: Modernized version	0.4579	0.2500	0.3874	0.2500	Age distribution of housing stock	0.3707
Portfolio C: New construction version	0.4161	0.5000	0.4434	0.5000	Average number of rooms per dwelling	0.4507

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1692	0.1429	0.1692	0.1429	0.3333	0.3333	0.1429	0.0925	Population density	0.2078
Portfolio B: Modernized version	0.4434	0.5714	0.3874	0.5714	0.3333	0.3333	0.5714	0.1404	Income level	0.4583
Portfolio C: New con-struction version	0.3874	0.2857	0.4434	0.2857	0.3333	0.3333	0.2857	0.1534	Land area	0.3339
								0.1664	Supply/ de-mand	
								0.1534	Tenure status	
								0.1534	Levels of rent	
								0.1404	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1470	0.1786	0.2078	0.4000	Demographic characteristics	**0.1776**
Portfolio B: Modernized version	0.5881	0.3707	0.4583	0.2000	Space characteristics	**0.4927**
Portfolio C: New construction version	0.2649	0.4507	0.3339	0.4000	Environment social characteristics	**0.3297**

Source: Own analyses

Appendix 51 AHP-survey Alice Pittini – Cluster 4: Poland

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1**	**1**	0.3333
Space characteristics	1	1	**1**	0.3333
Environment social characteristics	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/3**	**1/2**	**1/3**	**1/2**	0.0931
Household indicators	3	1	**1**	**1**	**1**	0.2360
Clusters of households	2	1	1	**1**	**1**	0.2175
Household composition	3	1	1	1	**1**	0.2360
Housing indicators	2	1	1	1	1	0.2175
CR	0.60%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**2**	**3**	0.5396
Age distribution of housing stock	1/2	1	**2**	0.2970
Average number of rooms per dwelling	1/3	1/2	1	0.1634
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**2**	**3**	**3**	**1**	**1**	**1/2**	0.1756
Income level	1/2	1	**1**	**1**	**1/2**	**1/2**	**2**	0.1161
Land area	1/3	1	1	**1**	**1/3**	**1/3**	**1/3**	0.0673
Supply/ demand	1/3	1	1	1	**1/3**	**1/3**	**1/3**	0.0673
Tenure status	1	2	3	3	1	**1**	**2**	0.2076
Levels of rent	1	2	3	3	1	1	**2**	0.2076
Economic conditions	2	1/2	3	3	1/2	1/2	1	0.1586
CR	5.36%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1**	0.2500
Portfolio B: Modernized version	2	1	**2**	0.5000
Portfolio C: New construction version	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1111	0.1005	0.1005	0.1005	0.1005	0.0931	Ageing indicators	0.1015
Portfolio B: Modernized version	0.4444	0.4330	0.4330	0.4330	0.4330	0.2360	Household indicators	0.4341
Portfolio C: New construction version	0.4444	0.4665	0.4665	0.4665	0.4665	0.2175	Clusters of households	0.4644
						0.2360	Household composition	
						0.2175	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.1005	0.1140	0.5396	Build Quality	0.0975
Portfolio B: Modernized version	0.4545	0.4330	0.4054	0.2970	Age distribution of housing stock	0.4401
Portfolio C: New construction version	0.4545	0.4665	0.4806	0.1634	Average number of rooms per dwelling	0.4624

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1005	0.1429	0.1260	0.0909	0.2000	0.2500	0.0909	0.1756	Population density	0.1567
Portfolio B: Modernized version	0.4330	0.5714	0.4161	0.4545	0.4000	0.5000	0.4545	0.1161	Income level	0.4599
Portfolio C: New con-struction version	0.4665	0.2857	0.4579	0.4545	0.4000	0.2500	0.4545	0.0673	Land area	0.3835
								0.0673	Supply/ de-mand	
								0.2076	Tenure status	
								0.2076	Levels of rent	
								0.1586	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1015	0.0975	0.1567	0.3333	Demographic characteristics	**0.1186**
Portfolio B: Modernized version	0.4341	0.4401	0.4599	0.3333	Space characteristics	**0.4447**
Portfolio C: New construction version	0.4644	0.4624	0.3835	0.3333	Environment social characteristics	**0.4368**

Source: Own analyses

Appendix 52 AHP-survey Alice Pittini – Cluster 5: Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic character-istics	1	**1**	**2**	0.4000
Space characteristics	1	1	**2**	0.4000
Environment social characteristics	1/2	1/2	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/2**	**1/2**	**1/3**	**1/4**	0.0874
Household indicators	2	1	**1**	**1**	**2**	0.2536
Clusters of households	2	1	1	**1**	**1**	0.2109
Household composition	3	1	1	1	**1**	0.2279
Housing indicators	4	1/2	1	1	1	0.2202
CR	3.51%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/2**	**1**	0.2500
Age distribution of housing stock	2	1	**2**	0.5000
Average number of rooms per dwelling	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/2**	**1**	**1/4**	**1/4**	**1/6**	**1/5**	0.0569
Income level	2	1	**2**	**1**	**1**	**1**	**1**	0.1592
Land area	1	1/2	1	**4**	**1**	**1**	**1**	0.1717
Supply/ demand	4	1	1/4	1	**1**	**1**	**1**	0.1350
Tenure status	4	1	1	1	1	**1**	**1**	0.1517
Levels of rent	6	1	1	1	1	1	**1**	0.1664
Economic conditions	5	1	1	1	1	1	1	0.1591
CR	8.79%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/3**	0.1260
Portfolio B: Modernized version	4	1	**1**	0.4579
Portfolio C: New construction version	3	1	1	0.4161
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modern-ized version	5	1	**1**	0.4545
Portfolio C: New con-struction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modern-ized version	4	1	**1**	0.4330
Portfolio C: New con-struction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1260	0.1005	0.1005	0.1005	0.1005	0.0874	Ageing indicators	0.1027
Portfolio B: Modernized version	0.4579	0.4330	0.4330	0.4330	0.4330	0.2536	Household indicators	0.4352
Portfolio C: New construction version	0.4161	0.4665	0.4665	0.4665	0.4665	0.2109	Clusters of households	0.4621
						0.2279	Household composition	
						0.2202	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.1005	0.1140	0.2500	Build Quality	0.1015
Portfolio B: Modernized version	0.4545	0.4330	0.4054	0.5000	Age distribution of housing stock	0.4315
Portfolio C: New construction version	0.4545	0.4665	0.4806	0.2500	Average number of rooms per dwelling	0.4670

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1005	0.1429	0.1260	0.0909	0.1429	0.1692	0.0909	0.0569	Population density	0.1267
Portfolio B: Modernized version	0.4330	0.5714	0.4161	0.4545	0.2857	0.4434	0.4545	0.1592	Income level	0.4379
Portfolio C: New con-struction version	0.4665	0.2857	0.4579	0.4545	0.5714	0.3874	0.4545	0.1717	Land area	0.4355
								0.1350	Supply/ de-mand	
								0.1517	Tenure status	
								0.1664	Levels of rent	
								0.1591	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1027	0.1015	0.1267	0.4000	Demographic characteristics	**0.1070**
Portfolio B: Modernized version	0.4352	0.4315	0.4379	0.4000	Space characteristics	**0.4343**
Portfolio C: New construction version	0.4621	0.4670	0.4355	0.2000	Environment social characteristics	**0.4587**

Source: Own analyses

Appendix 53 AHP-survey Alice Pittini – Cluster 6: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**3**	**1/4**	0.2109
Space characteristics	1/3	1	**1/7**	0.0841
Environment social characteristics	4	7	1	0.7049
CR	3.13%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**2**	**2**	**1**	**1**	0.2500
Household indicators	1/2	1	**1**	**1/2**	**1/2**	0.1250
Clusters of households	1/2	1	1	**1/2**	**1/2**	0.1250
Household composition	1	2	2	1	**1**	0.2500
Housing indicators	1	2	2	1	1	0.2500
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/3**	**1**	0.2000
Age distribution of housing stock	3	1	**3**	0.6000
Average number of rooms per dwelling	1	1/3	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1**	**1**	**1/3**	**1/2**	**1**	**1/2**	0.1023
Income level	1	1	**1**	**3**	**3**	**1**	**2**	0.2064
Land area	1	1	1	**3**	**3**	**1**	**1**	0.1911
Supply/ demand	3	1/3	1/3	1	**1**	**1**	**1**	0.1205
Tenure status	2	1/3	1/3	1	1	**2**	**1**	0.1247
Levels of rent	1	1	1	1	1/2	1	**2**	0.1355
Economic conditions	2	1/2	1	1	1	1/2	1	0.1194
CR	9.93%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**4**	0.3331
Portfolio B: Modernized version	2	1	**5**	0.5695
Portfolio C: New construction version	1/4	1/5	1	0.0974
CR	2.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1562
Portfolio B: Modernized version	5	1	**3**	0.6586
Portfolio C: New construction version	1	1/3	1	0.1852
CR	2.81%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**2**	0.4000
Portfolio B: Modernized version	1	1	**2**	0.4000
Portfolio C: New construction version	1/2	1/2	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**2**	0.1998
Portfolio B: Modernized version	4	1	**5**	0.6833
Portfolio C: New construction version	1/2	1/5	1	0.1168
CR	2.38%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1**	0.4000
Portfolio B: Modernized version	1/2	1	**1/2**	0.2000
Portfolio C: New construction version	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**4**	0.6667
Portfolio B: Modernized version	1/4	1	**1**	0.1667
Portfolio C: New construction version	1/4	1	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**2**	0.4000
Portfolio B: Modernized version	1	1	**2**	0.4000
Portfolio C: New construction version	1/2	1/2	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**3**	0.2499
Portfolio B: Modernized version	3	1	**6**	0.6548
Portfolio C: New construction version	1/3	1/6	1	0.0953
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**2**	0.2970
Portfolio B: Modernized version	2	1	**3**	0.5396
Portfolio C: New construction version	1/2	1/3	1	0.1634
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**2**	0.4000
Portfolio B: Modernized version	1	1	**2**	0.4000
Portfolio C: New construction version	1/2	1/2	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3**	0.6000
Portfolio B: Modernized version	1/3	1	**1**	0.2000
Portfolio C: New construction version	1/3	1	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1429
Portfolio B: Modernized version	4	1	**2**	0.5714
Portfolio C: New construction version	2	1/2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3331	0.1429	0.1429	0.1429	0.1562	0.2500	Ageing indicators	0.1937
Portfolio B: Modernized version	0.5695	0.5714	0.5714	0.5714	0.6586	0.1250	Household indicators	0.5928
Portfolio C: New construction version	0.0974	0.2857	0.2857	0.2857	0.1852	0.1250	Clusters of households	0.2135
						0.2500	Household composition	
						0.2500	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.4000	0.1998	0.4000	0.2000	Build Quality	0.2799
Portfolio B: Modernized version	0.4000	0.6833	0.2000	0.6000	Age distribution of housing stock	0.5300
Portfolio C: New construction version	0.2000	0.1168	0.4000	0.2000	Average number of rooms per dwelling	0.1901

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.6667	0.4000	0.2499	0.2970	0.4000	0.6000	0.1429	0.1023	Population density	0.3826
Portfolio B: Modernized version	0.1667	0.4000	0.6548	0.5396	0.4000	0.2000	0.5714	0.2064	Income level	0.4350
Portfolio C: New construction version	0.1667	0.2000	0.0953	0.1634	0.2000	0.2000	0.2857	0.1911	Land area	0.1824
								0.1205	Supply/ demand	
								0.1247	Tenure status	
								0.1355	Levels of rent	
								0.1194	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1937	0.2799	0.3826	0.2109	Demographic characteristics	**0.3341**
Portfolio B: Modernized version	0.5928	0.5300	0.4350	0.0841	Space characteristics	**0.4763**
Portfolio C: New construction version	0.2135	0.1901	0.1824	0.7049	Environment social characteristics	**0.1896**

Source: Own analyses

Appendix 54 Interview-summary Alice Pittini

Respondent	Alice Pittini

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	14.21%	46.36%	39.42%
Estonia	13.68%	48.73%	37.58%
Germany	n.a.	n.a.	n.a.
Hungary	17.76%	49.27%	32.97%
Latvia	13.68%	48.73%	37.58%
Lithuania	13.68%	48.73%	37.58%
Poland	11.86%	44.47%	43.68%
Romania	14.21%	46.36%	39.42%
Slovakia	10.70%	43.43%	45.87%
Spain	33.41%	47.63%	18.96%

Special core fields	Estonia, Latvia, Lithuania, Slovakia, Spain

Source: Own analyses

Appendix 55 AHP-survey Michael Pistorius – Cluster 1: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**5**	**1**	0.4545
Space characteristics	1/5	1	**1/5**	0.0909
Environment social characteristics	1	5	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/5**	**1/5**	**5**	**1**	0.1234
Household indicators	5	1	**1**	**6**	**1**	0.3140
Clusters of households	5	1	1	**5**	**1**	0.3064
Household composition	1/5	1/6	1/5	1	**1/5**	0.0411
Housing indicators	1	1	1	5	1	0.2151
CR	9.76%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/5**	**1/5**	0.0909
Age distribution of housing stock	5	1	**1**	0.4545
Average number of rooms per dwelling	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**5**	**1**	**1**	**1/5**	**1/5**	0.0671
Income level	5	1	**5**	**5**	**5**	**1**	**1**	0.2563
Land area	1/5	1/5	1	**1/5**	**1/5**	**1/5**	**1/5**	0.0298
Supply/ demand	1	1/5	5	1	**1**	**1/5**	**1/5**	0.0671
Tenure status	1	1/5	5	1	1	**1/5**	**1/5**	0.0671
Levels of rent	5	1	5	5	5	1	**1**	0.2563
Economic conditions	5	1	5	5	5	1	1	0.2563
CR	6.61%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapo-lated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapolat-ed version	1	**1**	**1/5**	0.1429
Portfolio B: Modern-ized version	1	1	**1/5**	0.1429
Portfolio C: New con-struction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the crite-rion demographic characteristics)**

Alternatives

	Portfolio A: Extrapo-lated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapolat-ed version	1	**5**	**5**	0.7143
Portfolio B: Modern-ized version	1/5	1	**1**	0.1428
Portfolio C: New con-struction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/4**	0.2172
Portfolio B: Modernized version	1/4	1	**1/9**	0.0658
Portfolio C: New construction version	4	9	1	0.7171
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**5**	0.7143
Portfolio B: Modernized version	1/5	1	**1**	0.1429
Portfolio C: New construction version	1/5	1	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**5**	0.4545
Portfolio B: Modernized version	1	1	**5**	0.4545
Portfolio C: New construction version	1/5	1/5	1	0.0909
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.7143	0.2172	0.1429	0.7143	0.1234	Ageing indicators	0.4680
Portfolio B: Modernized version	0.1429	0.1428	0.0658	0.1429	0.1429	0.3140	Household indicators	0.1192
Portfolio C: New construction version	0.7143	0.1429	0.7171	0.7143	0.1429	0.3064	Clusters of households	0.4128
						0.0411	Household composition	
						0.2151	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.0909	0.1429	0.0909	Build Quality	0.1145
Portfolio B: Modernized version	0.4545	0.4545	0.1429	0.4545	Age distribution of housing stock	0.3129
Portfolio C: New construction version	0.4545	0.4545	0.7143	0.4545	Average number of rooms per dwelling	0.5726

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3333	0.1429	0.3333	0.3333	0.3333	0.7143	0.4545	0.0671	Population density	0.4132
Portfolio B: Modernized version	0.3333	0.1429	0.3333	0.3333	0.3333	0.1429	0.4545	0.2563	Income level	0.2668
Portfolio C: New con-struction version	0.3333	0.7143	0.3333	0.3333	0.3333	0.1429	0.0909	0.0298	Land area	0.3200
								0.0671	Supply/ de-mand	
								0.0671	Tenure status	
								0.2563	Levels of rent	
								0.2563	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.4680	0.1145	0.4132	0.4545	Demographic characteristics	**0.4109**
Portfolio B: Modernized version	0.1192	0.3129	0.2668	0.0909	Space characteristics	**0.2039**
Portfolio C: New construction version	0.4128	0.5726	0.3200	0.4545	Environment social characteristics	**0.3852**

Source: Own analyses

Appendix 56 AHP-survey Michael Pistorius – Cluster 2: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1**	**1**	0.3333
Space characteristics	1	1	**1**	0.3333
Environment social characteristics	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**4**	**5**	0.3107
Household indicators	1	1	**1**	**4**	**5**	0.3107
Clusters of households	1	1	1	**1**	**1**	0.1859
Household composition	1/4	1/4	1	1	**1**	0.0992
Housing indicators	1/5	1/5	1	1	1	0.0935
CR	8.70%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/5**	**1/5**	0.0909
Age distribution of housing stock	5	1	**1**	0.4545
Average number of rooms per dwelling	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**5**	**1/5**	**1**	**1/5**	**1/5**	0.0630
Income level	5	1	**5**	**1**	**5**	**1**	**1**	0.2176
Land area	1/5	1/5	1	**1/5**	**1**	**1/5**	**1/5**	0.0369
Supply/ demand	5	1	5	1	**1**	**1**	**1**	0.1844
Tenure status	1	1/5	1	1	1	**1/5**	**1/5**	0.0630
Levels of rent	5	1	5	1	5	1	**1**	0.2176
Economic conditions	5	1	5	1	5	1	1	0.2176
CR	7.41%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**4**	0.2172
Portfolio B: Modernized version	4	1	**9**	0.7171
Portfolio C: New construction version	1/4	1/9	1	0.0658
CR	3.58%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**5**	0.4545
Portfolio B: Modernized version	1	1	**5**	0.4545
Portfolio C: New construction version	1/5	1/5	1	0.0909
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**5**	0.4545
Portfolio B: Modernized version	1	1	**5**	0.4545
Portfolio C: New construction version	1/5	1/5	1	0.0909
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**5**	0.4545
Portfolio B: Modernized version	1	1	**5**	0.4545
Portfolio C: New construction version	1/5	1/5	1	0.0909
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**5**	0.4545
Portfolio B: Modernized version	1	1	**5**	0.4545
Portfolio C: New construction version	1/5	1/5	1	0.0909
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2172	0.4545	0.4545	0.4545	0.4545	0.3107	Ageing indicators	0.3808
Portfolio B: Modernized version	0.7171	0.4545	0.4545	0.4545	0.4545	0.3107	Household indicators	0.5361
Portfolio C: New construction version	0.0658	0.0909	0.0909	0.0909	0.0909	0.1859	Clusters of households	0.0831
						0.0992	Household composition	
						0.0935	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0778	0.0778	0.1429	0.0909	Build Quality	0.1074
Portfolio B: Modernized version	0.4353	0.4353	0.1429	0.4545	Age distribution of housing stock	0.3024
Portfolio C: New construction version	0.4869	0.4869	0.7143	0.4545	Average number of rooms per dwelling	0.5903

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.1429	0.3333	0.0909	0.3333	0.3333	0.3333	0.0630	Population density	0.2319
Portfolio B: Modernized version	0.4545	0.1429	0.3333	0.4545	0.3333	0.3333	0.3333	0.2176	Income level	0.3219
Portfolio C: New construction version	0.4545	0.7143	0.3333	0.4545	0.3333	0.3333	0.3333	0.0369	Land area	0.4462
								0.1844	Supply/ demand	
								0.0630	Tenure status	
								0.2176	Levels of rent	
								0.2176	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3808	0.1074	0.2319	0.3333	Demographic characteristics	**0.2400**
Portfolio B: Modernized version	0.5361	0.3024	0.3219	0.3333	Space characteristics	**0.3868**
Portfolio C: New construction version	0.0831	0.5903	0.4462	0.3333	Environment social characteristics	**0.3732**

Source: Own analyses

Appendix 57 Interview-summary Michael Pistorius

Respondent	Michael Pistorius

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	41.09%	20.39%	38.52%
Estonia	41.09%	20.39%	38.52%
Germany	24.00%	38.68%	37.32%
Hungary	41.09%	20.39%	38.52%
Latvia	41.09%	20.39%	38.52%
Lithuania	41.09%	20.39%	38.52%
Poland	41.09%	20.39%	38.52%
Romania	41.09%	20.39%	38.52%
Slovakia	41.09%	20.39%	38.52%
Spain	41.09%	20.39%	38.52%

Special core fields	Germany

Source: Own analyses

Appendix 58 AHP-survey Klaus Schrader – Cluster 1: Bulgaria, Romania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**7**	**3**	0.6586
Space characteristics	1/7	1	**1/4**	0.0786
Environment social characteristics	1/3	4	1	0.2628
CR	3.13%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**1/3**	**1/3**	**7**	0.1864
Household indicators	1/3	1	**1/3**	**1/3**	**1**	0.0790
Clusters of households	3	3	1	**1**	**7**	0.3435
Household composition	3	3	1	1	**7**	0.3435
Housing indicators	1/7	1	1/7	1/7	1	0.0475
CR	6.67%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**7**	**5**	0.7396
Age distribution of housing stock	1/7	1	**1/2**	0.0938
Average number of rooms per dwelling	1/5	2	1	0.1666
CR	1.37%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/7**	**4**	**1/4**	**3**	**1/5**	**1/9**	0.0645
Income level	7	1	**9**	**2**	**3**	**1**	**2**	0.2677
Land area	1/4	1/9	1	**1/4**	**1/3**	**1/9**	**1/9**	0.0227
Supply/ demand	4	1/2	4	1	**1**	**1**	**1**	0.1460
Tenure status	1/3	1/3	3	1	1	**1/4**	**1/3**	0.0671
Levels of rent	5	1	9	1	4	1	**1**	0.2124
Economic conditions	9	1/2	9	1	3	1	1	0.2197
CR	9.37%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/3**	0.2000
Portfolio B: Modernized version	1	1	**1/3**	0.2000
Portfolio C: New construction version	3	3	1	0.6000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/7**	0.0925
Portfolio B: Modernized version	3	1	**1/2**	0.2922
Portfolio C: New construction version	7	2	1	0.6153
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/7**	0.0860
Portfolio B: Modernized version	4	1	**1**	0.4145
Portfolio C: New construction version	7	1	1	0.4995
CR	3.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/4**	0.1667
Portfolio B: Modernized version	1	1	**1/4**	0.1667
Portfolio C: New construction version	4	4	1	0.6667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/9**	0.0660
Portfolio B: Modernized version	5	1	**1/2**	0.3187
Portfolio C: New construction version	9	2	1	0.6153
CR	0.12%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/7**	0.0925
Portfolio B: Modernized version	3	1	**1/2**	0.2922
Portfolio C: New construction version	7	2	1	0.6153
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/8**	0.0731
Portfolio B: Modernized version	5	1	**1**	0.4272
Portfolio C: New construction version	8	1	1	0.4997
CR	2.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/7**	0.0860
Portfolio B: Modernized version	4	1	**1**	0.4145
Portfolio C: New construction version	7	1	1	0.4995
CR	3.37%	< 5%		1.0000

Source: Own analyses

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0778	0.2000	0.1429	0.0925	0.1140	0.1864	Ageing indicators	0.1166
Portfolio B: Modernized version	0.4353	0.2000	0.1429	0.2922	0.4054	0.0790	Household indicators	0.2657
Portfolio C: New construction version	0.4869	0.6000	0.7143	0.6153	0.4806	0.3435	Clusters of households	0.6178
						0.3435	Household composition	
						0.0475	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.0909	0.0860	0.1429	0.7396	Build Quality	0.0991
Portfolio B: Modernized version	0.4545	0.4145	0.1429	0.0938	Age distribution of housing stock	0.3989
Portfolio C: New construction version	0.4545	0.4995	0.7143	0.1666	Average number of rooms per dwelling	0.5020

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1260	0.0778	0.1667	0.0660	0.0925	0.0731	0.0860	0.0645	Population density	0.0830
Portfolio B: Modernized version	0.4161	0.4353	0.1667	0.3187	0.2922	0.4272	0.4145	0.2677	Income level	0.3950
Portfolio C: New con-struction version	0.4579	0.4869	0.6667	0.6153	0.6153	0.4997	0.4995	0.0227	Land area	0.5220
								0.1460	Supply/ de-mand	
								0.0671	Tenure status	
								0.2124	Levels of rent	
								0.2197	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1166	0.0991	0.0830	0.6586	Demographic characteristics	**0.1064**
Portfolio B: Modernized version	0.2657	0.3989	0.3950	0.0786	Space characteristics	**0.3101**
Portfolio C: New construction version	0.6178	0.5020	0.5220	0.2628	Environment social characteristics	**0.5835**

Source: Own analyses

Appendix 59 AHP-survey Klaus Schrader – Cluster 2: Estonia, Latvia, Lithuania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**8**	**1/2**	0.3568
Space characteristics	1/8	1	**1/9**	0.0540
Environment social characteristics	2	9	1	0.5891
CR	3.56%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**3**	**3**	**3**	0.4286
Household indicators	1/3	1	**1**	**1**	**1**	0.1429
Clusters of households	1/3	1	1	**1**	**1**	0.1429
Household composition	1/3	1	1	1	**1**	0.1429
Housing indicators	1/3	1	1	1	1	0.1429
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**7**	**9**	0.7928
Age distribution of housing stock	1/7	1	**2**	0.1312
Average number of rooms per dwelling	1/9	1/2	1	0.0760
CR	2.10%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/7**	**1**	**1/6**	**1/4**	**1/7**	**1/7**	0.0298
Income level	7	1	**7**	**1**	**2**	**1**	**1**	0.2105
Land area	1	1/7	1	**1/6**	**1/4**	**1/7**	**1/7**	0.0298
Supply/ demand	6	1	6	1	**2**	**1**	**1**	0.2023
Tenure status	4	1/2	4	1/2	1	**2**	**2**	0.1805
Levels of rent	7	1	7	1	1/2	1	**1**	0.1735
Economic conditions	7	1	7	1	1/2	1	1	0.1735
CR	3.80%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1428
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/9**	0.0691
Portfolio B: Modernized version	5	1	**1**	0.4200
Portfolio C: New construction version	9	1	1	0.5109
CR	3.72%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/9**	0.0592
Portfolio B: Modernized version	7	1	**1**	0.4507
Portfolio C: New construction version	9	1	1	0.4901
CR	0.68%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/3**	0.2000
Portfolio B: Modernized version	1	1	**1/3**	0.2000
Portfolio C: New construction version	3	3	1	0.6000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7143
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/9**	0.0636
Portfolio B: Modernized version	6	1	**1**	0.4366
Portfolio C: New construction version	9	1	1	0.4998
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/7**	0.0823
Portfolio B: Modernized version	4	1	**1/2**	0.3150
Portfolio C: New construction version	7	2	1	0.6026
CR	0.19%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/9**	0.0592
Portfolio B: Modernized version	7	1	**1**	0.4507
Portfolio C: New construction version	9	1	1	0.4901
CR	0.68%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.1429	0.1140	0.0778	0.0691	0.4286	Ageing indicators	0.0966
Portfolio B: Modernized version	0.4545	0.1428	0.4054	0.4353	0.4200	0.1429	Household indicators	0.3953
Portfolio C: New construction version	0.4545	0.7143	0.4806	0.4869	0.5109	0.1429	Clusters of households	0.5081
						0.1429	Household composition	
						0.1429	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0592	0.0778	0.0716	0.7928	Build Quality	0.0626
Portfolio B: Modernized version	0.4507	0.4353	0.4523	0.1312	Age distribution of housing stock	0.4488
Portfolio C: New construction version	0.4901	0.4869	0.4761	0.0760	Average number of rooms per dwelling	0.4886

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.2000	0.0716	0.1429	0.0636	0.0823	0.0778	0.0592	0.0298	Population density	0.0768
Portfolio B: Modernized version	0.2000	0.4523	0.1429	0.4366	0.3150	0.4353	0.4507	0.2105	Income level	0.4043
Portfolio C: New construction version	0.6000	0.4761	0.7143	0.4998	0.6026	0.4869	0.4901	0.0298	Land area	0.5189
								0.2023	Supply/ demand	
								0.1805	Tenure status	
								0.1735	Levels of rent	
								0.1735	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0966	0.0626	0.0768	0.3568	Demographic characteristics	**0.0831**
Portfolio B: Modernized version	0.3953	0.4488	0.4043	0.0540	Space characteristics	**0.4035**
Portfolio C: New construction version	0.5081	0.4886	0.5189	0.5891	Environment social characteristics	**0.5134**

Source: Own analyses

Appendix 60 AHP-survey Klaus Schrader – Cluster 3: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**7**	**1**	0.4667
Space characteristics	1/7	1	**1/7**	0.0667
Environment social characteristics	1	7	1	0.4667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**1**	**3**	**1**	0.2727
Household indicators	1/3	1	**1/3**	**1**	**1/3**	0.0909
Clusters of households	1	3	1	**3**	**1**	0.2727
Household composition	1/3	1	1/3	1	**1/3**	0.0909
Housing indicators	1	3	1	3	1	0.2727
CR	0.00%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/7**	**1/7**	0.0667
Age distribution of housing stock	7	1	**1**	0.4667
Average number of rooms per dwelling	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/9**	**1**	**1/7**	**1/7**	**1/7**	**1/9**	0.0368
Income level	9	1	**1**	**1**	**1**	**1**	**1**	0.1719
Land area	1	1	1	**1**	**1**	**1**	**1**	0.1328
Supply/ demand	7	1	1	1	**1**	**1**	**1**	0.1622
Tenure status	7	1	1	1	1	**1**	**1**	0.1622
Levels of rent	7	1	1	1	1	1	**1**	0.1622
Economic conditions	9	1	1	1	1	1	1	0.1719
CR	7.05%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**3**	0.1782
Portfolio B: Modernized version	5	1	**9**	0.7514
Portfolio C: New construction version	1/3	1/9	1	0.0704
CR	2.82%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3**	0.6000
Portfolio B: Modernized version	1/3	1	**1**	0.2000
Portfolio C: New construction version	1/3	1	1	0.2000
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3**	0.6000
Portfolio B: Modernized version	1/3	1	**1**	0.2000
Portfolio C: New construction version	1/3	1	1	0.2000
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/4**	0.0823
Portfolio B: Modernized version	7	1	**2**	0.6026
Portfolio C: New construction version	4	1/2	1	0.3150
CR	0.19%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3**	0.6000
Portfolio B: Modernized version	1/3	1	**1**	0.2000
Portfolio C: New construction version	1/3	1	1	0.2000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**3**	0.2051
Portfolio B: Modernized version	4	1	**8**	0.7167
Portfolio C: New construction version	1/3	1/8	1	0.0783
CR	1.77%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**3**	0.6586
Portfolio B: Modernized version	1/5	1	**1**	0.1562
Portfolio C: New construction version	1/3	1	1	0.1852
CR	2.81%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**3**	0.6586
Portfolio B: Modernized version	1/5	1	**1**	0.1562
Portfolio C: New construction version	1/3	1	1	0.1852
CR	2.81%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.1782	0.6000	0.6000	0.1692	0.2727	Ageing indicators	0.3195
Portfolio B: Modernized version	0.4286	0.7514	0.2000	0.2000	0.4434	0.0909	Household indicators	0.3789
Portfolio C: New construction version	0.4286	0.0704	0.2000	0.2000	0.3874	0.2727	Clusters of households	0.3017
						0.0909	Household composition	
						0.2727	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1692	0.0667	0.0823	0.0667	Build Quality	0.0808
Portfolio B: Modernized version	0.3874	0.4667	0.6026	0.4667	Age distribution of housing stock	0.5248
Portfolio C: New construction version	0.4434	0.4667	0.3150	0.4667	Average number of rooms per dwelling	0.3944

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3333	0.6000	0.2051	0.1429	0.6586	0.0909	0.6586	0.0368	Population density	0.4006
Portfolio B: Modernized version	0.3333	0.2000	0.7167	0.4286	0.1562	0.4545	0.1562	0.1719	Income level	0.3372
Portfolio C: New con-struction version	0.3333	0.2000	0.0783	0.4286	0.1852	0.4545	0.1852	0.1328	Land area	0.2621
								0.1622	Supply/ de-mand	
								0.1622	Tenure status	
								0.1622	Levels of rent	
								0.1719	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3195	0.0808	0.4006	0.4667	Demographic characteristics	**0.3414**
Portfolio B: Modernized version	0.3789	0.5248	0.3372	0.0667	Space characteristics	**0.3692**
Portfolio C: New construction version	0.3017	0.3944	0.2621	0.4667	Environment social characteristics	**0.2894**

Source: Own analyses

Appendix 61 AHP-survey Klaus Schrader – Cluster 4: Hungary, Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**3**	**1/5**	0.1782
Space characteristics	1/3	1	**1/9**	0.0704
Environment social characteristics	5	9	1	0.7514
CR	2.82%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**7**	**5**	**3**	**3**	0.5233
Household indicators	1/7	1	**1**	**2**	**2**	0.1427
Clusters of households	1/5	1	1	**1**	**2**	0.1277
Household composition	1/3	1/2	1	1	**1**	0.1092
Housing indicators	1/3	1/2	1/2	1	1	0.0971
CR	7.06%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**8**	**8**	0.8000
Age distribution of hous-ing stock	1/8	1	**1**	0.1000
Average number of rooms per dwelling	1/8	1	1	0.1000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/7**	**1**	**1/5**	**1/3**	**1/5**	**1/7**	0.0388
Income level	7	1	**6**	**1**	**2**	**1**	**1**	0.2360
Land area	1	1/6	1	**1/5**	**1**	**1**	**1**	0.0853
Supply/ demand	5	1	5	1	**1**	**1**	**1**	0.1977
Tenure status	3	1/2	1	1	1	**1**	**1**	0.1268
Levels of rent	5	1	1	1	1	1	**1**	0.1526
Economic conditions	7	1	1	1	1	1	1	0.1629
CR	7.23%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/7**	0.0925
Portfolio B: Modernized version	3	1	**1/2**	0.2922
Portfolio C: New construction version	7	2	1	0.6153
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/5**	0.1429
Portfolio B: Modernized version	1	1	**1/5**	0.1429
Portfolio C: New construction version	5	5	1	0.7142
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapo-lated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapolat-ed version	1	**1/3**	**1/7**	0.0879
Portfolio B: Modernized version	3	1	**1/3**	0.2426
Portfolio C: New con-struction version	7	3	1	0.6694
CR	0.68%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapo-lated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapolat-ed version	1	**1/3**	**1/7**	0.0925
Portfolio B: Modernized version	3	1	**1/2**	0.2922
Portfolio C: New con-struction version	7	2	1	0.6153
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/6**	0.1172
Portfolio B: Modernized version	2	1	**1/2**	0.2684
Portfolio C: New construction version	6	2	1	0.6144
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/4**	0.1667
Portfolio B: Modernized version	1	1	**1/4**	0.1667
Portfolio C: New construction version	4	4	1	0.6667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/9**	0.0592
Portfolio B: Modernized version	7	1	**1**	0.4507
Portfolio C: New construction version	9	1	1	0.4901
CR	0.68%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/4**	0.1667
Portfolio B: Modernized version	1	1	**1/4**	0.1667
Portfolio C: New construction version	4	4	1	0.6667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1/7**	0.0667
Portfolio B: Modernized version	7	1	**1**	0.4667
Portfolio C: New construction version	7	1	1	0.4667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/7**	0.1025
Portfolio B: Modernized version	2	1	**1/3**	0.2158
Portfolio C: New construction version	7	3	1	0.6817
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/7**	0.0778
Portfolio B: Modernized version	5	1	**1**	0.4353
Portfolio C: New construction version	7	1	1	0.4869
CR	1.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/6**	0.0924
Portfolio B: Modernized version	4	1	**1**	0.4232
Portfolio C: New construction version	6	1	1	0.4844
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.0925	0.1429	0.1140	0.1140	0.0716	0.5233	Ageing indicators	0.1028
Portfolio B: Modernized version	0.2922	0.1429	0.4054	0.4054	0.4523	0.1427	Household indicators	0.3133
Portfolio C: New construction version	0.6153	0.7142	0.4806	0.4806	0.4761	0.1277	Clusters of households	0.5840
						0.1092	Household composition	
						0.0971	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0879	0.0925	0.1172	0.8000	Build Quality	0.0913
Portfolio B: Modernized version	0.2426	0.2922	0.2684	0.1000	Age distribution of housing stock	0.2502
Portfolio C: New construction version	0.6694	0.6153	0.6144	0.1000	Average number of rooms per dwelling	0.6585

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1667	0.0592	0.1667	0.0667	0.1025	0.0778	0.0924	0.0388	Population density	0.0878
Portfolio B: Modernized version	0.1667	0.4507	0.1667	0.4667	0.2158	0.4353	0.4232	0.2360	Income level	0.3820
Portfolio C: New con-struction version	0.6667	0.4901	0.6667	0.4667	0.6817	0.4869	0.4844	0.0853	Land area	0.5302
								0.1977	Supply/ de-mand	
								0.1268	Tenure status	
								0.1526	Levels of rent	
								0.1629	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1028	0.0913	0.0878	0.1782	Demographic characteristics	**0.0907**
Portfolio B: Modernized version	0.3133	0.2502	0.3820	0.0704	Space characteristics	**0.3605**
Portfolio C: New construction version	0.5840	0.6585	0.5302	0.7514	Environment social characteristics	**0.5488**

Source: Own analyses

Appendix 62 AHP-survey Klaus Schrader – Cluster 5: Poland

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**5**	**1**	0.4545
Space characteristics	1/5	1	**1/5**	0.0909
Environment social characteristics	1	5	1	0.4545
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**3**	**1/2**	**1/2**	**1/3**	0.1393
Household indicators	1/3	1	**1/3**	**1/3**	**1/3**	0.0751
Clusters of households	2	3	1	**1**	**1**	0.2527
Household composition	2	3	1	1	**1**	0.2527
Housing indicators	3	3	1	1	1	0.2800
CR	2.33%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**7**	**5**	0.7396
Age distribution of housing stock	1/7	1	**1/2**	0.0938
Average number of rooms per dwelling	1/5	2	1	0.1666
CR	1.37%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**2**	**1/3**	**1/3**	**1/4**	**1/5**	0.0738
Income level	3	1	**2**	**2**	**2**	**2**	**2**	0.2399
Land area	1/2	1/2	1	**1**	**1**	**2**	**1**	0.1280
Supply/ demand	3	1/2	1	1	**1**	**1**	**1**	0.1344
Tenure status	3	1/2	1	1	1	**1**	**1**	0.1344
Levels of rent	4	1/2	1/2	1	1	1	**1**	0.1357
Economic conditions	5	1/2	1	1	1	1	1	0.1537
CR	8.13%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/3**	0.2499
Portfolio B: Modernized version	1/3	1	**1/6**	0.0953
Portfolio C: New construction version	3	6	1	0.6548
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/3**	0.2000
Portfolio B: Modernized version	1	1	**1/3**	0.2000
Portfolio C: New construction version	3	3	1	0.6000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/4**	0.1744
Portfolio B: Modernized version	1	1	**1/3**	0.1919
Portfolio C: New construction version	4	3	1	0.6337
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/6**	0.0836
Portfolio B: Modernized version	5	1	**1**	0.4443
Portfolio C: New construction version	6	1	1	0.4721
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/8**	0.0731
Portfolio B: Modernized version	5	1	**1**	0.4272
Portfolio C: New construction version	8	1	1	0.4997
CR	2.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/6**	0.1297
Portfolio B: Modernized version	1	1	**1/5**	0.1378
Portfolio C: New construction version	6	5	1	0.7324
CR	0.36%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/6**	0.0836
Portfolio B: Modernized version	5	1	**1**	0.4443
Portfolio C: New construction version	6	1	1	0.4721
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/3**	0.2000
Portfolio B: Modernized version	1	1	**1/3**	0.2000
Portfolio C: New construction version	3	3	1	0.6000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/7**	0.0716
Portfolio B: Modernized version	6	1	**1**	0.4523
Portfolio C: New construction version	7	1	1	0.4761
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/9**	0.0636
Portfolio B: Modernized version	6	1	**1**	0.4366
Portfolio C: New construction version	9	1	1	0.4998
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2499	0.2000	0.1744	0.1429	0.0836	0.1393	Ageing indicators	0.1534
Portfolio B: Modernized version	0.0953	0.2000	0.1919	0.2857	0.4443	0.0751	Household indicators	0.2734
Portfolio C: New construction version	0.6548	0.6000	0.6337	0.5714	0.4721	0.2527	Clusters of households	0.5731
						0.2527	Household composition	
						0.2800	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.0731	0.1111	0.1297	0.7396	Build Quality	0.0861
Portfolio B: Modernized version	0.4272	0.4444	0.1378	0.0938	Age distribution of housing stock	0.3806
Portfolio C: New construction version	0.4997	0.4444	0.7324	0.1666	Average number of rooms per dwelling	0.5333

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac- teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1692	0.0836	0.2000	0.0716	0.0716	0.0636	0.1005	0.0738	Population density	0.1015
Portfolio B: Modernized version	0.3874	0.4443	0.2000	0.4523	0.4523	0.4366	0.4330	0.2399	Income level	0.4082
Portfolio C: New con- struction version	0.4434	0.4721	0.6000	0.4761	0.4761	0.4998	0.4665	0.1280	Land area	0.4903
								0.1344	Supply/ de- mand	
								0.1344	Tenure status	
								0.1357	Levels of rent	
								0.1537	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1534	0.0861	0.1015	0.4545	Demographic characteristics	**0.1237**
Portfolio B: Modernized version	0.2734	0.3806	0.4082	0.0909	Space characteristics	**0.3444**
Portfolio C: New construction version	0.5731	0.5333	0.4903	0.4545	Environment social characteristics	**0.5319**

Source: Own analyses

Appendix 63 AHP-survey Klaus Schrader – Cluster 6: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**3**	**3**	0.6000
Space characteristics	1/3	1	**1**	0.2000
Environment social characteristics	1/3	1	1	0.2000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/3**	**1/4**	**1/5**	**3**	0.0928
Household indicators	3	1	**1**	**1**	**3**	0.2512
Clusters of households	4	1	1	**1**	**5**	0.2909
Household composition	5	1	1	1	**5**	0.3088
Housing indicators	1/3	1/3	1/5	1/5	1	0.0563
CR	3.91%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1/5**	**1/2**	0.1283
Age distribution of housing stock	5	1	**2**	0.5954
Average number of rooms per dwelling	2	1/2	1	0.2764
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/5**	**3**	**1/3**	**1/3**	**1/5**	**1/6**	0.0611
Income level	5	1	**1**	**2**	**1**	**1**	**1**	0.1825
Land area	1/3	1	1	**1/4**	**1/2**	**1/2**	**1/4**	0.0678
Supply/ demand	3	1/2	4	1	**1**	**1**	**1**	0.1603
Tenure status	3	1	2	1	1	**1/2**	**1/2**	0.1286
Levels of rent	5	1	2	1	2	1	**1**	0.1871
Economic conditions	6	1	4	1	2	1	1	0.2127
CR	8.79%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/4**	0.2109
Portfolio B: Modernized version	1/3	1	**1/7**	0.0841
Portfolio C: New construction version	4	7	1	0.7049
CR	3.13%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**1/2**	0.3187
Portfolio B: Modernized version	1/5	1	**1/9**	0.0660
Portfolio C: New construction version	2	9	1	0.6153
CR	0.12%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1**	0.4286
Portfolio B: Modernized version	1/3	1	**1/3**	0.1429
Portfolio C: New construction version	1	3	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/3**	0.2000
Portfolio B: Modernized version	1	1	**1/3**	0.2000
Portfolio C: New construction version	3	3	1	0.6000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/3**	0.2560
Portfolio B: Modernized version	1/4	1	**1/8**	0.0732
Portfolio C: New construction version	3	8	1	0.6708
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/4**	0.1429
Portfolio B: Modernized version	2	1	**1/2**	0.2857
Portfolio C: New construction version	4	2	1	0.5714
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1**	0.4286
Portfolio B: Modernized version	1/3	1	**1/3**	0.1429
Portfolio C: New construction version	1	3	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/2**	0.2500
Portfolio B: Modernized version	1	1	**1/2**	0.2500
Portfolio C: New construction version	2	2	1	0.5000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/7**	0.0823
Portfolio B: Modernized version	4	1	**1/2**	0.3150
Portfolio C: New construction version	7	2	1	0.6026
CR	0.19%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2**	0.5499
Portfolio B: Modernized version	1/3	1	**1**	0.2098
Portfolio C: New construction version	1/2	1	1	0.2402
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/7**	0.0879
Portfolio B: Modernized version	3	1	**1/3**	0.2426
Portfolio C: New construction version	7	3	1	0.6694
CR	0.68%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1/6**	0.1144
Portfolio B: Modernized version	1	1	**1/9**	0.0999
Portfolio C: New construction version	6	9	1	0.7857
CR	1.77%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/5**	0.1283
Portfolio B: Modernized version	2	1	**1/2**	0.2764
Portfolio C: New construction version	5	2	1	0.5954
CR	0.53%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.2109	0.3187	0.4286	0.2000	0.2560	0.0928	Ageing indicators	0.3005
Portfolio B: Modernized version	0.0841	0.0660	0.1429	0.2000	0.0732	0.2512	Household indicators	0.1318
Portfolio C: New construction version	0.7049	0.6153	0.4286	0.6000	0.6708	0.2909	Clusters of households	0.5677
						0.3088	Household composition	
						0.0563	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2500	0.1429	0.4286	0.1283	Build Quality	0.2356
Portfolio B: Modernized version	0.2500	0.2857	0.1429	0.5954	Age distribution of housing stock	0.2417
Portfolio C: New construction version	0.5000	0.5714	0.4286	0.2764	Average number of rooms per dwelling	0.5228

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2500	0.0823	0.5499	0.0879	0.1144	0.1111	0.1283	0.0611	Population density	0.1444
Portfolio B: Modernized version	0.2500	0.3150	0.2098	0.2426	0.0999	0.4444	0.2764	0.1825	Income level	0.2807
Portfolio C: New construction version	0.5000	0.6026	0.2402	0.6694	0.7857	0.4444	0.5954	0.0678	Land area	0.5749
								0.1603	Supply/ demand	
								0.1286	Tenure status	
								0.1871	Levels of rent	
								0.2127	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.3005	0.2356	0.1444	0.6000	Demographic characteristics	**0.2563**
Portfolio B: Modernized version	0.1318	0.2417	0.2807	0.2000	Space characteristics	**0.1836**
Portfolio C: New construction version	0.5677	0.5228	0.5749	0.2000	Environment social characteristics	**0.5602**

Source: Own analyses

Appendix 64 Interview-summary Klaus Schrader

Respondent	Klaus Schrader

Country	Extrapolated version	Modernized version	New construction version
Bulgaria	10.64%	31.01%	58.35%
Estonia	8.31%	40.35%	51.34%
Germany	34.14%	36.92%	28.94%
Hungary	9.07%	36.05%	54.88%
Latvia	8.31%	40.35%	51.34%
Lithuania	8.31%	40.35%	51.34%
Poland	12.37%	34.44%	53.19%
Romania	10.64%	31.01%	58.35%
Slovakia	9.07%	36.05%	54.88%
Spain	25.63%	18.36%	56.02%

Special core fields	Estonia, Latvia, Litu-ania, Germany, Po-land, Spain

Source: Own analyses

Appendix 65 AHP-survey Petra Gaugisch – Cluster 1: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**3**	**1**	0.4286
Space characteristics	1/3	1	**1/3**	0.1429
Environment social characteristics	1	3	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1/3**	**3**	0.2106
Household indicators	1	1	**1**	**1**	**1**	0.1844
Clusters of households	1	1	1	**1**	**1**	0.1844
Household composition	3	1	1	1	**1**	0.2621
Housing indicators	1/3	1	1	1	1	0.1585
CR	9.53%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**4**	**6**	0.7096
Age distribution of housing stock	1/4	1	**1**	0.1550
Average number of rooms per dwelling	1/6	1	1	0.1354
CR	1.77%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1**	**1/5**	**1/4**	**1/2**	**1**	**1**	0.0847
Income level	1	1	**3**	**2**	**2**	**1**	**1**	0.2166
Land area	5	1/3	1	**1**	**2**	**2**	**2**	0.1975
Supply/demand	4	1/2	1	1	**1**	**2**	**1**	0.1610
Tenure status	2	1/2	1/2	1	1	**1**	**2**	0.1268
Levels of rent	1	1	1/2	1/2	1	1	**1**	0.1056
Economic conditions	1	1	1/2	1	1/2	1	1	0.1078
CR	9.42%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1172
Portfolio B: Modernized version	6	1	**2**	0.6144
Portfolio C: New construction version	2	1/2	1	0.2684
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.1000
Portfolio B: Modernized version	6	1	**2**	0.6000
Portfolio C: New construction version	3	1/2	1	0.3000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/2**	0.1283
Portfolio B: Modernized version	5	1	**2**	0.5954
Portfolio C: New construction version	2	1/2	1	0.2764
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1140
Portfolio B: Modernized version	5	1	**1**	0.4806
Portfolio C: New construction version	3	1	1	0.4054
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1429
Portfolio B: Modernized version	5	1	**5**	0.7143
Portfolio C: New construction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.1000
Portfolio B: Modernized version	6	1	**2**	0.6000
Portfolio C: New construction version	3	1/2	1	0.3000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.1000
Portfolio B: Modernized version	6	1	**2**	0.6000
Portfolio C: New construction version	3	1/2	1	0.3000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1**	0.2500
Portfolio B: Modernized version	2	1	**2**	0.5000
Portfolio C: New construction version	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1**	0.1667
Portfolio B: Modernized version	4	1	**4**	0.6667
Portfolio C: New construction version	1	1/4	1	0.1667
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**2**	0.1998
Portfolio B: Modernized version	4	1	**5**	0.6833
Portfolio C: New construction version	1/2	1/5	1	0.1168
CR	2.38%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1692
Portfolio B: Modernized version	3	1	**1**	0.4434
Portfolio C: New construction version	2	1	1	0.3874
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4444
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1172	0.1000	0.1283	0.1140	0.1429	0.2106	Ageing indicators	0.1193
Portfolio B: Modernized version	0.6144	0.6000	0.5954	0.4806	0.7143	0.1844	Household indicators	0.5890
Portfolio C: New construction version	0.2684	0.3000	0.2764	0.4054	0.1429	0.1844	Clusters of households	0.2917
						0.2621	Household composition	
						0.1585	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1000	0.1000	0.2500	0.7096	Build Quality	0.1203
Portfolio B: Modernized version	0.6000	0.6000	0.5000	0.1550	Age distribution of housing stock	0.5865
Portfolio C: New construction version	0.3000	0.3000	0.2500	0.1354	Average number of rooms per dwelling	0.2932

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1667	0.3333	0.1998	0.1692	0.1429	0.2000	0.1111	0.0847	Population density	0.2042
Portfolio B: Modernized version	0.6667	0.3333	0.6833	0.4434	0.4286	0.4000	0.4444	0.2166	Income level	0.4795
Portfolio C: New con-struction version	0.1667	0.3333	0.1168	0.3874	0.4286	0.4000	0.4444	0.1975	Land area	0.3163
								0.1610	Supply/ de-mand	
								0.1268	Tenure status	
								0.1056	Levels of rent	
								0.1078	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1193	0.1203	0.2042	0.4286	Demographic characteristics	**0.1558**
Portfolio B: Modernized version	0.5890	0.5865	0.4795	0.1429	Space characteristics	**0.5417**
Portfolio C: New construction version	0.2917	0.2932	0.3163	0.4286	Environment social characteristics	**0.3024**

Source: Own analyses

Appendix 66 AHP-survey Petra Gaugisch – Cluster 2: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**2**	**1**	0.4000
Space characteristics	1/2	1	**1/2**	0.2000
Environment social characteristics	1	2	1	0.4000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1/3**	**1**	0.1583
Household indicators	1	1	**1**	**1/2**	**1/3**	0.1266
Clusters of households	1	1	1	**1**	**1/2**	0.1594
Household composition	3	2	1	1	**1/2**	0.2431
Housing indicators	1	3	2	2	1	0.3127
CR	6.64%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**4**	**2**	0.5714
Age distribution of housing stock	1/4	1	**1/2**	0.1429
Average number of rooms per dwelling	1/2	2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**1**	**1/2**	**1/5**	**1**	**1/7**	0.0625
Income level	3	1	**3**	**2**	**1**	**1**	**1**	0.1785
Land area	1	1/3	1	**1**	**1/2**	**1/3**	**1/4**	0.0641
Supply/ demand	2	1/2	1	1	**1/2**	**1**	**1/2**	0.1002
Tenure status	5	1	2	2	1	**1/2**	**1/4**	0.1479
Levels of rent	1	1	3	1	2	1	**1**	0.1683
Economic conditions	7	1	4	2	4	1	1	0.2784
CR	7.24%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/2**	0.1172
Portfolio B: Modernized version	6	1	**2**	0.6144
Portfolio C: New construction version	2	1/2	1	0.2684
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1095
Portfolio B: Modernized version	5	1	**2**	0.5815
Portfolio C: New construction version	3	1/2	1	0.3090
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1095
Portfolio B: Modernized version	5	1	**2**	0.5815
Portfolio C: New construction version	3	1/2	1	0.3090
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/3**	0.1095
Portfolio B: Modernized version	5	1	**2**	0.5815
Portfolio C: New construction version	3	1/2	1	0.3090
CR	0.36%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/7**	**1**	0.1194
Portfolio B: Modernized version	7	1	**5**	0.7471
Portfolio C: New construction version	1	1/5	1	0.1335
CR	1.21%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.1000
Portfolio B: Modernized version	6	1	**2**	0.6000
Portfolio C: New construction version	3	1/2	1	0.3000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.0953
Portfolio B: Modernized version	6	1	**3**	0.6548
Portfolio C: New construction version	3	1/3	1	0.2499
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/6**	**1/3**	0.0953
Portfolio B: Modernized version	6	1	**3**	0.6548
Portfolio C: New construction version	3	1/3	1	0.2499
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1**	0.1429
Portfolio B: Modernized version	5	1	**5**	0.7143
Portfolio C: New construction version	1	1/5	1	0.1429
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1634
Portfolio B: Modernized version	3	1	**2**	0.5396
Portfolio C: New construction version	2	1/2	1	0.2970
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1**	0.2500
Portfolio B: Modernized version	2	1	**2**	0.5000
Portfolio C: New construction version	1	1/2	1	0.2500
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/2**	0.1365
Portfolio B: Modernized version	4	1	**3**	0.6250
Portfolio C: New construction version	2	1/3	1	0.2385
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/2**	0.1634
Portfolio B: Modernized version	3	1	**2**	0.5396
Portfolio C: New construction version	2	1/2	1	0.2970
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**1/5**	**1/2**	0.1168
Portfolio B: Modern-ized version	5	1	**4**	0.6833
Portfolio C: New con-struction version	2	1/4	1	0.1998
CR	2.38%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1172	0.1095	0.1095	0.1095	0.1194	0.1583	Ageing indicators	0.1138
Portfolio B: Modernized version	0.6144	0.5815	0.5815	0.5815	0.7471	0.1266	Household indicators	0.6385
Portfolio C: New construction version	0.2684	0.3090	0.3090	0.3090	0.1335	0.1594	Clusters of households	0.2477
						0.2431	Household composition	
						0.3127	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1000	0.0953	0.0953	0.5714	Build Quality	0.0980
Portfolio B: Modernized version	0.6000	0.6548	0.6548	0.1429	Age distribution of housing stock	0.6235
Portfolio C: New construction version	0.3000	0.2499	0.2499	0.2857	Average number of rooms per dwelling	0.2785

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1429	0.1634	0.2500	0.3333	0.1365	0.1634	0.1168	0.0625	Population density	0.1678
Portfolio B: Modernized version	0.7143	0.5396	0.5000	0.3333	0.6250	0.5396	0.6833	0.1785	Income level	0.5800
Portfolio C: New con-struction version	0.1429	0.2970	0.2500	0.3333	0.2385	0.2970	0.1998	0.0641	Land area	0.2523
								0.1002	Supply/ de-mand	
								0.1479	Tenure status	
								0.1683	Levels of rent	
								0.2784	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1138	0.0980	0.1678	0.4000	Demographic characteristics	**0.1322**
Portfolio B: Modernized version	0.6385	0.6235	0.5800	0.2000	Space characteristics	**0.6121**
Portfolio C: New construction version	0.2477	0.2785	0.2523	0.4000	Environment social characteristics	**0.2557**

Source: Own analyses

Appendix 67 Interview-summary Petra Gaugisch

Respondent	Petra Gaugisch

Country	Extrapolated version	Modernized version	New construction version
Germany	15.58%	54.17%	30.24%
Spain	13.22%	61.21%	25.57%

Special core fields	Germany, Spain

Source: Own analyses

Appendix 68 AHP-survey Klaus Kirchhoff: Romania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**3**	**1/5**	0.1830
Space characteristics	1/3	1	**1/8**	0.0752
Environment social characteristics	5	8	1	0.7418
CR	4.28%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**4**	**3**	**1**	**1**	0.2792
Household indicators	1/4	1	**1**	**1/4**	**1/4**	0.0742
Clusters of households	1/3	1	1	**1/3**	**1/3**	0.0881
Household composition	1	4	3	1	**1**	0.2792
Housing indicators	1	4	3	1	1	0.2792
CR	0.22%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**4**	**2**	0.5714
Age distribution of housing stock	1/4	1	**1/2**	0.1429
Average number of rooms per dwelling	1/2	2	1	0.2857
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**5**	**3**	**1/3**	**4**	**1/5**	**1/7**	0.1036
Income level	1/5	1	**1**	**1/5**	**1**	**1/5**	**1/5**	0.0398
Land area	1/3	1	1	**1/3**	**1/4**	**1/5**	**1/7**	0.0373
Supply/ demand	3	5	3	1	**5**	**1**	**1/2**	0.1958
Tenure status	1/4	1	4	1/5	1	**1/5**	**1/5**	0.0551
Levels of rent	5	5	5	1	5	1	**1**	0.2531
Economic conditions	7	5	7	2	5	1	1	0.3153
CR	8.76%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**1/3**	0.2718
Portfolio B: Modernized version	1/5	1	**1/8**	0.0670
Portfolio C: New construction version	3	8	1	0.6612
CR	4.27%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/2**	0.3196
Portfolio B: Modernized version	1/3	1	**1/4**	0.1220
Portfolio C: New construction version	2	4	1	0.5584
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1/3**	0.2385
Portfolio B: Modernized version	1/2	1	**1/4**	0.1365
Portfolio C: New construction version	3	4	1	0.6250
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1/2**	0.2970
Portfolio B: Modernized version	1/2	1	**1/3**	0.1634
Portfolio C: New construction version	2	3	1	0.5396
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1/3**	0.2385
Portfolio B: Modernized version	1/2	1	**1/4**	0.1365
Portfolio C: New construction version	3	4	1	0.6250
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/3**	0.2583
Portfolio B: Modernized version	1/3	1	**1/5**	0.1047
Portfolio C: New construction version	3	5	1	0.6370
CR	3.72%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1/4**	0.1998
Portfolio B: Modernized version	1/2	1	**1/5**	0.1168
Portfolio C: New construction version	4	5	1	0.6833
CR	2.38%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/4**	0.2051
Portfolio B: Modernized version	1/3	1	**1/8**	0.0783
Portfolio C: New construction version	4	8	1	0.7167
CR	1.77%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/5**	0.1140
Portfolio B: Modernized version	3	1	**1**	0.4054
Portfolio C: New construction version	5	1	1	0.4806
CR	2.80%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**1/3**	0.2560
Portfolio B: Modernized version	1/4	1	**1/8**	0.0732
Portfolio C: New construction version	3	8	1	0.6708
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1/4**	0.2051
Portfolio B: Modernized version	1/3	1	**1/8**	0.0783
Portfolio C: New construction version	4	8	1	0.7167
CR	1.77%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2718	0.3196	0.2000	0.2385	0.1429	0.2792	Ageing indicators	0.2237
Portfolio B: Modernized version	0.0670	0.1220	0.4000	0.1365	0.4286	0.0742	Household indicators	0.2208
Portfolio C: New construction version	0.6612	0.5584	0.4000	0.6250	0.4286	0.0881	Clusters of households	0.5555
						0.2792	Household composition	
						0.2792	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2970	0.2385	0.2583	0.5714	Build Quality	0.2776
Portfolio B: Modernized version	0.1634	0.1365	0.1047	0.1429	Age distribution of housing stock	0.1428
Portfolio C: New construction version	0.5396	0.6250	0.6370	0.2857	Average number of rooms per dwelling	0.5796

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2000	0.1998	0.2051	0.1140	0.2560	0.1260	0.2051	0.1036	Population density	0.1693
Portfolio B: Modernized version	0.4000	0.1168	0.0783	0.4054	0.0732	0.4161	0.0783	0.0398	Income level	0.2624
Portfolio C: New construction version	0.4000	0.6833	0.7167	0.4806	0.6708	0.4579	0.7167	0.0373	Land area	0.5683
								0.1958	Supply/ demand	
								0.0551	Tenure status	
								0.2531	Levels of rent	
								0.3153	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.2237	0.2776	0.1693	0.1830	Demographic characteristics	**0.1874**
Portfolio B: Modernized version	0.2208	0.1428	0.2624	0.0752	Space characteristics	**0.2458**
Portfolio C: New construction version	0.5555	0.5796	0.5683	0.7418	Environment social characteristics	**0.5668**

Source: Own analyses

Appendix 69 Interview-summary Klaus Kirchhoff

Respondent	Klaus Kirchhoff

Country	Extrapolated version	Modernized version	New construction version
Romania	18.74%	24.58%	56.68%

Special core fields	Romania

Source: Own analyses

Appendix 70 AHP-survey Polina Stoykova: Bulgaria

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1**	**1/3**	0.2000
Space characteristics	1	1	**1/3**	0.2000
Environment social characteristics	3	3	1	0.6000
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1/3**	**1/3**	**1**	**1/4**	0.0850
Household indicators	3	1	**1**	**3**	**1**	0.2694
Clusters of households	3	1	1	**3**	**1**	0.2694
Household composition	1	1/3	1/3	1	**1/3**	0.0898
Housing indicators	4	1	1	3	1	0.2864
CR	0.22%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**4**	**3**	0.6337
Age distribution of housing stock	1/4	1	**1**	0.1744
Average number of rooms per dwelling	1/3	1	1	0.1919
CR	0.89%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**3**	**1/3**	**1/4**	**1/3**	**1/6**	0.0685
Income level	4	1	**3**	**1**	**1**	**1**	**1**	0.1753
Land area	1/3	1/3	1	**1/4**	**1**	**1**	**1/2**	0.0785
Supply/ demand	3	1	4	1	**1**	**1**	**2**	0.1970
Tenure status	4	1	1	1	1	**1**	**2**	0.1755
Levels of rent	3	1	1	1	1	1	**1**	0.1463
Economic conditions	6	1	2	1/2	1/2	1	1	0.1589
CR	9.78%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1111
Portfolio B: Modernized version	4	1	**1**	0.4444
Portfolio C: New construction version	4	1	1	0.4445
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1429
Portfolio B: Modernized version	3	1	**1**	0.4286
Portfolio C: New construction version	3	1	1	0.4286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/5**	**1/5**	0.0909
Portfolio B: Modernized version	5	1	**1**	0.4545
Portfolio C: New construction version	5	1	1	0.4545
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2000
Portfolio B: Modernized version	2	1	**1**	0.4000
Portfolio C: New construction version	2	1	1	0.4000
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3333
Portfolio B: Modernized version	1	1	**1**	0.3333
Portfolio C: New construction version	1	1	1	0.3333
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1260
Portfolio B: Modernized version	3	1	**1**	0.4161
Portfolio C: New construction version	4	1	1	0.4579
CR	0.89%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1692
Portfolio B: Modernized version	2	1	**1**	0.3874
Portfolio C: New construction version	3	1	1	0.4434
CR	1.76%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/5**	0.1005
Portfolio B: Modernized version	4	1	**1**	0.4330
Portfolio C: New construction version	5	1	1	0.4665
CR	0.53%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/6**	0.0924
Portfolio B: Modernized version	4	1	**1**	0.4232
Portfolio C: New construction version	6	1	1	0.4844
CR	1.76%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0909	0.1111	0.1429	0.1429	0.1429	0.0850	Ageing indicators	0.1299
Portfolio B: Modernized version	0.4545	0.4444	0.4286	0.4286	0.4286	0.2694	Household indicators	0.4350
Portfolio C: New construction version	0.4545	0.4445	0.4286	0.4286	0.4286	0.2694	Clusters of households	0.4351
						0.0898	Household composition	
						0.2864	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1429	0.0909	0.1692	0.6337	Build Quality	0.1389
Portfolio B: Modernized version	0.4286	0.4545	0.3874	0.1744	Age distribution of housing stock	0.4252
Portfolio C: New construction version	0.4286	0.4545	0.4434	0.1919	Average number of rooms per dwelling	0.4360

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.2000	0.1260	0.3333	0.1260	0.1692	0.1005	0.0924	0.0685	Population density	0.1459
Portfolio B: Modernized version	0.4000	0.4161	0.3333	0.4161	0.3874	0.4330	0.4232	0.1753	Income level	0.4070
Portfolio C: New con-struction version	0.4000	0.4579	0.3333	0.4579	0.4434	0.4665	0.4844	0.0785	Land area	0.4471
								0.1970	Supply/ de-mand	
								0.1755	Tenure status	
								0.1463	Levels of rent	
								0.1589	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1299	0.1389	0.1459	0.2000	Demographic characteristics	**0.1413**
Portfolio B: Modernized version	0.4350	0.4252	0.4070	0.2000	Space characteristics	**0.4163**
Portfolio C: New construction version	0.4351	0.4360	0.4471	0.6000	Environment social characteristics	**0.4425**

Source: Own analyses

Appendix 71 Interview-summary Polina Stoykova

Respondent	Polina Stoykova

Country	Extrapolated version	Modernized version	New construction version
Romania	14.13%	41.63%	44.25%

Special core fields	Bulgaria

Source: Own analyses

Appendix 72 Acceptance AHP-survey Matthias Ross

Am 23.12.2014 um 14:23 schrieb Matthias Ross:

Ergebnisse der Befragung

Liebe Marion,

meine Antworten sind und bleiben OK,

Schöne Weihnachten von

Matthias

FOM Hochschule für Oekonomie & Management University of Applied Sciences

Source: Ross (2014)

Appendix 73 Acceptance AHP-survey Axel Detz

Am 23.12.2014 um 13:57 schrieb Axel Detz:

Ergebnisse der Befragung

Hi Marion,

ich sehe nichts, was ich im Nachhinein ändern würde...

Gruß ... Axel

HOCHSCHULE FRESENIUS
UNIVERSITY OF APPLIED SCIENCES

Source: Detz (2014)

Appendix 74 Acceptance AHP-survey Frank Borrmann

Am 29.01.2015 um 10:48 schrieb Frank Borrmann:

Ergebnisse der Befragung

OK, gerne. Ich kann da nichts weiter entdecken.

Beste Grüße

frank

FOM Hochschule für Oekonomie & Management University of Applied Sciences

Source: Borrmann (2015)

Appendix 75 Acceptance AHP-survey Mara Meinel

Am 09.01.2015 um 15:45 schrieb Mara Meinel:

Die Ergebnisse unseres Interviews

Liebe Marion,

die Ergebnisse kannst Du gern veröffentlichen.

Ich wünsche Dir ein schönes Wochenende.

LG

Mara

Mit freundlichen Grüßen

Mara Meinel
Geschäftsführerin

BECKEN
VERWALTUNG

Source: Meinel (2015)

Appendix 76 Acceptance AHP-survey Michael Wulf

Am 13.01.2015 um 15:12 schrieb BVE - Wulf, Michael:

Auswertungen zum Interview

Hallo Frau Preuß,

sehr gerne und es freut mich, dass Sie die Ergebnisse verwenden können. Weiterhin viel Glück bei dieser umfangreichen Arbeit.

Freundliche Grüße aus Iserbrook

Bauverein der Elbgemeinden eG
Michael Wulf

Bauverein der
Elbgemeinden eG

Source: Wulf (2015)

Appendix 77 Acceptance AHP-survey Berit Jalas

Am 13.01.2015 um 16:10 schrieb Dipl.-Betr. Berit Jalas:

Auswertungen

Liebe Marion,

freut mich sehr, dass die Ergebnisse super stimmig sind.

Viel Erfolg bei Deinen weiteren Interviews und viel Kraft und Durchhaltevermögen bei Deiner Doktorarbeit!!!

Liebe Grüße

Dipl.-Betr. Berit Jalas

Prokuristin

BECKEN

VERWALTUNG

Source: Jalas (2015)

Appendix 78 Acceptance AHP-survey Richard Winter, Susanne Gentz

Am 09.04.2015 um 15:48 schrieb Winter, Richard:

Auswertungen des Interviews

Liebe Frau Preuß,

Aus meiner Sicht sind die Unterlagen soweit in Ordnung.

Beste Grüße und viel Erfolg
Richard Winter

JONES LANG
LASALLE

Source: Winter, Gentz (2015)

Appendix 79 Acceptance AHP-survey Özgür Öner

Am 22.01.2015 um 17:45 schrieb Öner, Özgür:

Auswertungen der Befragung

Liebe Frau Preuß,

vielen Dank für Ihre Nachricht und für die Übermittlung der Ergebnisse.

Ich werde die Informationen vertraulich behandeln und freue mich jetzt schon auf die Veröffentlichung Ihrer Dissertation.

In jedem Fall wünsche ich Ihnen viel Erfolg für den Abschluss Ihrer Arbeit.

Viele Grüße,
Özgür Öner

Dr. Özgür Öner
Leiter des Brüsseler Büros
GdW Bundesverband deutscher Wohnungs-
und Immobilienunternehmen e.V.
3, Rue du Luxembourg
1000 Bruxelles

GdW

Source: Öner (2015)

Appendix 80 Acceptance AHP-survey Alice Pittini

Am 09.02.2015 um 14:51 schrieb Alice Pittini - Housing Europe:

Results of the interviews

Hi Marion, ok for the 9 countries.

Keep me informed about your research, I'm very curious to see the final results!

Good luck and keep in touch
Alice

HOUSING
EUROPE

Alice Pittini
Research Coordinator
18, Square de Meeûs, 1050, Brussels

Source: Pittini (2015)

Appendix 81 Acceptance AHP-survey Michael Pistorius

Am 20.01.2015 um 13:15 schrieb Pistorius <Pistorius@vnw.de>:

Die Auswertungen zur Befragung

Alles in Ordnung so. Viel Erfolg weiterhin!

Freundliche Grüße

Michael Pistorius

Referat Wohnungswirtschaft
Verband norddeutscher Wohnungsunternehmen e.V.

vnw

Hamburg
Mecklenburg-Vorpommern
Schleswig-Holstein

Source: Pistorius (2015)

Appendix 82 Acceptance AHP-survey Klaus Schrader

Am 02.03.2015 um 09:45 schrieb Schrader, Klaus:

Die Ergebnisse des Interviews

Hallo Frau Preuß,

freut mich, dass meine Antworten konsistent ausgefallen sind. Nach Durchsicht der einzelnen Tabellen habe ich keine nachträglichen Änderungswünsche.

Wünsche weiterhin viel Erfolg mit der Arbeit und freue mich auf einen Bericht zum Endergebnis.

Freundliche Grüße aus Berlin

Klaus Schrader
Statistik und Research
Statistischer und volkswirtschaftlicher Research

Die Wohnungswirtschaft
Deutschland

GdW Bundesverband deutscher Wohnungs- und Immobilienunternehmen e.V.

Source: Schrader (2015)

Appendix 83 Acceptance AHP-survey Petra Gaugisch

Am 09.03.2015 um 14:11 schrieb Gaugisch, Petra:

Interview-Ergebnisse

Hallo Frau Preuß,
danke für die Auswertung. Sie sind so in Ordnung und Sie können diese gerne für die Thesis und für Veröffentlichungen verwenden.
Ja, es wäre schön, wenn wir uns irgendwo nochmals treffen. Viel Erfolg noch bei der Arbeit

Mit freundlichen Grüßen

Petra Gaugisch

Dipl.-Päd. Petra Gaugisch, Fraunhofer-Institut für Arbeitswirtschaft und Organisation IAO, CC Workspace Innovation

Fraunhofer
IAO

FRAUNHOFER-INSTITUT FÜR ARBEITSWIRTSCHAFT UND ORGANISATION IAO

Source: Gaugisch (2015)

Appendix 84 Acceptance AHP-survey Klaus Kirchhoff

Am 23.01.2015 um 12:21 schrieb Klaus Kirchhoff:

Ergebnisse der Befragung

Liebe Frau Preuß,

es hat mich gefreut Sie und Ihr interessantes Projekt kennen zu lernen. Die Ergebnisse sind aus meiner Sicht ok.

Beste Grüße

KRK

Klaus Rainer Kirchhoff
Honorarkonsul

Honorarkonsulat von Rumänien

Source: Kirchhoff (2015)

Appendix 85 Acceptance AHP-survey Polina Stoykova

Am 09.02.2015 um 13:52 schrieb BulgarianProperties.com (Polina Stoykova):

Calculation/ results

Dear Marion,

Thank you for the info!
I think it is correct and I hope it helps you in your study.

Best regards,
Polina

Polina Stoykova MRICS
Managing Director & Head of Research

BULGARIAN PROPERTIES

WWW.BULGARIANPROPERTIES.COM

Address: 19, Yakubitsa Str., floor 5, Sofia 1164, Bulgaria

Source: Stoykova (2015)

Appendix 86 AHP-survey in total: Bulgaria

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic character-istics	1	**1 1/3**	**3/4**	0.3211
Space characteristics	3/4	1	**4/7**	0.2462
Environment social characteristics	1 3/8	1 3/4	1	0.4327
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**6/7**	**2/3**	**1**	**8/9**	0.1780
Household indicators	1 1/6	1	**1**	**1 3/7**	**8/9**	0.2133
Clusters of households	1 3/7	1	1	**1 3/8**	**1 1/5**	0.2363
Household composition	1	5/7	3/4	1	**3/4**	0.1608
Housing indicators	1 1/8	1 1/9	5/6	1 1/3	1	0.2116
CR	0.19%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**2**	**2 4/9**	0.5289
Age distribution of housing stock	1/2	1	**1 1/9**	0.2502
Average number of rooms per dwelling	2/5	1	1	0.2209
CR	0.05%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**2 2/9**	**1**	**3/4**	**1/2**	**1/5**	0.0810
Income level	4	1	**3 1/4**	**2 3/8**	**2**	**1**	**1 1/5**	0.2362
Land area	4/9	1/3	1	**2/3**	**4/7**	**4/9**	**2/7**	0.0624
Supply/ demand	1 1/9	3/7	1 1/2	1	**5/9**	**4/7**	**4/7**	0.0941
Tenure status	1 1/3	1/2	1 3/4	1 4/5	1	**4/7**	**3/5**	0.1205
Levels of rent	2 1/5	1	2 2/9	1 5/7	1 3/4	1	**3/4**	0.1755
Economic conditions	5	5/6	3 5/8	1 3/4	1 5/8	1 1/3	1	0.2303
CR	2.10%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**1/2**	0.1883
Portfolio B: Modernized version	2 1/5	1	**1**	0.4152
Portfolio C: New construction version	2 1/9	1	1	0.3965
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**5/9**	0.2133
Portfolio B: Modernized version	1 7/8	1	**1**	0.3918
Portfolio C: New construction version	1 5/6	1	1	0.3949
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1784
Portfolio B: Modernized version	1 6/7	1	**2/3**	0.3327
Portfolio C: New construction version	2 3/4	1 1/2	1	0.4889
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/5**	**1/3**	0.1754
Portfolio B: Modernized version	1 5/7	1	**3/5**	0.3024
Portfolio C: New construction version	3	1 5/7	1	0.5221
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/5**	**3/7**	0.1991
Portfolio B: Modernized version	1 2/3	1	**3/4**	0.3416
Portfolio C: New construction version	2 1/3	1 1/3	1	0.4593
CR	0.03%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1087
Portfolio B: Modernized version	3 8/9	1	**4/5**	0.4044
Portfolio C: New construction version	4 2/7	1 1/4	1	0.4869
CR	0.20%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**2/7**	0.1320
Portfolio B: Modernized version	3	1	**1**	0.4154
Portfolio C: New construction version	3 1/2	1	1	0.4526
CR	0.08%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/8**	**2/7**	0.1374
Portfolio B: Modernized version	2 2/3	1	**5/7**	0.3627
Portfolio C: New construction version	3 5/8	1 2/5	1	0.4999
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1461
Portfolio B: Modernized version	3	1	**1**	0.4400
Portfolio C: New construction version	2 5/6	1	1	0.4139
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/3**	0.1533
Portfolio B: Modernized version	2 4/9	1	**4/5**	0.3769
Portfolio C: New construction version	3	1 1/4	1	0.4698
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**2/3**	0.2824
Portfolio B: Modernized version	1	1	**3/4**	0.3006
Portfolio C: New construction version	1 1/2	1 1/3	1	0.4171
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**2/7**	0.1510
Portfolio B: Modernized version	2 1/4	1	**2/3**	0.3451
Portfolio C: New construction version	3 3/8	1 4/9	1	0.5039
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**1/3**	0.1624
Portfolio B: Modernized version	2 3/8	1	**7/8**	0.3886
Portfolio C: New construction version	2 4/5	1 1/7	1	0.4490
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7/9**	**1/2**	0.2434
Portfolio B: Modernized version	1 2/7	1	**5/6**	0.3330
Portfolio C: New construction version	1 5/6	1 1/5	1	0.4236
CR	0.32%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/3**	0.1574
Portfolio B: Modernized version	2 3/5	1	**1**	0.4109
Portfolio C: New construction version	2 3/4	1	1	0.4316
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1883	0.2133	0.1784	0.1754	0.1991	0.1780	Ageing indicators	0.1915
Portfolio B: Modernized version	0.4152	0.3918	0.3327	0.3024	0.3416	0.2133	Household indicators	0.3570
Portfolio C: New construction version	0.3965	0.3949	0.4889	0.5221	0.4593	0.2363	Clusters of households	0.4515
						0.1608	Household composition	
						0.2116	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1087	0.1320	0.1374	0.5289	Build Quality	0.1209
Portfolio B: Modernized version	0.4044	0.4154	0.3627	0.2502	Age distribution of housing stock	0.3979
Portfolio C: New construction version	0.4869	0.4526	0.4999	0.2209	Average number of rooms per dwelling	0.4812

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1461	0.1533	0.2824	0.1510	0.1624	0.2434	0.1574	0.0810	Population density	0.1784
Portfolio B: Modernized version	0.4400	0.3769	0.3006	0.3451	0.3886	0.3330	0.4109	0.2362	Income level	0.3758
Portfolio C: New con-struction version	0.4139	0.4698	0.4171	0.5039	0.4490	0.4236	0.4316	0.0624	Land area	0.4458
								0.0941	Supply/ de-mand	
								0.1205	Tenure status	
								0.1755	Levels of rent	
								0.2303	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.1915	0.1209	0.1784	0.3211	Demographic characteristics	**0.1684**
Portfolio B: Modernized version	0.3570	0.3979	0.3758	0.2462	Space characteristics	**0.3752**
Portfolio C: New construction version	0.4515	0.4812	0.4458	0.4327	Environment social characteristics	**0.4563**

Source: Own analyses

Appendix 87 AHP-survey in total: Estonia, Latvia, Lithuania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1 1/2**	**4/5**	0.3460
Space characteristics	2/3	1	**3/5**	0.2352
Environment social characteristics	1 1/4	1 5/7	1	0.4188
CR	0.17%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**5/6**	**7/8**	**1 2/5**	**1**	0.1984
Household indicators	1 1/5	1	**1**	**1 3/7**	**1**	0.2178
Clusters of households	1 1/7	1	1	**1 2/7**	**2/3**	0.1937
Household composition	5/7	5/7	7/9	1	**2/3**	0.1517
Housing indicators	1	1	1 4/7	1 1/2	1	0.2384
CR	0.61%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**2**	**2**	0.5011
Age distribution of housing stock	1/2	1	**1 1/9**	0.2600
Average number of rooms per dwelling	1/2	1	1	0.2389
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**2/7**	**2**	**8/9**	**1/2**	**1/3**	**1/4**	0.0768
Income level	3 1/2	1	**2 1/2**	**1 8/9**	**1 6/7**	**1**	**1 1/9**	0.2146
Land area	1/2	2/5	1	**5/7**	**1/2**	**3/7**	**1/3**	0.0691
Supply/ demand	1 1/9	1/2	1 2/5	1	**5/8**	**5/9**	**3/7**	0.0952
Tenure status	2	1/2	1 7/8	1 3/5	1	**2/3**	**6/7**	0.1410
Levels of rent	2 5/6	1	2 1/3	1 4/5	1 3/7	1	**1**	0.1917
Economic conditions	4 1/6	8/9	3	2 1/3	1 1/6	1	1	0.2116
CR	1.47%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**3/5**	0.2404
Portfolio B: Modernized version	1 1/2	1	**7/8**	0.3559
Portfolio C: New construction version	1 2/3	1 1/7	1	0.4037
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/7**	**1/2**	0.2069
Portfolio B: Modernized version	1 3/4	1	**4/5**	0.3578
Portfolio C: New construction version	2	1 1/4	1	0.4352
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**3/8**	0.1850
Portfolio B: Modernized version	1 5/6	1	**3/4**	0.3477
Portfolio C: New construction version	2 3/5	1 1/3	1	0.4673
CR	0.10%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1680
Portfolio B: Modernized version	2	1	**4/5**	0.3643
Portfolio C: New construction version	2 8/9	1 1/4	1	0.4676
CR	0.16%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.1949
Portfolio B: Modernized version	2	1	**1**	0.3856
Portfolio C: New construction version	2 1/5	1	1	0.4195
CR	0.04%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**1/4**	0.1103
Portfolio B: Modernized version	3 3/4	1	**7/8**	0.4161
Portfolio C: New construction version	4 1/3	1 1/7	1	0.4736
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1404
Portfolio B: Modernized version	3	1	**1**	0.4141
Portfolio C: New construction version	3 1/5	1	1	0.4455
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/3**	0.1580
Portfolio B: Modernized version	2 1/2	1	**4/5**	0.3854
Portfolio C: New construction version	2 7/9	1 1/4	1	0.4565
CR	0.15%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2019
Portfolio B: Modernized version	2	1	**1**	0.3955
Portfolio C: New construction version	2	1	1	0.4026
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**1/3**	0.1503
Portfolio B: Modernized version	2 3/8	1	**3/4**	0.3638
Portfolio C: New construction version	3 2/7	1 1/3	1	0.4859
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**8/9**	**1/2**	0.2357
Portfolio B: Modernized version	1 1/9	1	**4/7**	0.2724
Portfolio C: New construction version	2 1/6	1 3/4	1	0.4918
CR	0.12%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**3/8**	0.1838
Portfolio B: Modernized version	1 4/5	1	**3/4**	0.3455
Portfolio C: New construction version	2 2/3	1 1/3	1	0.4707
CR	0.13%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**4/9**	0.1956
Portfolio B: Modernized version	1 8/9	1	**6/7**	0.3723
Portfolio C: New construction version	2 2/9	1 1/6	1	0.4321
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/6**	**1/2**	0.2441
Portfolio B: Modernized version	1 2/9	1	**3/4**	0.3171
Portfolio C: New construction version	2	1 1/3	1	0.4388
CR	0.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**3/7**	0.1768
Portfolio B: Modernized version	2 1/3	1	**1**	0.4057
Portfolio C: New construction version	2 1/3	1	1	0.4175
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2404	0.2069	0.1850	0.1680	0.1949	0.1984	Ageing indicators	0.2005
Portfolio B: Modernized version	0.3559	0.3578	0.3477	0.3643	0.3856	0.2178	Household indicators	0.3631
Portfolio C: New construction version	0.4037	0.4352	0.4673	0.4676	0.4195	0.1937	Clusters of households	0.4364
						0.1517	Household composition	
						0.2384	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1103	0.1404	0.1580	0.5011	Build Quality	0.1295
Portfolio B: Modernized version	0.4161	0.4141	0.3854	0.2600	Age distribution of housing stock	0.4082
Portfolio C: New construction version	0.4736	0.4455	0.4565	0.2389	Average number of rooms per dwelling	0.4622

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac- teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2019	0.1503	0.2357	0.1838	0.1956	0.2441	0.1768	0.0768	Population density	0.1933
Portfolio B: Modernized version	0.3955	0.3638	0.2724	0.3455	0.3723	0.3171	0.4057	0.2146	Income level	0.3593
Portfolio C: New con- struction version	0.4026	0.4859	0.4918	0.4707	0.4321	0.4388	0.4175	0.0691	Land area	0.4474
								0.0952	Supply/ de- mand	
								0.1410	Tenure status	
								0.1917	Levels of rent	
								0.2116	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2005	0.1295	0.1933	0.3460	Demographic characteristics	**0.1808**
Portfolio B: Modernized version	0.3631	0.4082	0.3593	0.2352	Space characteristics	**0.3721**
Portfolio C: New construction version	0.4364	0.4622	0.4474	0.4188	Environment social characteristics	**0.4471**

Source: Own analyses

Appendix 88 AHP-survey in total: Germany

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**2**	**5/6**	0.3742
Space characteristics	1/2	1	**1/2**	0.1979
Environment social characteristics	1 1/5	2	1	0.4280
CR	0.23%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1 1/2**	**1 2/9**	**1 1/6**	**1 8/9**	0.2613
Household indicators	2/3	1	**3/4**	**5/6**	**1**	0.1634
Clusters of households	4/5	1 1/3	1	**1**	**1 1/9**	0.2001
Household composition	6/7	1 1/5	1	1	**1 1/6**	0.2082
Housing indicators	1/2	1	1	6/7	1	0.1671
CR	0.33%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1 1/3**	**1 2/5**	0.4069
Age distribution of housing stock	3/4	1	**1**	0.2993
Average number of rooms per dwelling	5/7	1	1	0.2938
CR	0.03%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**3/8**	**1 5/7**	**1/2**	**1**	**5/9**	**2/5**	0.0979
Income level	2 5/8	1	**2**	**1 1/5**	**1 2/3**	**1 1/7**	**1 1/9**	0.1966
Land area	4/7	1/2	1	**5/8**	**1**	**5/7**	**3/4**	0.1003
Supply/ demand	1 7/8	5/6	1 3/5	1	**1 1/3**	**1 1/7**	**1 1/9**	0.1677
Tenure status	1	3/5	1	3/4	1	**3/5**	**4/5**	0.1096
Levels of rent	1 4/5	7/8	1 2/5	7/8	1 5/7	1	**1**	0.1639
Economic conditions	2 1/2	1	1 1/3	1	1 1/4	1	1	0.1639
CR	1.40%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**5/7**	0.1786
Portfolio B: Modernized version	3 1/4	1	**2**	0.5619
Portfolio C: New construction version	1 2/5	1/2	1	0.2596
CR	0.10%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/7**	**7/8**	0.1768
Portfolio B: Modernized version	3 4/7	1	**2 8/9**	0.6158
Portfolio C: New construction version	1 1/7	1/3	1	0.2074
CR	0.07%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**4/5**	0.2262
Portfolio B: Modernized version	2 1/7	1	**1 3/4**	0.4912
Portfolio C: New construction version	1 1/4	4/7	1	0.2827
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1**	0.2471
Portfolio B: Modernized version	2	1	**1 8/9**	0.4933
Portfolio C: New construction version	1	1/2	1	0.2596
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1**	0.2132
Portfolio B: Modernized version	2 7/9	1	**2 1/2**	0.5690
Portfolio C: New construction version	1	2/5	1	0.2179
CR	0.17%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**3/4**	0.1852
Portfolio B: Modernized version	3	1	**2**	0.5551
Portfolio C: New construction version	1 3/8	1/2	1	0.2597
CR	0.06%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/2**	0.1860
Portfolio B: Modernized version	2 4/9	1	**1 1/4**	0.4512
Portfolio C: New construction version	2	4/5	1	0.3628
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**1/2**	0.2132
Portfolio B: Modernized version	1 4/7	1	**5/7**	0.3314
Portfolio C: New construction version	2 1/9	1 2/5	1	0.4553
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**5/8**	0.2044
Portfolio B: Modernized version	2 1/3	1	**1 1/2**	0.4731
Portfolio C: New construction version	1 3/5	2/3	1	0.3225
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**3/5**	0.2250
Portfolio B: Modernized version	1 7/9	1	**1 1/9**	0.4049
Portfolio C: New construction version	1 2/3	1	1	0.3701
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**1 1/9**	0.2718
Portfolio B: Modernized version	1 4/5	1	**1 5/7**	0.4694
Portfolio C: New construction version	1	4/7	1	0.2588
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/7**	**1/3**	0.1303
Portfolio B: Modernized version	3 2/3	1	**1 1/4**	0.4815
Portfolio C: New construction version	3	4/5	1	0.3882
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**1/2**	0.2220
Portfolio B: Modernized version	1 1/2	1	**5/6**	0.3412
Portfolio C: New construction version	2	1 2/9	1	0.4368
CR	0.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/4**	**5/6**	0.2855
Portfolio B: Modernized version	1 1/3	1	**1 1/7**	0.3775
Portfolio C: New construction version	1 1/5	7/8	1	0.3370
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/7**	**3/5**	0.2432
Portfolio B: Modernized version	1 2/5	1	**1**	0.3585
Portfolio C: New construction version	1 5/7	1	1	0.3982
CR	0.17%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1786	0.1768	0.2262	0.2471	0.2132	0.2613	Ageing indicators	0.2079
Portfolio B: Modernized version	0.5619	0.6158	0.4912	0.4933	0.5690	0.1634	Household indicators	0.5434
Portfolio C: New construction version	0.2596	0.2074	0.2827	0.2596	0.2179	0.2001	Clusters of households	0.2487
						0.2082	Household composition	
						0.1671	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1852	0.1860	0.2132	0.4069	Build Quality	0.1937
Portfolio B: Modernized version	0.5551	0.4512	0.3314	0.2993	Age distribution of housing stock	0.4583
Portfolio C: New construction version	0.2597	0.3628	0.4553	0.2938	Average number of rooms per dwelling	0.3480

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Alternative ranking
Portfolio A: Extrapolated version	0.2044	0.2250	0.2718	0.1303	0.2220	0.2855	0.2432	0.2244
Portfolio B: Modernized version	0.4731	0.4049	0.4694	0.4815	0.3412	0.3775	0.3585	0.4118
Portfolio C: New construction version	0.3225	0.3701	0.2588	0.3882	0.4368	0.3370	0.3982	0.3638

Criteria ranking	Subcriteria: Environment social characteristics
0.0979	Population density
0.1966	Income level
0.1003	Land area
0.1677	Supply/ demand
0.1096	Tenure status
0.1639	Levels of rent
0.1639	Economic conditions

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2079	0.1937	0.2244	0.3742	Demographic characteristics	**0.2121**
Portfolio B: Modernized version	0.5434	0.4583	0.4118	0.1979	Space characteristics	**0.4703**
Portfolio C: New construction version	0.2487	0.3480	0.3638	0.4280	Environment social characteristics	**0.3176**

Source: Own analyses

Appendix 89 AHP-survey in total: Hungary

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**1 2/3**	**5/7**	0.3367
Space characteristics	3/5	1	**1/2**	0.2136
Environment social characteristics	1 2/5	2	1	0.4498
CR	0.21%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**1**	**1 5/9**	**1**	0.2120
Household indicators	1	1	**1**	**1 4/7**	**1 1/6**	0.2265
Clusters of households	1	1	1	**1 1/3**	**1**	0.2137
Household composition	2/3	2/3	3/4	1	**2/3**	0.1442
Housing indicators	1	6/7	1	1 1/2	1	0.2036
CR	0.10%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1 1/2**	**1 7/8**	0.4586
Age distribution of housing stock	2/3	1	**1 1/5**	0.2953
Average number of rooms per dwelling	1/2	5/6	1	0.2461
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**2**	**5/6**	**2/3**	**1/2**	**1/4**	0.0836
Income level	3 5/7	1	**2 4/5**	**2**	**2**	**1 1/4**	**1 1/4**	0.2367
Land area	1/2	1/3	1	**5/7**	**5/8**	**1/2**	**3/8**	0.0717
Supply/ demand	1 1/5	1/2	1 2/5	1	**2/3**	**3/5**	**3/7**	0.0976
Tenure status	1 3/7	1/2	1 5/8	1 1/2	1	**2/3**	**2/3**	0.1224
Levels of rent	2	4/5	2	1 5/7	1 1/2	1	**7/9**	0.1687
Economic conditions	3 5/6	4/5	2 2/3	2 3/8	1 4/7	1 2/7	1	0.2193
CR	1.27%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/7**	**4/7**	0.2220
Portfolio B: Modernized version	1 3/4	1	**1**	0.3836
Portfolio C: New construction version	1 3/4	1	1	0.3943
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/5**	**5/8**	0.2328
Portfolio B: Modernized version	1 2/3	1	**1**	0.3851
Portfolio C: New construction version	1 3/5	1	1	0.3821
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**2/5**	0.1891
Portfolio B: Modernized version	1 5/6	1	**5/6**	0.3574
Portfolio C: New construction version	2 1/2	1 2/9	1	0.4535
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**3/8**	0.1961
Portfolio B: Modernized version	1 1/2	1	**2/3**	0.3129
Portfolio C: New construction version	2 2/3	1 1/2	1	0.4910
CR	0.26%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**1/2**	0.2186
Portfolio B: Modernized version	1 1/2	1	**4/5**	0.3393
Portfolio C: New construction version	2	1 1/4	1	0.4420
CR	0.06%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/4**	0.1213
Portfolio B: Modernized version	3 1/3	1	**4/5**	0.3939
Portfolio C: New construction version	4	1 1/4	1	0.4848
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**1/3**	0.1602
Portfolio B: Modernized version	2 2/7	1	**5/6**	0.3754
Portfolio C: New construction version	3	1 1/5	1	0.4644
CR	0.05%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**1/3**	0.1598
Portfolio B: Modernized version	2 1/4	1	**4/5**	0.3658
Portfolio C: New construction version	3	1 1/4	1	0.4744
CR	0.06%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**2/5**	0.1672
Portfolio B: Modernized version	2 1/2	1	**1**	0.4135
Portfolio C: New construction version	2 1/2	1	1	0.4193
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**2/7**	0.1464
Portfolio B: Modernized version	2 1/2	1	**3/4**	0.3667
Portfolio C: New construction version	3 1/3	1 1/3	1	0.4869
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**5/8**	0.2741
Portfolio B: Modernized version	1	1	**3/4**	0.2997
Portfolio C: New construction version	1 5/8	1 1/3	1	0.4262
CR	0.18%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/3**	0.1499
Portfolio B: Modernized version	2 2/5	1	**3/4**	0.3605
Portfolio C: New construction version	3 1/4	1 1/3	1	0.4896
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**3/8**	0.1798
Portfolio B: Modernized version	2	1	**4/5**	0.3625
Portfolio C: New construction version	2 3/5	1 1/4	1	0.4577
CR	0.05%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/5**	**4/7**	0.2507
Portfolio B: Modernized version	1 1/4	1	**5/6**	0.3278
Portfolio C: New construction version	1 7/9	1 2/9	1	0.4215
CR	0.26%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.1904
Portfolio B: Modernized version	2 1/7	1	**1**	0.4038
Portfolio C: New construction version	2 1/9	1	1	0.4058
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2220	0.2328	0.1891	0.1961	0.2186	0.2120	Ageing indicators	0.2130
Portfolio B: Modernized version	0.3836	0.3851	0.3574	0.3129	0.3393	0.2265	Household indicators	0.3591
Portfolio C: New construction version	0.3943	0.3821	0.4535	0.4910	0.4420	0.2137	Clusters of households	0.4279
						0.1442	Household composition	
						0.2036	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1213	0.1602	0.1598	0.4586	Build Quality	0.1423
Portfolio B: Modernized version	0.3939	0.3754	0.3658	0.2953	Age distribution of housing stock	0.3815
Portfolio C: New construction version	0.4848	0.4644	0.4744	0.2461	Average number of rooms per dwelling	0.4762

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1672	0.1464	0.2741	0.1499	0.1798	0.2507	0.1904	0.0836	Population density	0.1890
Portfolio B: Modernized version	0.4135	0.3667	0.2997	0.3605	0.3625	0.3278	0.4038	0.2367	Income level	0.3663
Portfolio C: New con-struction version	0.4193	0.4869	0.4262	0.4896	0.4577	0.4215	0.4058	0.0717	Land area	0.4448
								0.0976	Supply/ de-mand	
								0.1224	Tenure status	
								0.1687	Levels of rent	
								0.2193	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2130	0.1423	0.1890	0.3367	Demographic characteristics	**0.1871**
Portfolio B: Modernized version	0.3591	0.3815	0.3663	0.2136	Space characteristics	**0.3671**
Portfolio C: New construction version	0.4279	0.4762	0.4448	0.4498	Environment social characteristics	**0.4458**

Source: Own analyses

Appendix 90 AHP-survey in total: Poland

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**1 5/8**	**7/8**	0.3617
Space characteristics	5/8	1	**1/2**	0.2199
Environment social characteristics	1 1/7	2	1	0.4183
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**4/5**	**2/3**	**1**	**5/8**	0.1563
Household indicators	1 1/4	1	**1**	**1 1/7**	**5/6**	0.2019
Clusters of households	1 1/2	1	1	**1 1/4**	**6/7**	0.2164
Household composition	1 1/9	7/8	4/5	1	**2/3**	0.1744
Housing indicators	1 3/5	1 1/5	1 1/6	1 1/2	1	0.2509
CR	0.04%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**2 2/9**	**2 1/5**	0.5253
Age distribution of housing stock	4/9	1	**1**	0.2319
Average number of rooms per dwelling	1/2	1	1	0.2428
CR	0.03%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**2 2/7**	**8/9**	**3/4**	**1/2**	**1/4**	0.0958
Income level	2 8/9	1	**2**	**1 3/4**	**1 7/8**	**1 1/7**	**1 2/7**	0.2130
Land area	4/9	1/2	1	**5/6**	**5/8**	**4/7**	**1/2**	0.0830
Supply/ demand	1 1/9	4/7	1 1/5	1	**3/4**	**3/5**	**4/9**	0.1004
Tenure status	1 1/3	1/2	1 4/7	1 1/3	1	**2/3**	**2/3**	0.1226
Levels of rent	2	7/8	1 3/4	1 5/7	1 1/2	1	**6/7**	0.1713
Economic conditions	3 5/6	7/9	2 1/9	2 1/4	1 1/2	1 1/6	1	0.2139
CR	2.06%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/4**	**5/9**	0.2425
Portfolio B: Modernized version	1 1/3	1	**3/4**	0.3194
Portfolio C: New construction version	1 5/6	1 1/3	1	0.4381
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**4/9**	0.1879
Portfolio B: Modernized version	2	1	**1**	0.3859
Portfolio C: New construction version	2 1/4	1 1/9	1	0.4261
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1730
Portfolio B: Modernized version	2	1	**3/4**	0.3478
Portfolio C: New construction version	2 5/6	1 1/3	1	0.4791
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/3**	0.1519
Portfolio B: Modernized version	2 4/9	1	**4/5**	0.3767
Portfolio C: New construction version	3 1/7	1 1/4	1	0.4714
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**3/7**	0.1796
Portfolio B: Modernized version	2 1/4	1	**1**	0.4077
Portfolio C: New construction version	2 1/3	1	1	0.4127
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/9**	**2/9**	0.0998
Portfolio B: Modernized version	4 4/9	1	**1**	0.4481
Portfolio C: New construction version	4 4/7	1	1	0.4521
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**3/8**	0.1597
Portfolio B: Modernized version	2 1/2	1	**1**	0.4067
Portfolio C: New construction version	2 5/7	1	1	0.4336
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1623
Portfolio B: Modernized version	2	1	**5/7**	0.3434
Portfolio C: New construction version	3 1/5	1 3/8	1	0.4943
CR	0.20%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.1931
Portfolio B: Modernized version	2 1/7	1	**1 1/9**	0.4202
Portfolio C: New construction version	2	1	1	0.3868
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/3**	0.1528
Portfolio B: Modernized version	2 1/2	1	**4/5**	0.3785
Portfolio C: New construction version	3	1 1/4	1	0.4687
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7/9**	**1/2**	0.2412
Portfolio B: Modernized version	1 2/7	1	**3/4**	0.3207
Portfolio C: New construction version	1 8/9	1 1/3	1	0.4381
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**3/8**	0.1642
Portfolio B: Modernized version	2 3/8	1	**6/7**	0.3855
Portfolio C: New construction version	2 5/7	1 1/6	1	0.4503
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**1/2**	0.1916
Portfolio B: Modernized version	2 1/5	1	**1 1/7**	0.4293
Portfolio C: New construction version	2	7/8	1	0.3792
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**2/3**	0.2531
Portfolio B: Modernized version	1 3/7	1	**1**	0.3776
Portfolio C: New construction version	1 1/2	1	1	0.3694
CR	0.16%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**4/9**	0.1835
Portfolio B: Modernized version	2 2/9	1	**1**	0.3972
Portfolio C: New construction version	2 2/9	1	1	0.4193
CR	0.06%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2425	0.1879	0.1730	0.1519	0.1796	0.1563	Ageing indicators	0.1849
Portfolio B: Modernized version	0.3194	0.3859	0.3478	0.3767	0.4077	0.2019	Household indicators	0.3711
Portfolio C: New construction version	0.4381	0.4261	0.4791	0.4714	0.4127	0.2164	Clusters of households	0.4440
						0.1744	Household composition	
						0.2509	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.0998	0.1597	0.1623	0.5253	Build Quality	0.1289
Portfolio B: Modernized version	0.4481	0.4067	0.3434	0.2319	Age distribution of housing stock	0.4130
Portfolio C: New construction version	0.4521	0.4336	0.4943	0.2428	Average number of rooms per dwelling	0.4581

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1931	0.1528	0.2412	0.1642	0.1916	0.2531	0.1835	0.0958	Population density	0.1936
Portfolio B: Modernized version	0.4202	0.3785	0.3207	0.3855	0.4293	0.3776	0.3972	0.2130	Income level	0.3885
Portfolio C: New con-struction version	0.3868	0.4687	0.4381	0.4503	0.3792	0.3694	0.4193	0.0830	Land area	0.4179
								0.1004	Supply/ de-mand	
								0.1226	Tenure status	
								0.1713	Levels of rent	
								0.2139	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1849	0.1289	0.1936	0.3617	Demographic characteristics	**0.1762**
Portfolio B: Modernized version	0.3711	0.4130	0.3885	0.2199	Space characteristics	**0.3876**
Portfolio C: New construction version	0.4440	0.4581	0.4179	0.4183	Environment social characteristics	**0.4362**

Source: Own analyses

Appendix 91 AHP-survey in total: Romania

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1 4/9**	**5/7**	0.3232
Space characteristics	2/3	1	**1/2**	0.2301
Environment social characteristics	1 3/7	1 7/8	1	0.4466
CR	0.10%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**5/6**	**1**	**1**	0.1984
Household indicators	1	1	**1**	**1 1/6**	**4/5**	0.1932
Clusters of households	1 1/5	1	1	**1 1/7**	**1**	0.2171
Household composition	1	6/7	7/8	1	**5/6**	0.1782
Housing indicators	1	1 1/4	1	1 1/5	1	0.2131
CR	0.21%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**2**	**2 3/8**	0.5250
Age distribution of hous-ing stock	1/2	1	**1**	0.2464
Average number of rooms per dwelling	3/7	1	1	0.2287
CR	0.09%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**2 2/9**	**1**	**1**	**4/9**	**1/5**	0.0846
Income level	3	1	**3**	**2**	**2**	**1**	**1**	0.2113
Land area	4/9	1/3	1	**2/3**	**1/2**	**2/5**	**1/4**	0.0596
Supply/ demand	1 1/9	1/2	1 4/9	1	**5/8**	**4/7**	**1/3**	0.0897
Tenure status	1	1/2	2	1 3/5	1	**1/2**	**1/2**	0.1100
Levels of rent	2 2/7	1	2 1/2	1 5/7	2	1	**3/4**	0.1860
Economic conditions	5	1	4	2 5/6	2	1 1/3	1	0.2587
CR	1.60%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/5**	**1/2**	0.2128
Portfolio B: Modernized version	1 2/3	1	**7/8**	0.3652
Portfolio C: New construction version	2	1 1/7	1	0.4220
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**4/7**	0.2359
Portfolio B: Modernized version	1 1/2	1	**7/8**	0.3563
Portfolio C: New construction version	1 5/7	1 1/7	1	0.4078
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**3/8**	0.1834
Portfolio B: Modernized version	1 7/9	1	**2/3**	0.3307
Portfolio C: New construction version	2 2/3	1 1/2	1	0.4859
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**1/3**	0.1846
Portfolio B: Modernized version	1 1/2	1	**5/9**	0.2826
Portfolio C: New construction version	3	1 4/5	1	0.5328
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/5**	**3/7**	0.1991
Portfolio B: Modernized version	1 2/3	1	**3/4**	0.3416
Portfolio C: New construction version	2 1/3	1 1/3	1	0.4593
CR	0.03%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/7**	**1/4**	0.1178
Portfolio B: Modernized version	3 1/3	1	**4/5**	0.3953
Portfolio C: New construction version	4 1/7	1 2/9	1	0.4869
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**2/7**	0.1455
Portfolio B: Modernized version	2 1/2	1	**5/6**	0.3820
Portfolio C: New construction version	3 3/8	1 1/5	1	0.4725
CR	0.15%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**2/7**	0.1449
Portfolio B: Modernized version	2 2/7	1	**5/8**	0.3309
Portfolio C: New construction version	3 5/8	1 3/5	1	0.5242
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/3**	**1/3**	0.1461
Portfolio B: Modernized version	3	1	**1**	0.4400
Portfolio C: New construction version	2 5/6	1	1	0.4139
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1619
Portfolio B: Modernized version	2 1/9	1	**5/7**	0.3445
Portfolio C: New construction version	3	1 3/7	1	0.4936
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**3/5**	0.2761
Portfolio B: Modernized version	1	1	**5/8**	0.2713
Portfolio C: New construction version	1 2/3	1 5/8	1	0.4526
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**2/7**	0.1497
Portfolio B: Modernized version	2 1/4	1	**2/3**	0.3443
Portfolio C: New construction version	3 4/9	1 4/9	1	0.5059
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1731
Portfolio B: Modernized version	2	1	**3/4**	0.3483
Portfolio C: New construction version	2 4/5	1 1/3	1	0.4786
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/5**	**5/9**	0.2473
Portfolio B: Modernized version	1 1/4	1	**5/6**	0.3310
Portfolio C: New construction version	1 4/5	1 1/5	1	0.4217
CR	0.34%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**3/8**	0.1732
Portfolio B: Modernized version	2 1/9	1	**4/5**	0.3676
Portfolio C: New construction version	2 2/3	1 1/4	1	0.4592
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2128	0.2359	0.1834	0.1846	0.1991	0.1984	Ageing indicators	0.2029
Portfolio B: Modernized version	0.3652	0.3563	0.3307	0.2826	0.3416	0.1932	Household indicators	0.3363
Portfolio C: New construction version	0.4220	0.4078	0.4859	0.5328	0.4593	0.2171	Clusters of households	0.4608
						0.1782	Household composition	
						0.2131	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1178	0.1455	0.1449	0.5250	Build Quality	0.1308
Portfolio B: Modernized version	0.3953	0.3820	0.3309	0.2464	Age distribution of housing stock	0.3773
Portfolio C: New construction version	0.4869	0.4725	0.5242	0.2287	Average number of rooms per dwelling	0.4919

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac- teristics	Alternative ranking
Portfolio A: Extrapolated version	0.1461	0.1619	0.2761	0.1497	0.1731	0.2473	0.1732	0.0846	Population density	0.1863
Portfolio B: Modernized version	0.4400	0.3445	0.2713	0.3443	0.3483	0.3310	0.3676	0.2113	Income level	0.3521
Portfolio C: New con- struction version	0.4139	0.4936	0.4526	0.5059	0.4786	0.4217	0.4592	0.0596	Land area	0.4616
								0.0897	Supply/ de- mand	
								0.1100	Tenure status	
								0.1860	Levels of rent	
								0.2587	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2029	0.1308	0.1863	0.3232	Demographic characteristics	**0.1789**
Portfolio B: Modernized version	0.3363	0.3773	0.3521	0.2301	Space characteristics	**0.3528**
Portfolio C: New construction version	0.4608	0.4919	0.4616	0.4466	Environment social characteristics	**0.4683**

Source: Own analyses

Appendix 92 AHP-survey in total: Slovakia

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**1 5/9**	**3/4**	0.3413
Space characteristics	2/3	1	**4/7**	0.2306
Environment social characteristics	1 1/3	1 7/9	1	0.4281
CR	0.21%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**7/8**	**1 2/5**	**1**	0.2003
Household indicators	1	1	**1**	**1 4/7**	**1**	0.2258
Clusters of households	1 1/7	1	1	**1 1/3**	**1**	0.2167
Household composition	5/7	2/3	3/4	1	**2/3**	0.1473
Housing indicators	1	1	1	1 1/2	1	0.2099
CR	0.07%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1 4/9**	**2**	0.4567
Age distribution of housing stock	2/3	1	**1 1/3**	0.3132
Average number of rooms per dwelling	1/2	3/4	1	0.2301
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/4**	**2**	**6/7**	**2/3**	**2/5**	**1/4**	0.0801
Income level	3 5/7	1	**2 2/3**	**2**	**2**	**1**	**1**	0.2213
Land area	1/2	3/8	1	**7/8**	**2/3**	**1/2**	**2/5**	0.0770
Supply/ demand	1 1/6	1/2	1 1/7	1	**2/3**	**1/2**	**2/5**	0.0908
Tenure status	1 1/2	1/2	1 1/2	1 4/7	1	**4/7**	**3/5**	0.1197
Levels of rent	2 2/5	1	1 8/9	1 6/7	1 3/4	1	**7/9**	0.1802
Economic conditions	4 1/3	1	2 4/7	2 4/7	1 2/3	1 2/7	1	0.2310
CR	1.55%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/7**	**1/2**	0.2131
Portfolio B: Modernized version	1 3/4	1	**6/7**	0.3650
Portfolio C: New construction version	2	1 1/6	1	0.4219
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/5**	**4/7**	0.2254
Portfolio B: Modernized version	1 2/3	1	**1**	0.3753
Portfolio C: New construction version	1 3/4	1	1	0.3993
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**3/8**	0.1821
Portfolio B: Modernized version	1 5/6	1	**3/4**	0.3465
Portfolio C: New construction version	2 5/7	1 1/3	1	0.4714
CR	0.20%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**1/3**	0.1883
Portfolio B: Modernized version	1 1/2	1	**5/8**	0.3025
Portfolio C: New construction version	2 7/8	1 3/5	1	0.5091
CR	0.34%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/3**	**4/9**	0.2107
Portfolio B: Modernized version	1 1/2	1	**3/4**	0.3293
Portfolio C: New construction version	2 1/4	1 1/3	1	0.4600
CR	0.09%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/7**	**1/4**	0.1170
Portfolio B: Modernized version	3 3/8	1	**2/3**	0.3704
Portfolio C: New construction version	4 1/9	1 1/2	1	0.5126
CR	0.39%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**1/3**	0.1470
Portfolio B: Modernized version	2 3/5	1	**7/8**	0.3932
Portfolio C: New construction version	3 2/9	1 1/7	1	0.4598
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**1/3**	0.1540
Portfolio B: Modernized version	2 1/3	1	**3/4**	0.3625
Portfolio C: New construction version	3 1/5	1 1/3	1	0.4834
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**3/8**	0.1597
Portfolio B: Modernized version	2 4/7	1	**1**	0.4081
Portfolio C: New construction version	2 2/3	1	1	0.4322
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**2/7**	0.1464
Portfolio B: Modernized version	2 1/2	1	**3/4**	0.3667
Portfolio C: New construction version	3 1/3	1 1/3	1	0.4869
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**3/5**	0.2676
Portfolio B: Modernized version	1	1	**5/7**	0.2999
Portfolio C: New construction version	1 2/3	1 2/5	1	0.4324
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**2/7**	0.1430
Portfolio B: Modernized version	2 1/2	1	**5/7**	0.3554
Portfolio C: New construction version	3 1/2	1 2/5	1	0.5016
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1654
Portfolio B: Modernized version	2	1	**3/4**	0.3510
Portfolio C: New construction version	3	1 1/3	1	0.4836
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/4**	**1/2**	0.2358
Portfolio B: Modernized version	1 3/8	1	**5/6**	0.3366
Portfolio C: New construction version	1 8/9	1 2/9	1	0.4276
CR	0.15%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**3/7**	0.1825
Portfolio B: Modernized version	2 1/5	1	**1**	0.3999
Portfolio C: New construction version	2 2/7	1	1	0.4176
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2131	0.2254	0.1821	0.1883	0.2107	0.2003	Ageing indicators	0.2050
Portfolio B: Modernized version	0.3650	0.3753	0.3465	0.3025	0.3293	0.2258	Household indicators	0.3466
Portfolio C: New construction version	0.4219	0.3993	0.4714	0.5091	0.4600	0.2167	Clusters of households	0.4484
						0.1473	Household composition	
						0.2099	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1170	0.1470	0.1540	0.4567	Build Quality	0.1349
Portfolio B: Modernized version	0.3704	0.3932	0.3625	0.3132	Age distribution of housing stock	0.3757
Portfolio C: New construction version	0.5126	0.4598	0.4834	0.2301	Average number of rooms per dwelling	0.4894

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1597	0.1464	0.2676	0.1430	0.1654	0.2358	0.1825	0.0801	Population density	0.1832
Portfolio B: Modernized version	0.4081	0.3667	0.2999	0.3554	0.3510	0.3366	0.3999	0.2213	Income level	0.3642
Portfolio C: New con-struction version	0.4322	0.4869	0.4324	0.5016	0.4836	0.4276	0.4176	0.0770	Land area	0.4526
								0.0908	Supply/ de-mand	
								0.1197	Tenure status	
								0.1802	Levels of rent	
								0.2310	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2050	0.1349	0.1832	0.3413	Demographic characteristics	**0.1795**
Portfolio B: Modernized version	0.3466	0.3757	0.3642	0.2306	Space characteristics	**0.3609**
Portfolio C: New construction version	0.4484	0.4894	0.4526	0.4281	Environment social characteristics	**0.4596**

Source: Own analyses

Appendix 93 AHP-survey in total: Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic charac-teristics	1	**2**	**1 1/4**	0.4360
Space characteristics	1/2	1	**5/7**	0.2291
Environment social characteristics	4/5	1 2/5	1	0.3349
CR	0.12%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**7/9**	**4/5**	**1**	0.1825
Household indicators	1	1	**4/5**	**6/7**	**5/6**	0.1801
Clusters of households	1 2/7	1 2/9	1	**1**	**1 1/7**	0.2236
Household composition	1 1/4	1 1/6	1	1	**1**	0.2198
Housing indicators	1	1 1/5	7/8	1	1	0.1941
CR	0.19%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1**	**1 1/4**	0.3622
Age distribution of housing stock	1	1	**1 1/6**	0.3444
Average number of rooms per dwelling	4/5	6/7	1	0.2933
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**3/5**	**1 5/7**	**2/3**	**2/3**	**2/3**	**2/5**	0.1022
Income level	1 5/7	1	**1 2/5**	**1 2/7**	**1 2/7**	**1**	**1**	0.1674
Land area	4/7	5/7	1	**3/5**	**3/4**	**3/5**	**1/2**	0.0933
Supply/ demand	1 1/2	7/9	1 2/3	1	**1**	**5/6**	**2/3**	0.1374
Tenure status	1 5/9	7/9	1 1/3	1	1	**3/4**	**2/3**	0.1359
Levels of rent	1 5/9	1	1 2/3	1 1/5	1 1/3	1	**7/8**	0.1643
Economic conditions	2 4/7	1	2	1 1/2	1 4/9	1 1/7	1	0.1995
CR	0.85%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/4**	**5/6**	0.2848
Portfolio B: Modernized version	1 1/3	1	**1**	0.3733
Portfolio C: New construction version	1 1/5	1	1	0.3419
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/7**	**5/7**	0.2622
Portfolio B: Modernized version	1 2/5	1	**1**	0.3707
Portfolio C: New construction version	1 3/7	1	1	0.3671
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**4/7**	0.2209
Portfolio B: Modernized version	1 4/5	1	**1**	0.4013
Portfolio C: New construction version	1 5/7	1	1	0.3778
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**3/5**	0.2233
Portfolio B: Modernized version	1 4/5	1	**1**	0.4003
Portfolio C: New construction version	1 2/3	1	1	0.3764
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1 1/5**	0.3621
Portfolio B: Modernized version	1	1	**1**	0.3272
Portfolio C: New construction version	5/6	1	1	0.3107
CR	0.05%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2/5**	**2/3**	0.1974
Portfolio B: Modernized version	2 5/9	1	**1 2/3**	0.5004
Portfolio C: New construction version	1 1/2	3/5	1	0.3022
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**4/5**	0.2422
Portfolio B: Modernized version	1 8/9	1	**1 1/2**	0.4581
Portfolio C: New construction version	1 1/4	2/3	1	0.2997
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**6/7**	**2/3**	0.2772
Portfolio B: Modernized version	1 1/6	1	**6/7**	0.3301
Portfolio C: New construction version	1 4/9	1 1/6	1	0.3927
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3271
Portfolio B: Modernized version	1	1	**1**	0.3522
Portfolio C: New construction version	1	1	1	0.3207
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/7**	**5/8**	0.2298
Portfolio B: Modernized version	1 3/4	1	**1 1/7**	0.4081
Portfolio C: New construction version	1 3/5	7/8	1	0.3621
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3446
Portfolio B: Modernized version	1	1	**1**	0.3369
Portfolio C: New construction version	1	1	1	0.3185
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/7**	**8/9**	0.2834
Portfolio B: Modernized version	1 2/5	1	**1 1/4**	0.3994
Portfolio C: New construction version	1 1/8	4/5	1	0.3172
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**5/9**	0.2022
Portfolio B: Modernized version	2 1/8	1	**1**	0.4214
Portfolio C: New construction version	1 5/6	1	1	0.3764
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1**	0.3187
Portfolio B: Modernized version	1	1	**1 1/8**	0.3568
Portfolio C: New construction version	1	8/9	1	0.3246
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**3/5**	0.2038
Portfolio B: Modernized version	2 1/4	1	**1 1/2**	0.4721
Portfolio C: New construction version	1 5/8	2/3	1	0.3241
CR	0.05%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2848	0.2622	0.2209	0.2233	0.3621	0.1825	Ageing indicators	0.2679
Portfolio B: Modernized version	0.3733	0.3707	0.4013	0.4003	0.3272	0.1801	Household indicators	0.3761
Portfolio C: New construction version	0.3419	0.3671	0.3778	0.3764	0.3107	0.2236	Clusters of households	0.3560
						0.2198	Household composition	
						0.1941	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1974	0.2422	0.2772	0.3622	Build Quality	0.2362
Portfolio B: Modernized version	0.5004	0.4581	0.3301	0.3444	Age distribution of housing stock	0.4359
Portfolio C: New construction version	0.3022	0.2997	0.3927	0.2933	Average number of rooms per dwelling	0.3279

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.3271	0.2298	0.3446	0.2834	0.2022	0.3187	0.2038	0.1022	Population density	0.2635
Portfolio B: Modernized version	0.3522	0.4081	0.3369	0.3994	0.4214	0.3568	0.4721	0.1674	Income level	0.4007
Portfolio C: New construction version	0.3207	0.3621	0.3185	0.3172	0.3764	0.3246	0.3241	0.0933	Land area	0.3358
								0.1374	Supply/ demand	
								0.1359	Tenure status	
								0.1643	Levels of rent	
								0.1995	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2679	0.2362	0.2635	0.4360	Demographic characteristics	**0.2592**
Portfolio B: Modernized version	0.3761	0.4359	0.4007	0.2291	Space characteristics	**0.3980**
Portfolio C: New construction version	0.3560	0.3279	0.3358	0.3349	Environment social characteristics	**0.3428**

Source: Own analyses

Appendix 94 Box-whisker interview-results in total, Bulgaria

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
14.13%	41.63%	44.25%	Polina Stoykova

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.22%	20.39%	21.66%
25th Percentile	11.32%	35.11%	39.83%
Median	14.61%	41.62%	43.96%
75th Percentile	22.56%	45.21%	45.06%
Maximum	41.09%	49.11%	58.35%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.22%	20.39%	21.66%
Series 2	4.10%	14.72%	18.17%
Series 3	3.29%	6.51%	4.13%
Series 4	7.95%	3.59%	1.10%
Series 5	18.53%	3.90%	13.30%

Source: Own analyses

Appendix 95 Box-whisker interview-results in total, Estonia, Latvia, Lithuania

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
24.10%	37.66%	38.24%	Michael Wulf
7.36%	46.25%	46.39%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
13.68%	48.73%	37.58%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
8.31%	40.35%	51.34%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.36%	20.39%	37.58%
25th Percentile	12.51%	37.07%	38.84%
Median	16.15%	40.35%	42.24%
75th Percentile	22.89%	43.12%	45.49%
Maximum	41.09%	48.73%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.36%	20.39%	37.58%
Series 2	5.15%	16.68%	1.26%
Series 3	3.65%	3.28%	3.41%
Series 4	6.74%	2.77%	3.25%
Series 5	18.20%	5.62%	11.74%

Source: Own analyses

Appendix 96 Box-whisker interview-results in total, Germany

Extrapolated	Modernized	New construction	Interviewees
25.91%	41.36%	32.73%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
12.83%	41.97%	45.21%	Frank Borrmann
21.99%	47.07%	30.94%	Mara Meinel
36.24%	49.20%	14.57%	Michael Wulf
12.64%	71.18%	16.18%	Berit Jalas
16.27%	49.49%	34.24%	Richard Winter, Susanne Gentz
27.22%	43.87%	28.91%	Özgür Öner
24.00%	38.68%	37.32%	Michael Pistorius
34.14%	36.92%	28.94%	Klaus Schrader
15.58%	54.17%	30.24%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	12.64%	36.92%	14.57%
25th Percentile	15.93%	40.20%	28.93%
Median	21.99%	43.87%	30.94%
75th Percentile	26.57%	49.35%	35.78%
Maximum	36.24%	71.18%	45.21%

Data for chart	Extrapolated	Modernized	New construction
Series 1	12.64%	36.92%	14.57%
Series 2	3.29%	3.28%	14.36%
Series 3	6.07%	3.67%	2.02%
Series 4	4.58%	5.48%	4.84%
Series 5	9.68%	21.84%	9.43%

Source: Own analyses

Appendix 97 Box-whisker interview-results in total, Hungary

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
17.76%	49.27%	32.97%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.82%	20.39%	21.66%
25th Percentile	13.17%	36.91%	38.84%
Median	17.76%	40.40%	42.24%
75th Percentile	21.97%	45.32%	45.38%
Maximum	41.09%	49.27%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.82%	20.39%	21.66%
Series 2	5.35%	16.52%	17.18%
Series 3	4.59%	3.50%	3.41%
Series 4	4.21%	4.92%	3.14%
Series 5	19.13%	3.95%	11.85%

Source: Own analyses

Appendix 98 Box-whisker interview-results in total, Poland

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
19.19%	38.69%	42.12%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
19.91%	44.73%	35.36%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
11.86%	44.47%	43.68%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
12.37%	34.44%	53.19%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.82%	20.39%	35.36%
25th Percentile	12.12%	38.23%	39.93%
Median	16.15%	40.40%	42.24%
75th Percentile	20.73%	44.55%	44.32%
Maximum	41.09%	46.02%	53.19%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.82%	20.39%	35.36%
Series 2	4.30%	17.84%	4.57%
Series 3	4.04%	2.18%	2.31%
Series 4	4.58%	4.15%	2.08%
Series 5	20.37%	1.48%	8.87%

Source: Own analyses

Appendix 99 Box-whisker interview-results in total, Romania

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
18.74%	24.58%	56.68%	Klaus Kirchhoff

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.22%	20.39%	21.66%
25th Percentile	11.32%	29.40%	39.83%
Median	15.58%	41.01%	43.96%
75th Percentile	22.56%	45.21%	49.01%
Maximum	41.09%	49.11%	58.35%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.22%	20.39%	21.66%
Series 2	4.10%	9.01%	18.17%
Series 3	4.26%	11.60%	4.13%
Series 4	6.98%	4.21%	5.05%
Series 5	18.53%	3.90%	9.34%

Source: Own analyses

Appendix 100 Box-whisker interview-results in total, Slovakia

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
10.70%	43.43%	45.87%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.82%	20.39%	21.66%
25th Percentile	11.02%	36.27%	39.56%
Median	16.15%	40.40%	44.05%
75th Percentile	22.89%	44.03%	46.02%
Maximum	41.09%	49.11%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.82%	20.39%	21.66%
Series 2	3.20%	15.88%	17.90%
Series 3	5.14%	4.14%	4.49%
Series 4	6.74%	3.63%	1.97%
Series 5	18.20%	5.09%	11.21%

Source: Own analyses

Appendix 101 Box-whisker interview-results in total, Spain

Extrapolated	Modernized	New construction	Interviewees
48.54%	24.29%	27.17%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
15.85%	40.72%	43.42%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
27.05%	35.10%	37.85%	Michael Wulf
20.19%	59.61%	20.19%	Berit Jalas
33.09%	53.08%	13.84%	Richard Winter, Susanne Gentz
19.27%	41.92%	38.81%	Özgür Öner
33.41%	47.63%	18.96%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
25.63%	18.36%	56.02%	Klaus Schrader
13.22%	61.21%	25.57%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	13.22%	18.36%	13.84%
25th Percentile	18.92%	32.40%	24.23%
Median	23.67%	39.94%	38.19%
75th Percentile	33.17%	48.99%	40.14%
Maximum	48.54%	61.21%	56.02%

Data for chart	Extrapolated	Modernized	New construction
Series 1	13.22%	18.36%	13.84%
Series 2	5.70%	14.04%	10.39%
Series 3	4.75%	7.54%	13.96%
Series 4	9.51%	9.06%	1.95%
Series 5	15.37%	12.22%	15.88%

Source: Own analyses

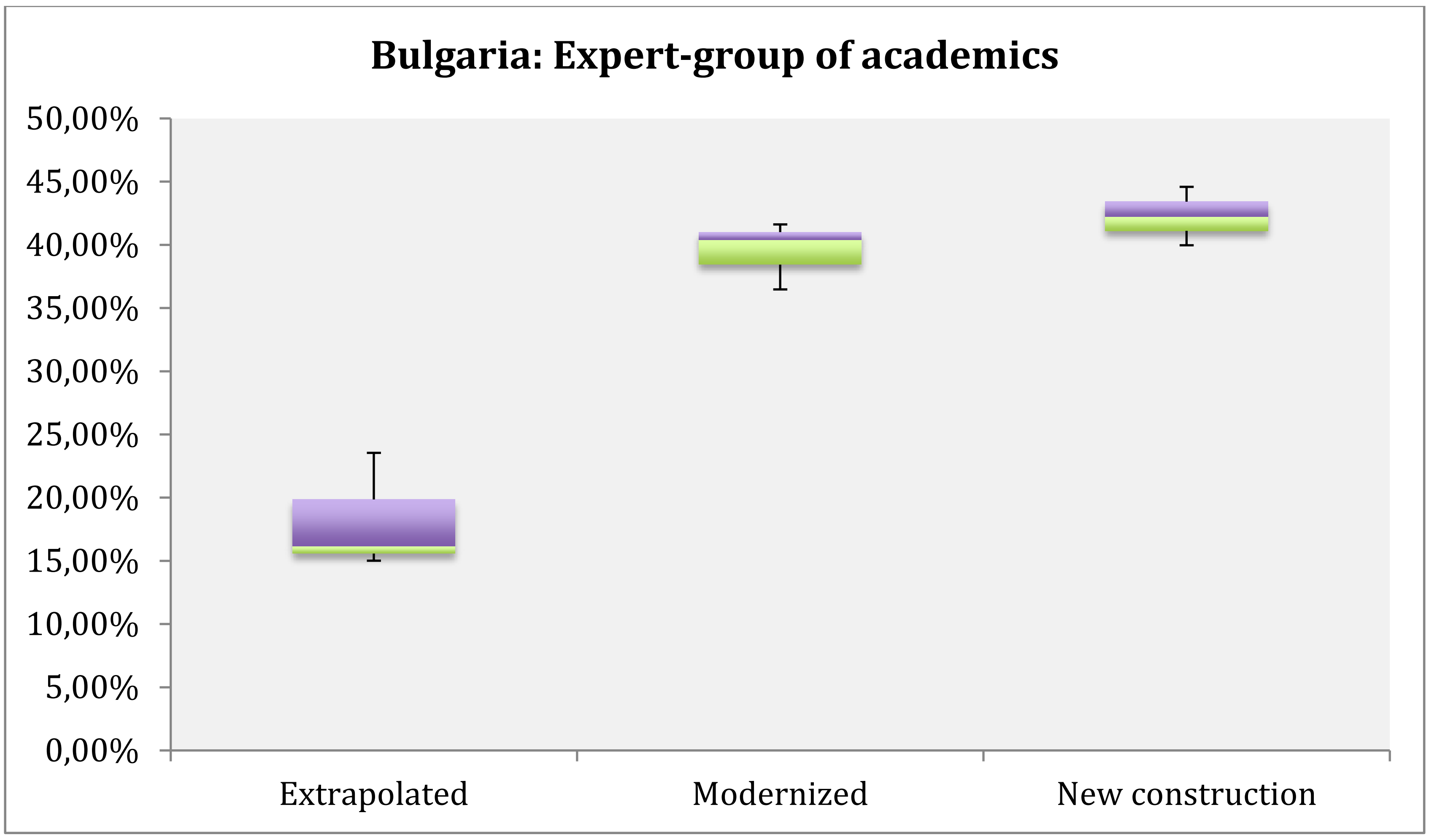
Appendix 102 Box-whisker interview-results, Bulgaria, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
14.13%	41.63%	44.25%	Polina Stoykova

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	15.01%	36.48%	39.97%
25th Percentile	15.58%	38.44%	41.11%
Median	16.15%	40.40%	42.24%
75th Percentile	19.85%	41.01%	43.42%
Maximum	23.55%	41.61%	44.59%

Data for chart	Extrapolated	Modernized	New construction
Series 1	15.01%	36.48%	39.97%
Series 2	0.57%	1.96%	1.14%
Series 3	0.57%	1.96%	1.14%
Series 4	3.70%	0.61%	1.18%
Series 5	3.70%	0.61%	1.18%



Source: Own analyses

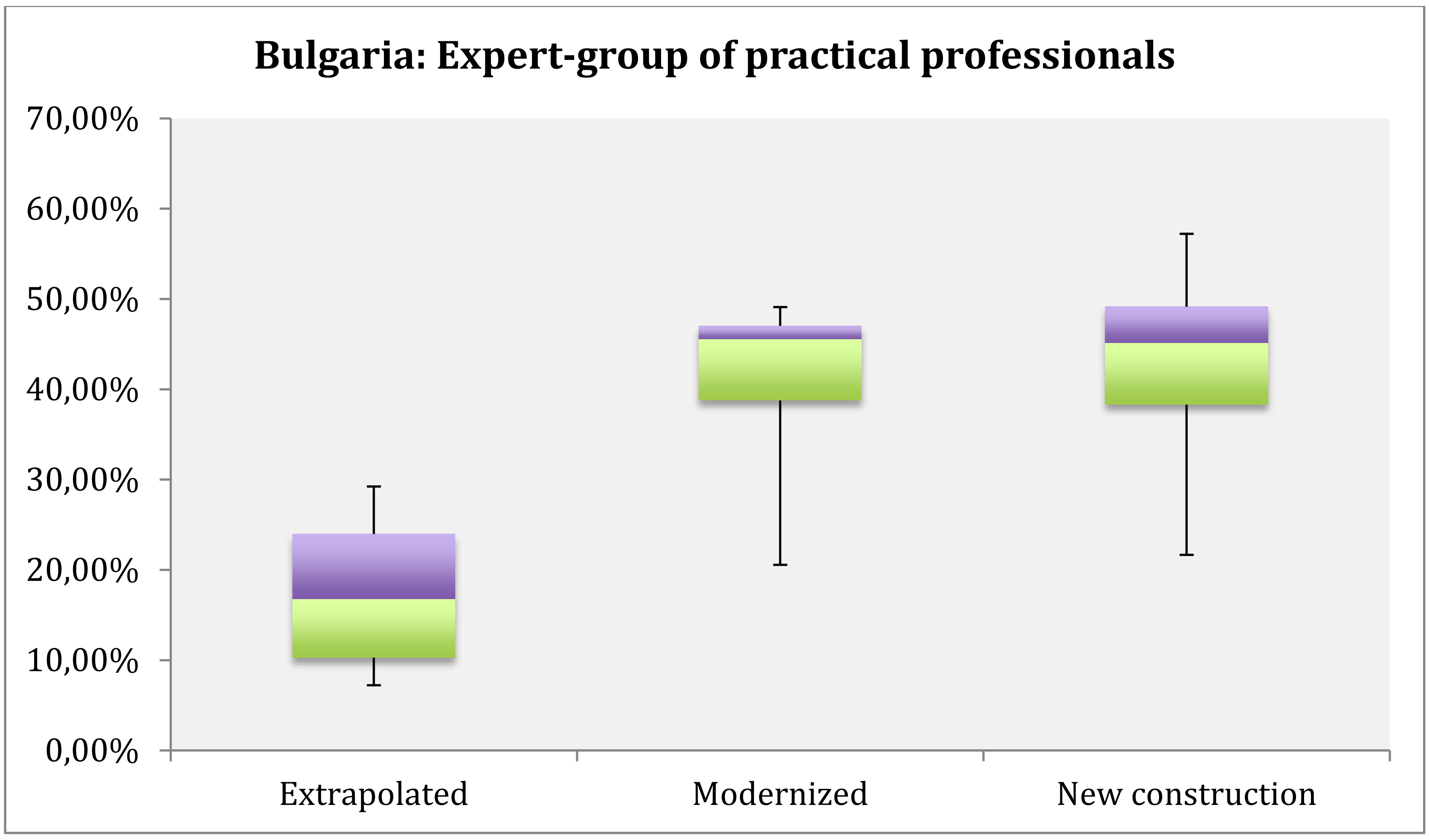
Appendix 103 Box-whisker interview-results, Bulgaria, expert-group: Practical professional

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
14.13%	41.63%	44.25%	Polina Stoykova

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.22%	20.55%	21.66%
25th Percentile	10.27%	38.77%	38.32%
Median	16.76%	45.59%	45.16%
75th Percentile	23.98%	47.03%	49.15%
Maximum	29.23%	49.11%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.22%	20.55%	21.66%
Series 2	3.05%	18.22%	16.66%
Series 3	6.49%	6.82%	6.84%
Series 4	7.22%	1.44%	3.99%
Series 5	5.25%	2.09%	8.09%



Source: Own analyses

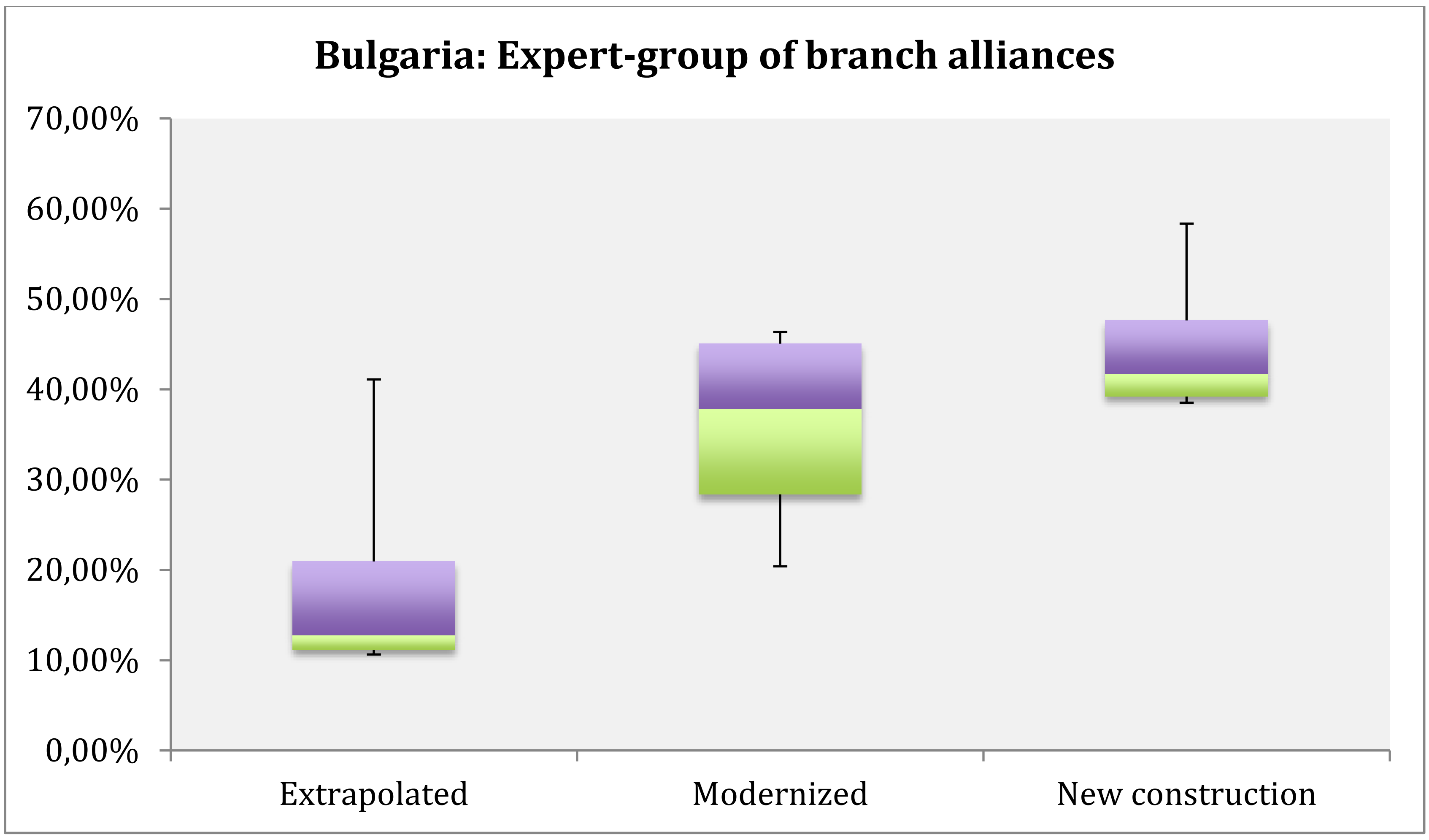
Appendix 104 Box-whisker interview-results, Bulgaria, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
14.13%	41.63%	44.25%	Polina Stoykova

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	10.64%	20.39%	38.52%
25th Percentile	11.16%	28.36%	39.20%
Median	12.77%	37.82%	41.74%
75th Percentile	20.93%	45.06%	47.63%
Maximum	41.09%	46.36%	58.35%

Data for chart	Extrapolated	Modernized	New construction
Series 1	10.64%	20.39%	38.52%
Series 2	0.52%	7.97%	0.68%
Series 3	1.61%	9.46%	2.54%
Series 4	8.16%	7.24%	5.89%
Series 5	20.16%	1.31%	10.73%



Source: Own analyses

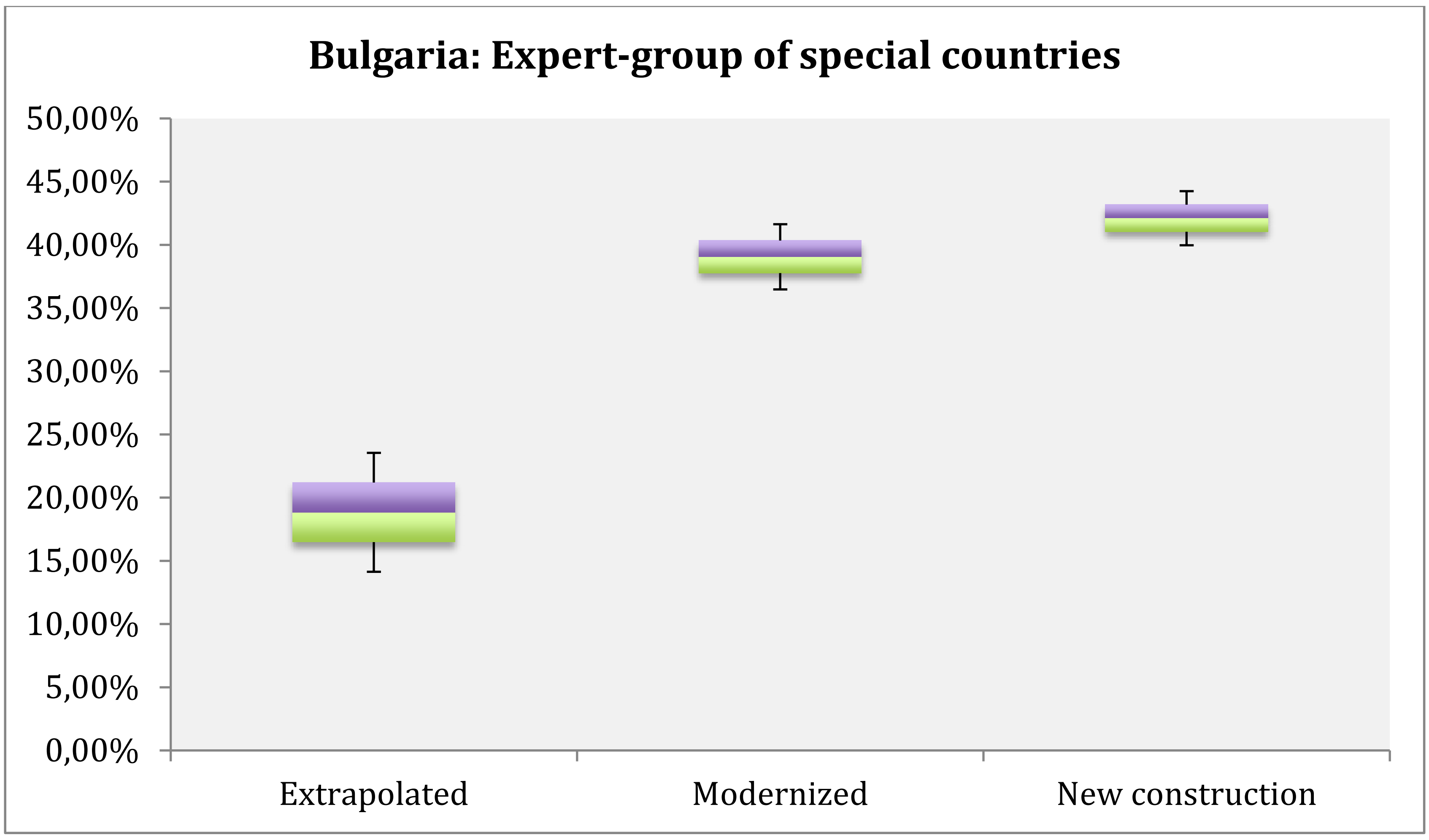
Appendix 105 Box-whisker interview-results, Bulgaria, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
14.13%	41.63%	44.25%	Polina Stoykova
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	14.13%	36.48%	39.97%
25th Percentile	16.49%	37.77%	41.04%
Median	18.84%	39.06%	42.11%
75th Percentile	21.20%	40.34%	43.18%
Maximum	23.55%	41.63%	44.25%

Data for chart	Extrapolated	Modernized	New construction
Series 1	14.13%	36.48%	39.97%
Series 2	2.36%	1.29%	1.07%
Series 3	2.36%	1.29%	1.07%
Series 4	2.36%	1.29%	1.07%
Series 5	2.36%	1.29%	1.07%



Source: Own analyses

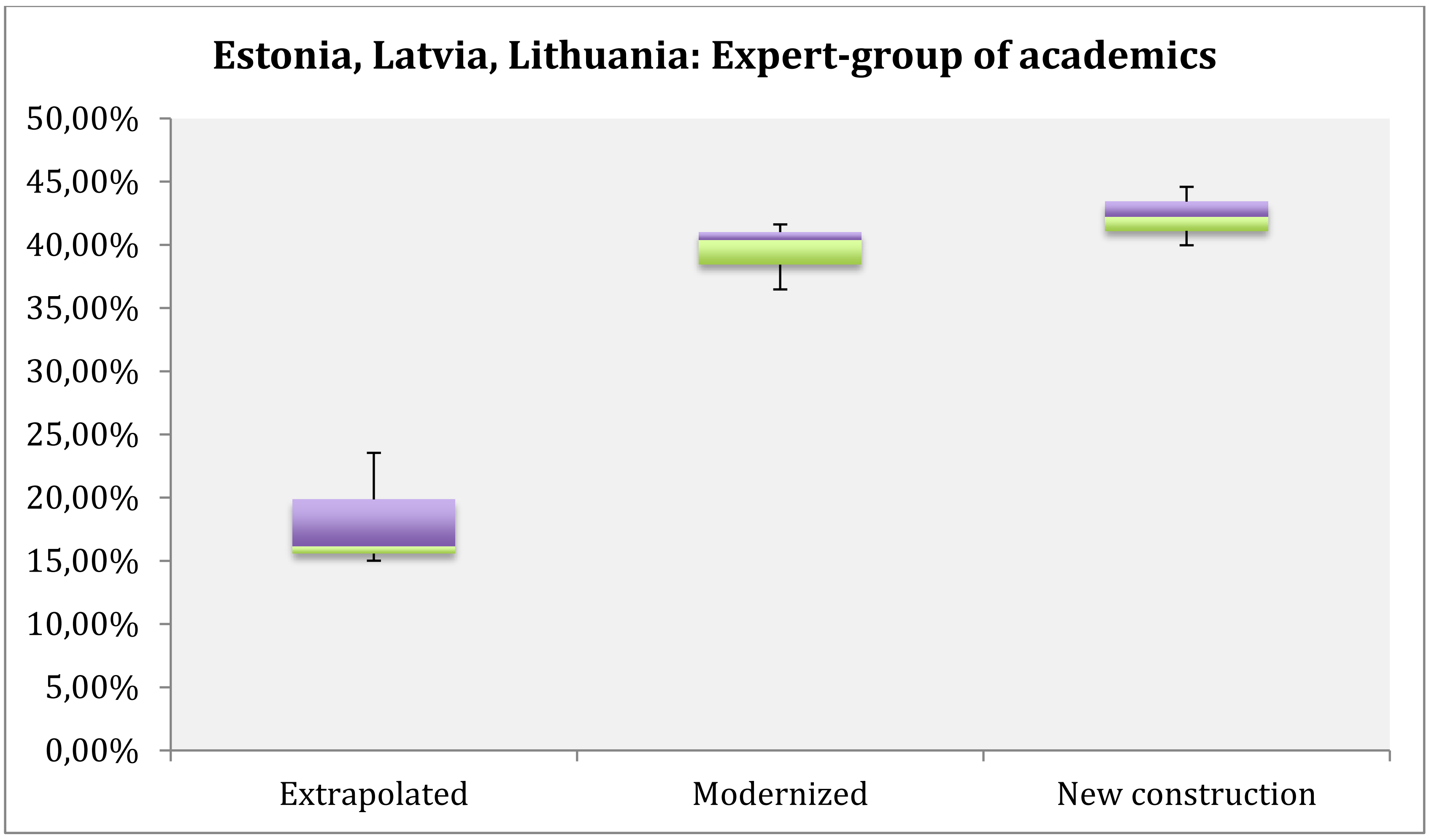
Appendix 106 Box-whisker interview-results, Estonia, Latvia, Lithuania, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
24.10%	37.66%	38.24%	Michael Wulf
7.36%	46.25%	46.39%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
13.68%	48.73%	37.58%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
8.31%	40.35%	51.34%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	15.01%	36.48%	39.97%
25th Percentile	15.58%	38.44%	41.11%
Median	16.15%	40.40%	42.24%
75th Percentile	19.85%	41.01%	43.42%
Maximum	23.55%	41.61%	44.59%

Data for chart	Extrapolated	Modernized	New construction
Series 1	15.01%	36.48%	39.97%
Series 2	0.57%	1.96%	1.14%
Series 3	0.57%	1.96%	1.14%
Series 4	3.70%	0.61%	1.18%
Series 5	3.70%	0.61%	1.18%



Source: Own analyses

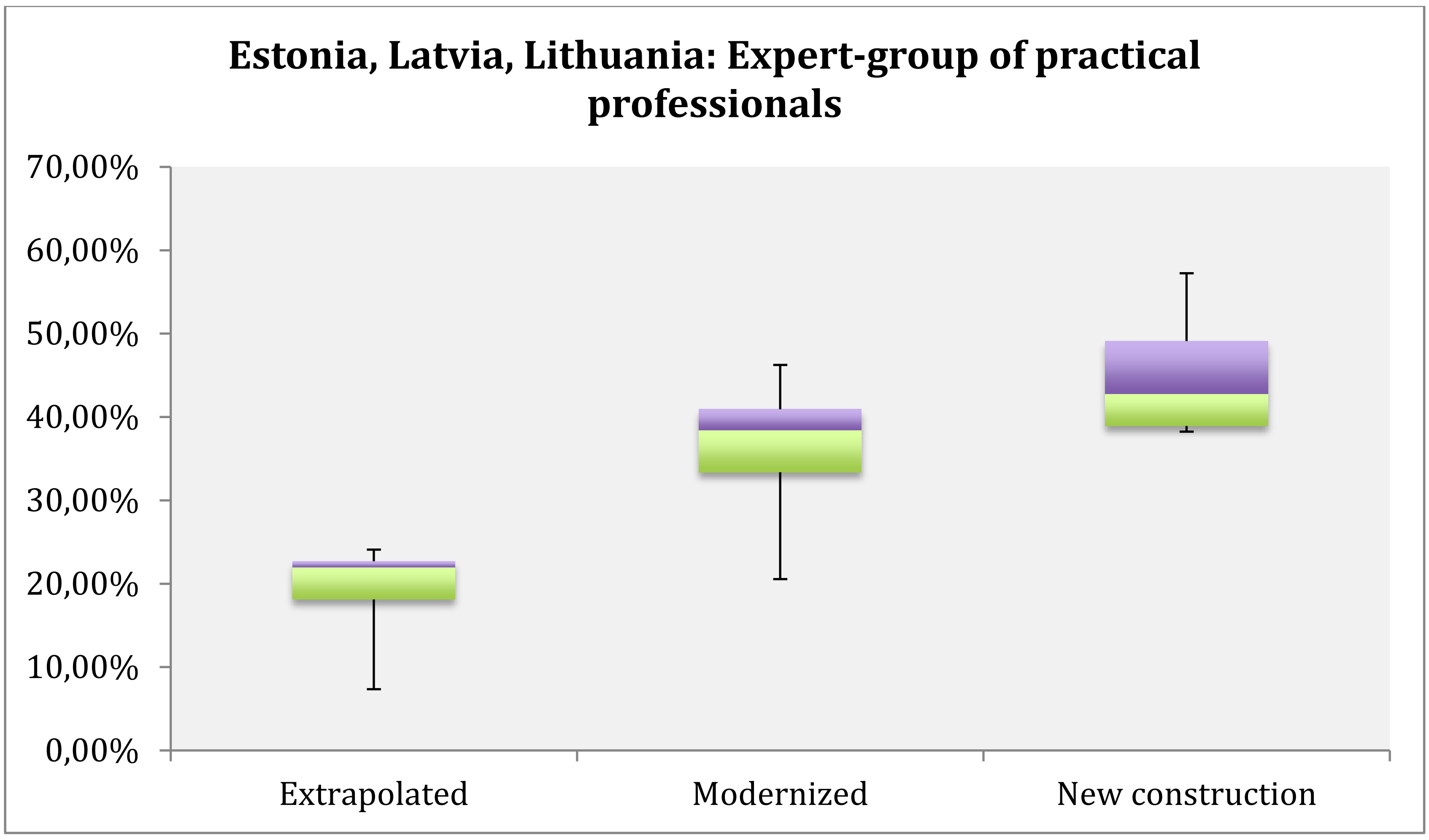
Appendix 107 Box-whisker interview-results, Estonia, Latvia, Lithuania, expert-group: Practical professionals

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
24.10%	37.66%	38.24%	Michael Wulf
7.36%	46.25%	46.39%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
13.68%	48.73%	37.58%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
8.31%	40.35%	51.34%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.36%	20.55%	38.24%
25th Percentile	18.12%	33.38%	38.92%
Median	21.97%	38.41%	42.77%
75th Percentile	22.70%	40.93%	49.10%
Maximum	24.10%	46.25%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.36%	20.55%	38.24%
Series 2	10.76%	12.83%	0.68%
Series 3	3.85%	5.02%	3.85%
Series 4	0.73%	2.52%	6.33%
Series 5	1.40%	5.33%	8.13%



Source: Own analyses

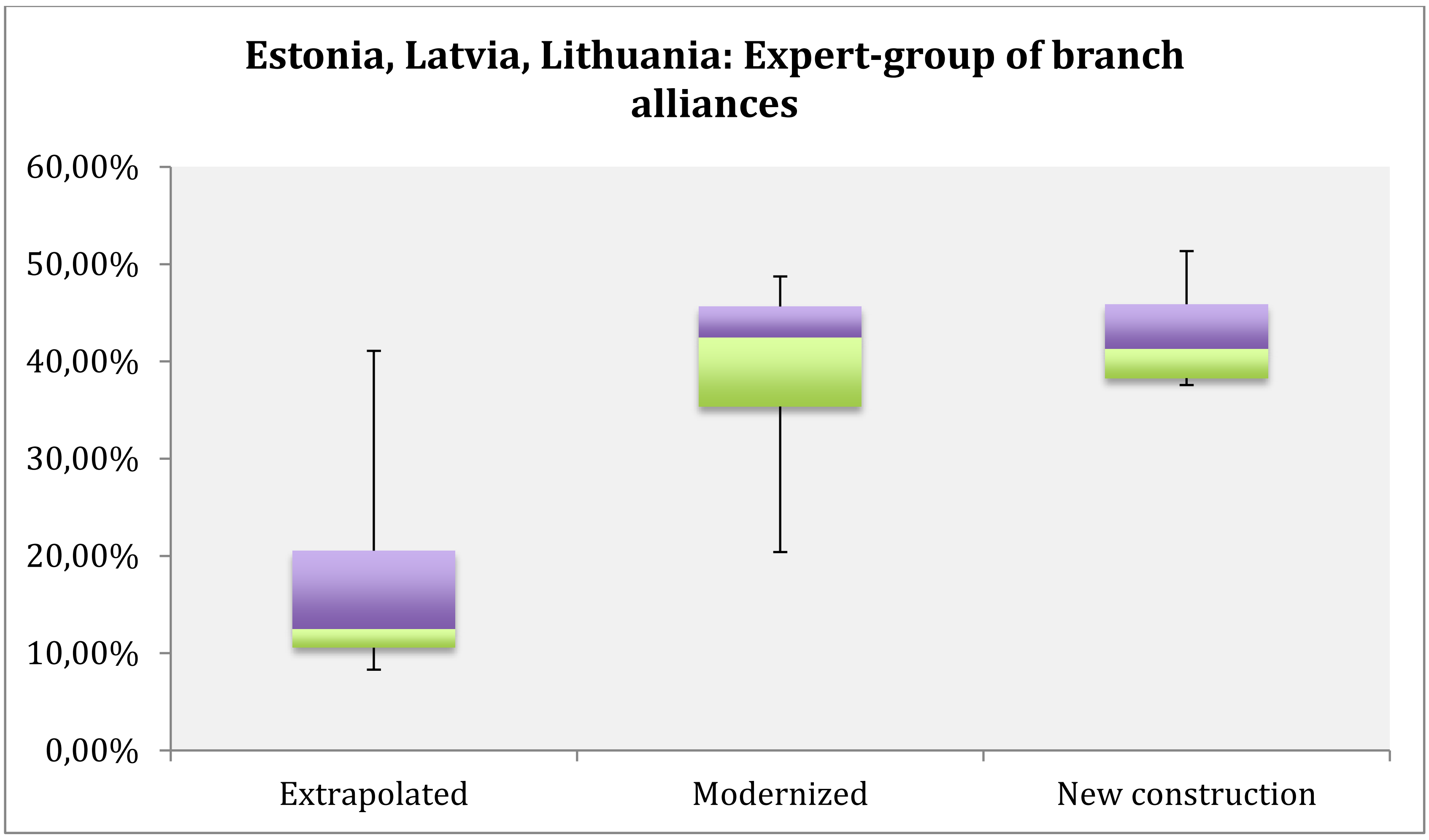
Appendix 108 Box-whisker interview-results, Estonia, Latvia, Lithuania, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
24.10%	37.66%	38.24%	Michael Wulf
7.36%	46.25%	46.39%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
13.68%	48.73%	37.58%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
8.31%	40.35%	51.34%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	8.31%	20.39%	37.58%
25th Percentile	10.58%	35.36%	38.29%
Median	12.51%	42.49%	41.29%
75th Percentile	20.53%	45.65%	45.87%
Maximum	41.09%	48.73%	51.34%

Data for chart	Extrapolated	Modernized	New construction
Series 1	8.31%	20.39%	37.58%
Series 2	2.27%	14.97%	0.71%
Series 3	1.93%	7.13%	3.00%
Series 4	8.03%	3.16%	4.59%
Series 5	20.56%	3.08%	5.47%



Source: Own analyses

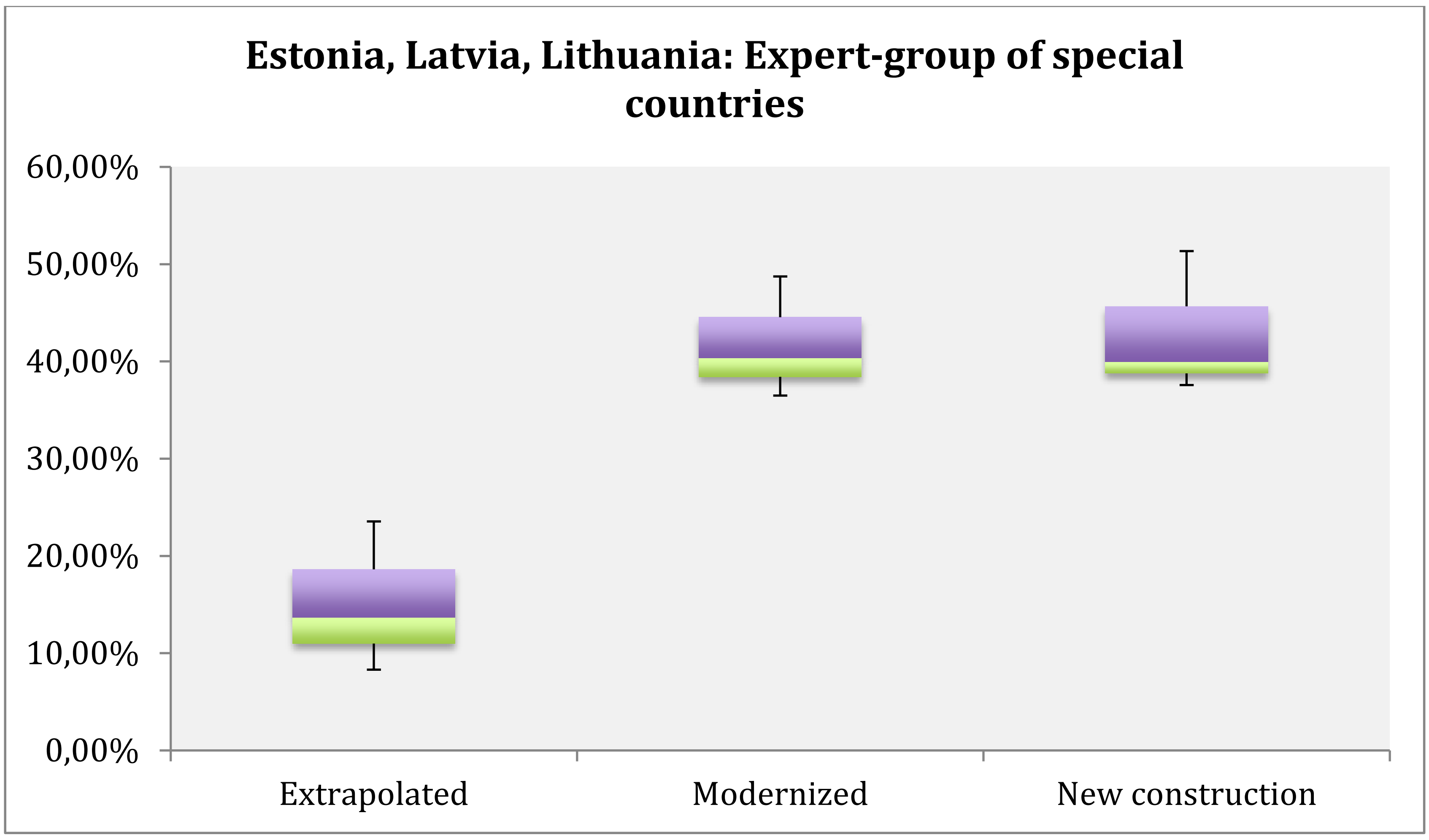
Appendix 109 Box-whisker interview-results, Estonia, Latvia, Lithuania, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
13.68%	48.73%	37.58%	Alice Pittini
8.31%	40.35%	51.34%	Klaus Schrader
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
24.10%	37.66%	38.24%	Michael Wulf
7.36%	46.25%	46.39%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
41.09%	20.39%	38.52%	Michael Pistorius

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	8.31%	36.48%	37.58%
25th Percentile	11.00%	38.42%	38.78%
Median	13.68%	40.35%	39.97%
75th Percentile	18.62%	44.54%	45.66%
Maximum	23.55%	48.73%	51.34%

Data for chart	Extrapolated	Modernized	New construction
Series 1	8.31%	36.48%	37.58%
Series 2	2.69%	1.94%	1.20%
Series 3	2.69%	1.94%	1.20%
Series 4	4.94%	4.19%	5.69%
Series 5	4.94%	4.19%	5.69%



Source: Own analyses

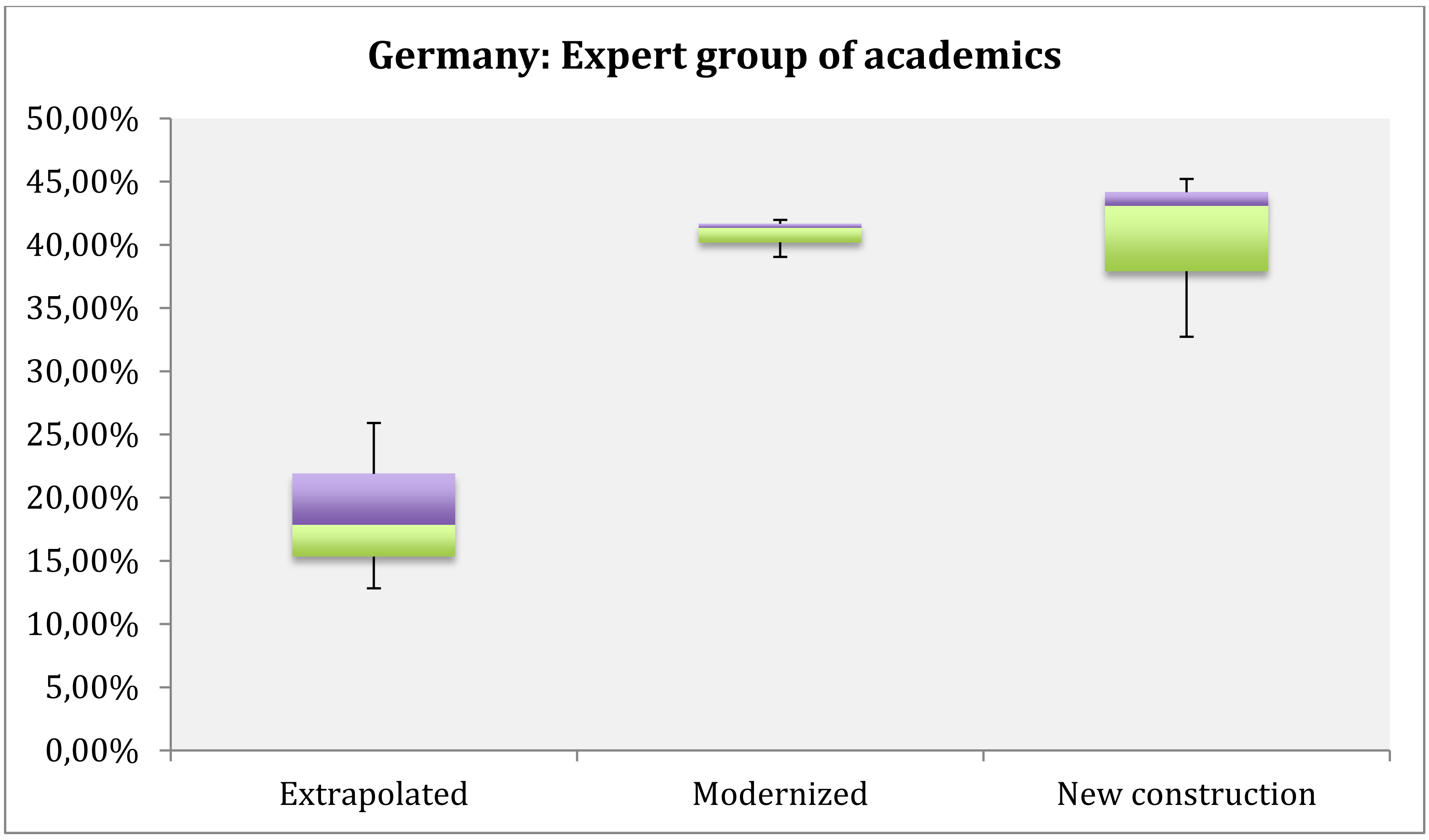
Appendix 110 Box-whisker interview-results, Germany, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
25.91%	41.36%	32.73%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
12.83%	41.97%	45.21%	Frank Borrmann
21.99%	47.07%	30.94%	Mara Meinel
36.24%	49.20%	14.57%	Michael Wulf
12.64%	71.18%	16.18%	Berit Jalas
16.27%	49.49%	34.24%	Richard Winter, Susanne Gentz
27.22%	43.87%	28.91%	Özgür Öner
24.00%	38.68%	37.32%	Michael Pistorius
34.14%	36.92%	28.94%	Klaus Schrader
15.58%	54.17%	30.24%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	12.83%	39.04%	32.73%
25th Percentile	15.35%	40.20%	37.92%
Median	17.86%	41.36%	43.10%
75th Percentile	21.89%	41.67%	44.16%
Maximum	25.91%	41.97%	45.21%

Data for chart	Extrapolated	Modernized	New construction
Series 1	12.83%	39.04%	32.73%
Series 2	2.52%	1.16%	5.19%
Series 3	2.52%	1.16%	5.19%
Series 4	4.03%	0.31%	1.06%
Series 5	4.03%	0.31%	1.06%



Source: Own analyses

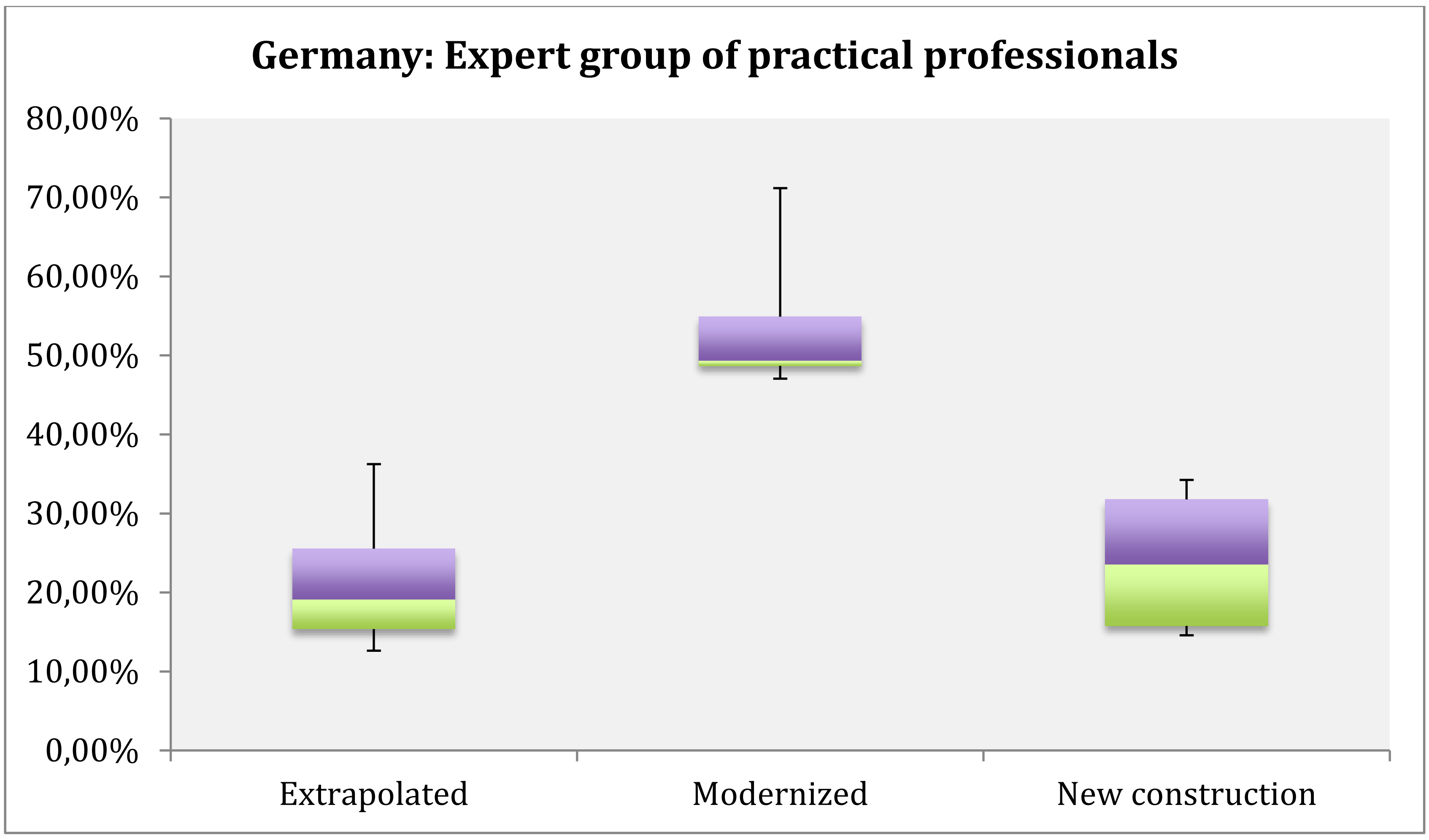
Appendix 111 Box-whisker interview-results, Germany, expert-group: Practical professionals

Extrapolated	Modernized	New construction	Interviewees
25.91%	41.36%	32.73%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
12.83%	41.97%	45.21%	Frank Borrmann
21.99%	47.07%	30.94%	Mara Meinel
36.24%	49.20%	14.57%	Michael Wulf
12.64%	71.18%	16.18%	Berit Jalas
16.27%	49.49%	34.24%	Richard Winter, Susanne Gentz
27.22%	43.87%	28.91%	Özgür Öner
24.00%	38.68%	37.32%	Michael Pistorius
34.14%	36.92%	28.94%	Klaus Schrader
15.58%	54.17%	30.24%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	12.64%	47.07%	14.57%
25th Percentile	15.36%	48.67%	15.78%
Median	19.13%	49.35%	23.56%
75th Percentile	25.55%	54.91%	31.77%
Maximum	36.24%	71.18%	34.24%

Data for chart	Extrapolated	Modernized	New construction
Series 1	12.64%	47.07%	14.57%
Series 2	2.72%	1.60%	1.21%
Series 3	3.77%	0.68%	7.78%
Series 4	6.42%	5.57%	8.21%
Series 5	10.69%	16.27%	2.48%



Source: Own analyses

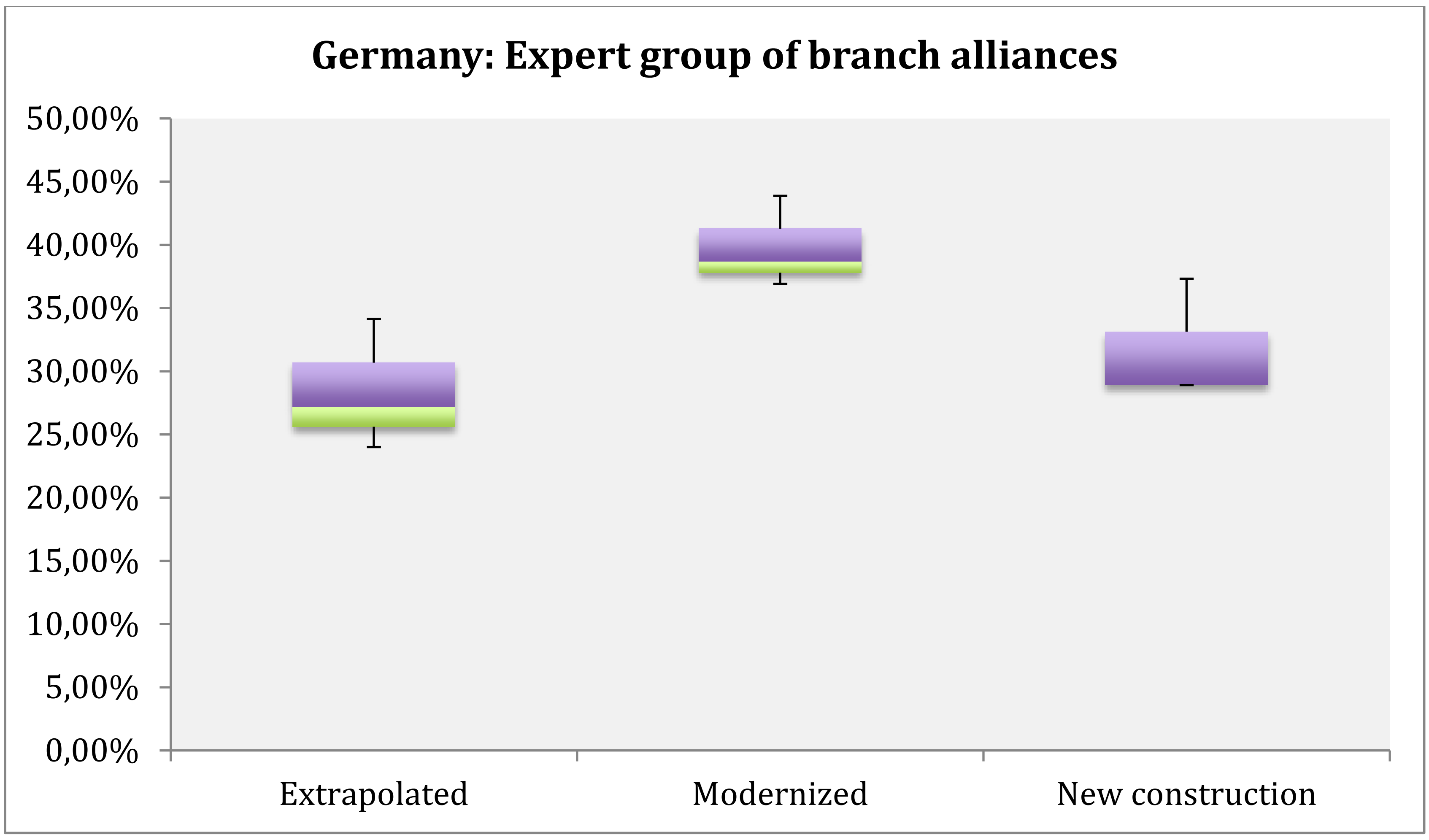
Appendix 112 Box-whisker interview-results, Germany, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
25.91%	41.36%	32.73%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
12.83%	41.97%	45.21%	Frank Borrmann
21.99%	47.07%	30.94%	Mara Meinel
36.24%	49.20%	14.57%	Michael Wulf
12.64%	71.18%	16.18%	Berit Jalas
16.27%	49.49%	34.24%	Richard Winter, Susanne Gentz
27.22%	43.87%	28.91%	Özgür Öner
24.00%	38.68%	37.32%	Michael Pistorius
34.14%	36.92%	28.94%	Klaus Schrader
15.58%	54.17%	30.24%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	24.00%	36.92%	28.91%
25th Percentile	25.61%	37.80%	28.93%
Median	27.22%	38.68%	28.94%
75th Percentile	30.68%	41.28%	33.13%
Maximum	34.14%	43.87%	37.32%

Data for chart	Extrapolated	Modernized	New construction
Series 1	24.00%	36.92%	28.91%
Series 2	1.61%	0.88%	0.01%
Series 3	1.61%	0.88%	0.01%
Series 4	3.46%	2.60%	4.19%
Series 5	3.46%	2.60%	4.19%



Source: Own analyses

Appendix 113 Box-whisker interview-results, Germany, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
25.91%	41.36%	32.73%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
12.83%	41.97%	45.21%	Frank Borrmann
21.99%	47.07%	30.94%	Mara Meinel
36.24%	49.20%	14.57%	Michael Wulf
12.64%	71.18%	16.18%	Berit Jalas
16.27%	49.49%	34.24%	Richard Winter, Susanne Gentz
27.22%	43.87%	28.91%	Özgür Öner
24.00%	38.68%	37.32%	Michael Pistorius
34.14%	36.92%	28.94%	Klaus Schrader
15.58%	54.17%	30.24%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	12.64%	36.92%	14.57%
25th Percentile	15.93%	40.20%	28.93%
Median	21.99%	43.87%	30.94%
75th Percentile	26.57%	49.35%	35.78%
Maximum	36.24%	71.18%	45.21%

Data for chart	Extrapolated	Modernized	New construction
Series 1	12.64%	36.92%	14.57%
Series 2	3.29%	3.28%	14.36%
Series 3	6.07%	3.67%	2.02%
Series 4	4.58%	5.48%	4.84%
Series 5	9.68%	21.84%	9.43%

Source: Own analyses

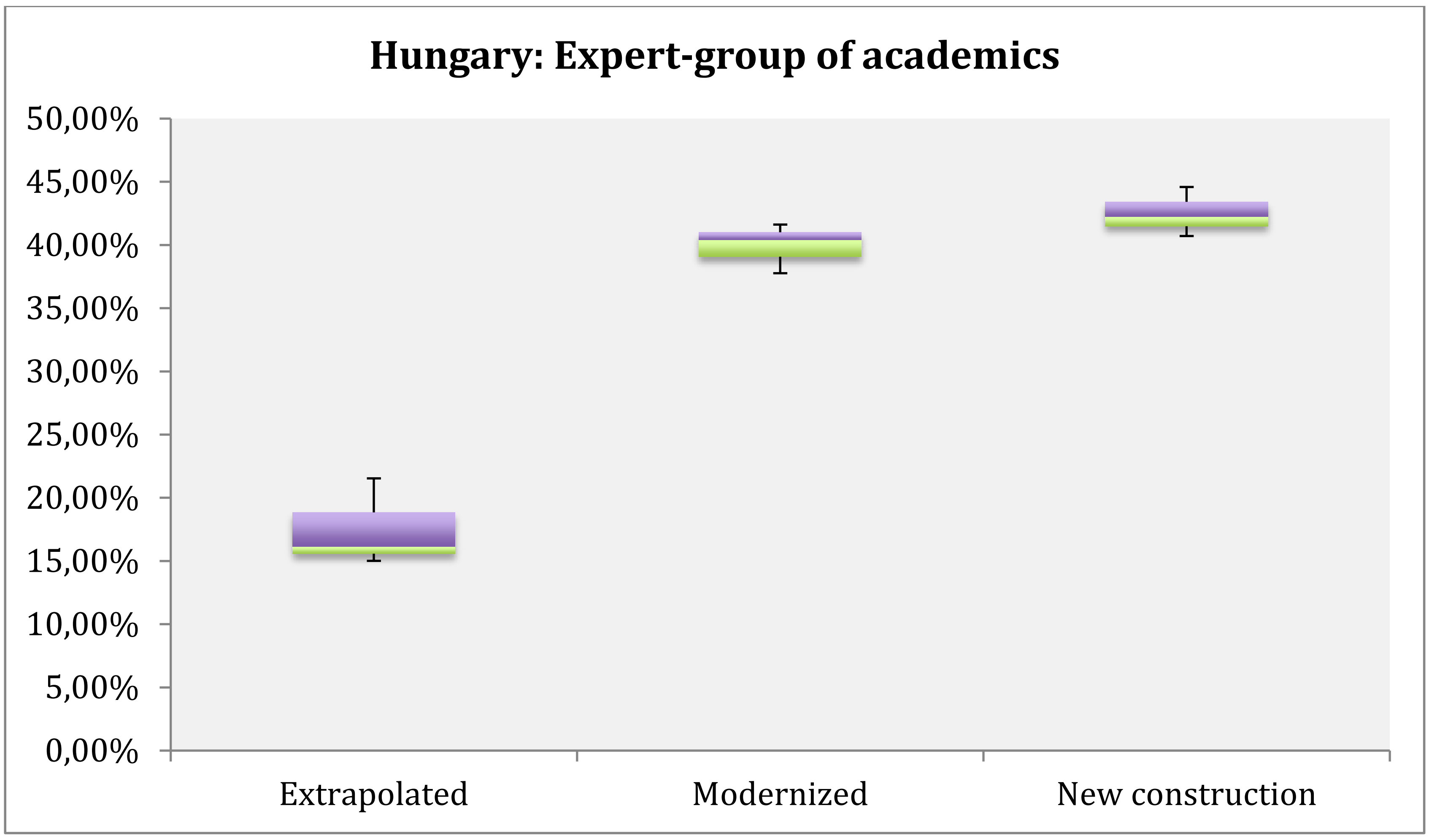
Appendix 114 Box-whisker interview-results, Hungary, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
17.76%	49.27%	32.97%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	15.01%	37.76%	40.71%
25th Percentile	15.58%	39.08%	41.48%
Median	16.15%	40.40%	42.24%
75th Percentile	18.85%	41.01%	43.42%
Maximum	21.54%	41.61%	44.59%

Data for chart	Extrapolated	Modernized	New construction
Series 1	15.01%	37.76%	40.71%
Series 2	0.57%	1.32%	0.76%
Series 3	0.57%	1.32%	0.76%
Series 4	2.70%	0.61%	1.18%
Series 5	2.70%	0.61%	1.18%



Source: Own analyses

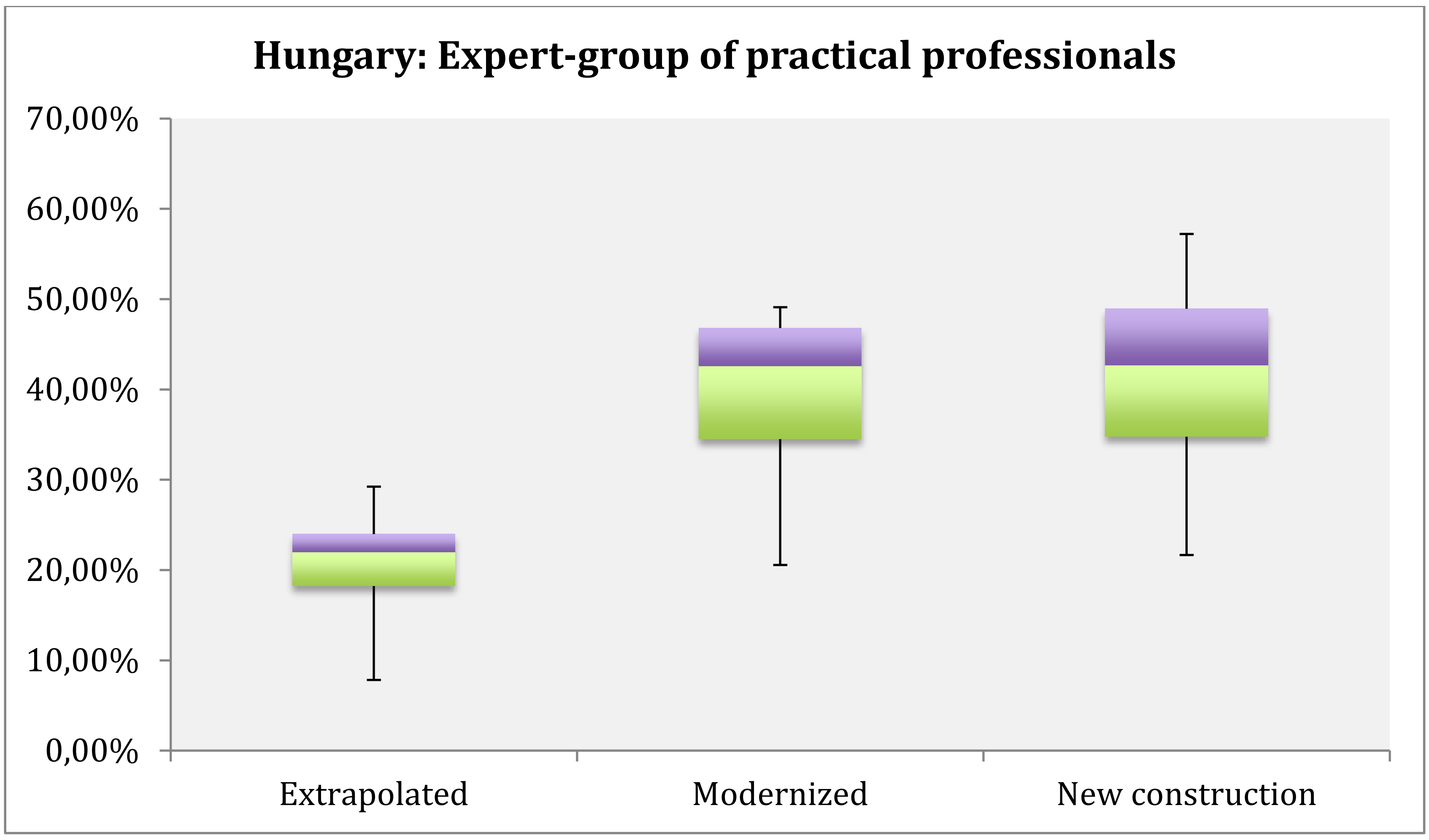
Appendix 115 Box-whisker interview-results, Hungary, expert-group: Practical professionals

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
17.76%	49.27%	32.97%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.82%	20.55%	21.66%
25th Percentile	18.23%	34.50%	34.78%
Median	21.97%	42.59%	42.66%
75th Percentile	23.98%	46.79%	48.94%
Maximum	29.23%	49.11%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.82%	20.55%	21.66%
Series 2	10.41%	13.95%	13.12%
Series 3	3.74%	8.09%	7.88%
Series 4	2.02%	4.21%	6.28%
Series 5	5.25%	2.32%	8.30%



Source: Own analyses

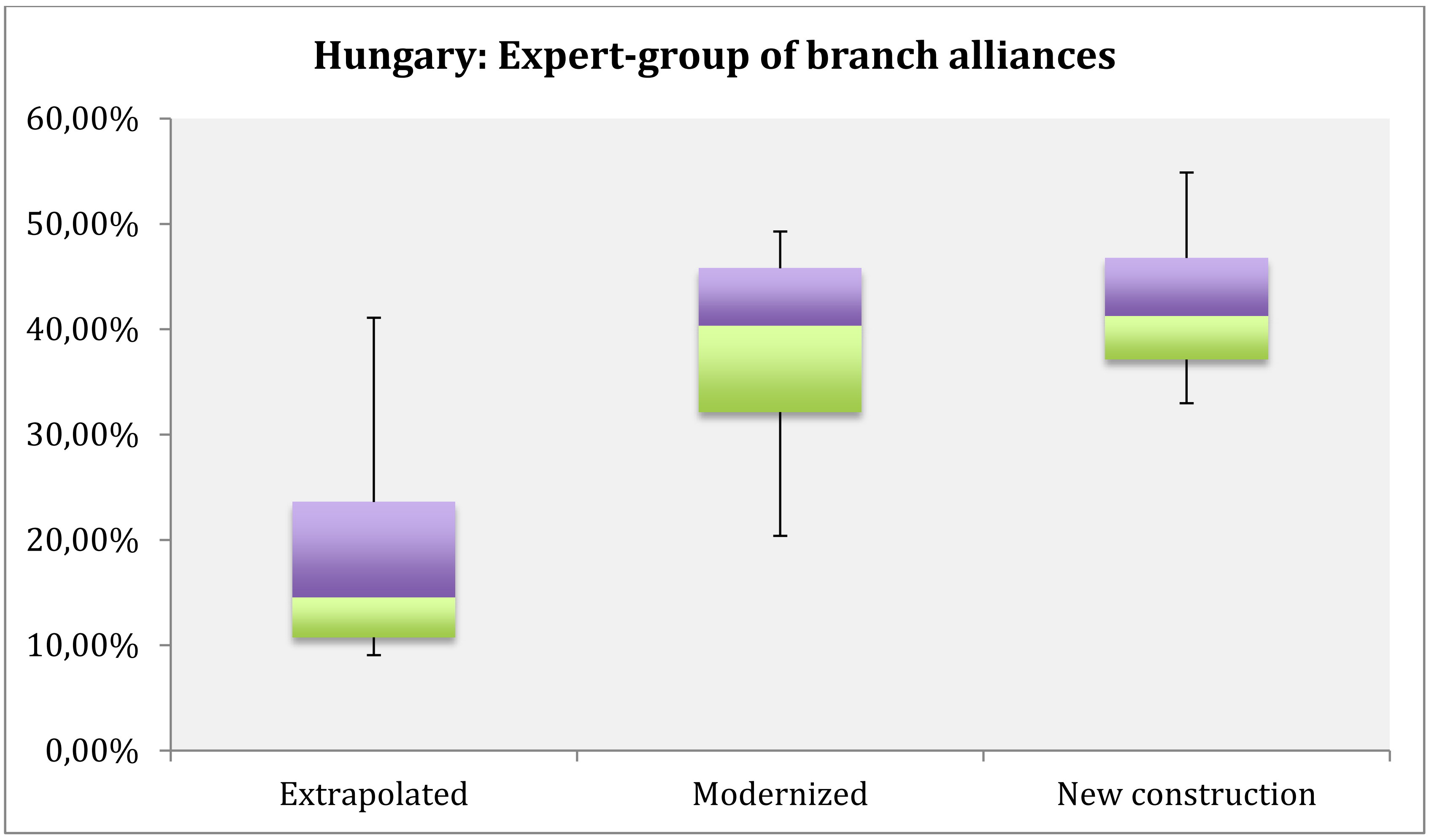
Appendix 116 Box-whisker interview-results, Hungary, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
17.76%	49.27%	32.97%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	9.07%	20.39%	32.97%
25th Percentile	10.77%	32.14%	37.13%
Median	14.55%	40.34%	41.29%
75th Percentile	23.59%	45.78%	46.76%
Maximum	41.09%	49.27%	54.88%

Data for chart	Extrapolated	Modernized	New construction
Series 1	9.07%	20.39%	32.97%
Series 2	1.70%	11.75%	4.16%
Series 3	3.78%	8.20%	4.15%
Series 4	9.05%	5.45%	5.47%
Series 5	17.50%	3.49%	8.12%



Source: Own analyses

Appendix 117 Box-whisker interview-results, Hungary, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
17.76%	49.27%	32.97%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

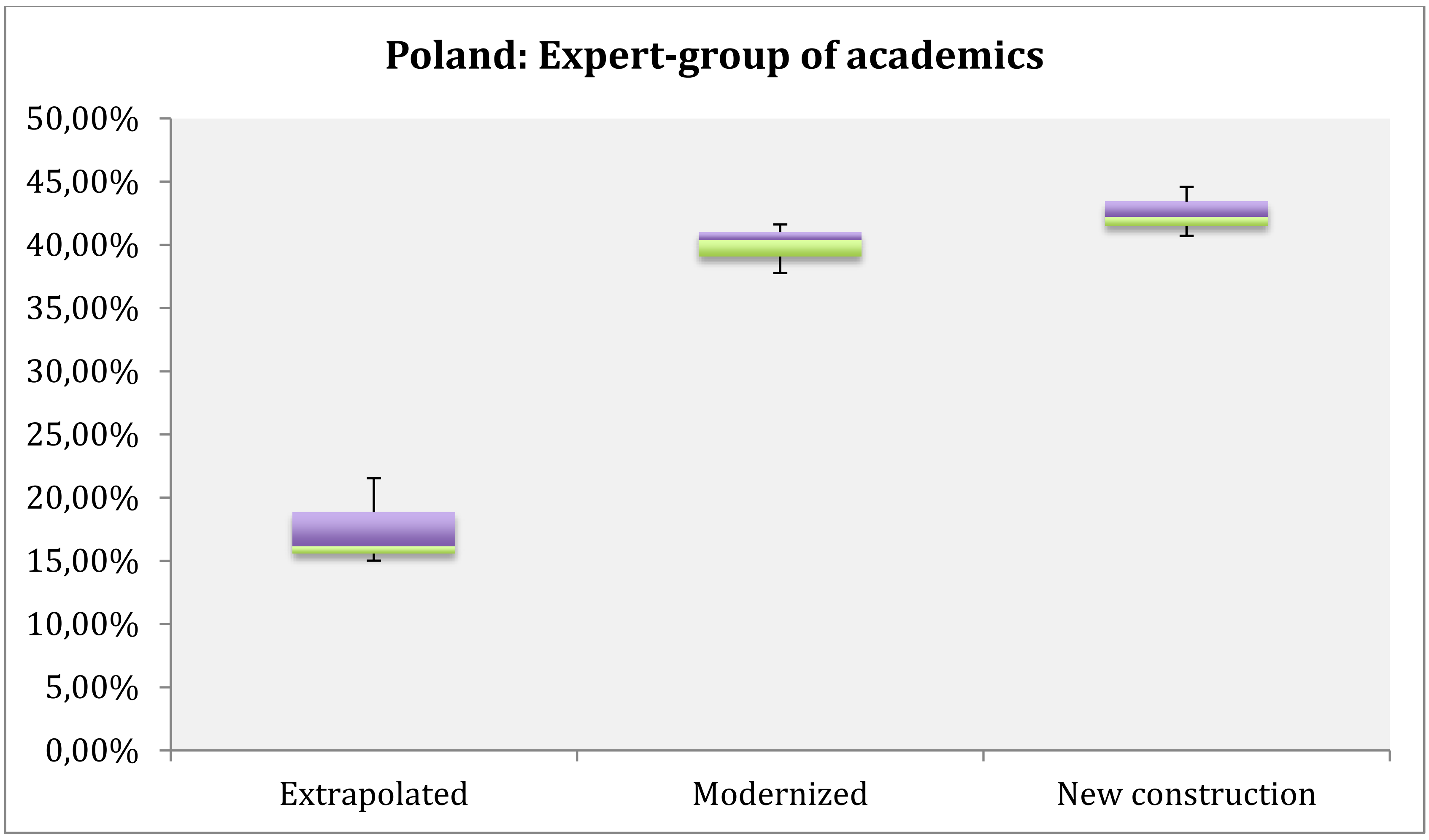
Appendix 118 Box-whisker interview-results, Poland, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
19.19%	38.69%	42.12%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
19.91%	44.73%	35.36%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
11.86%	44.47%	43.68%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
12.37%	34.44%	53.19%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	15.01%	37.76%	40.71%
25th Percentile	15.58%	39.08%	41.48%
Median	16.15%	40.40%	42.24%
75th Percentile	18.85%	41.01%	43.42%
Maximum	21.54%	41.61%	44.59%

Data for chart	Extrapolated	Modernized	New construction
Series 1	15.01%	37.76%	40.71%
Series 2	0.57%	1.32%	0.76%
Series 3	0.57%	1.32%	0.76%
Series 4	2.70%	0.61%	1.18%
Series 5	2.70%	0.61%	1.18%



Source: Own analyses

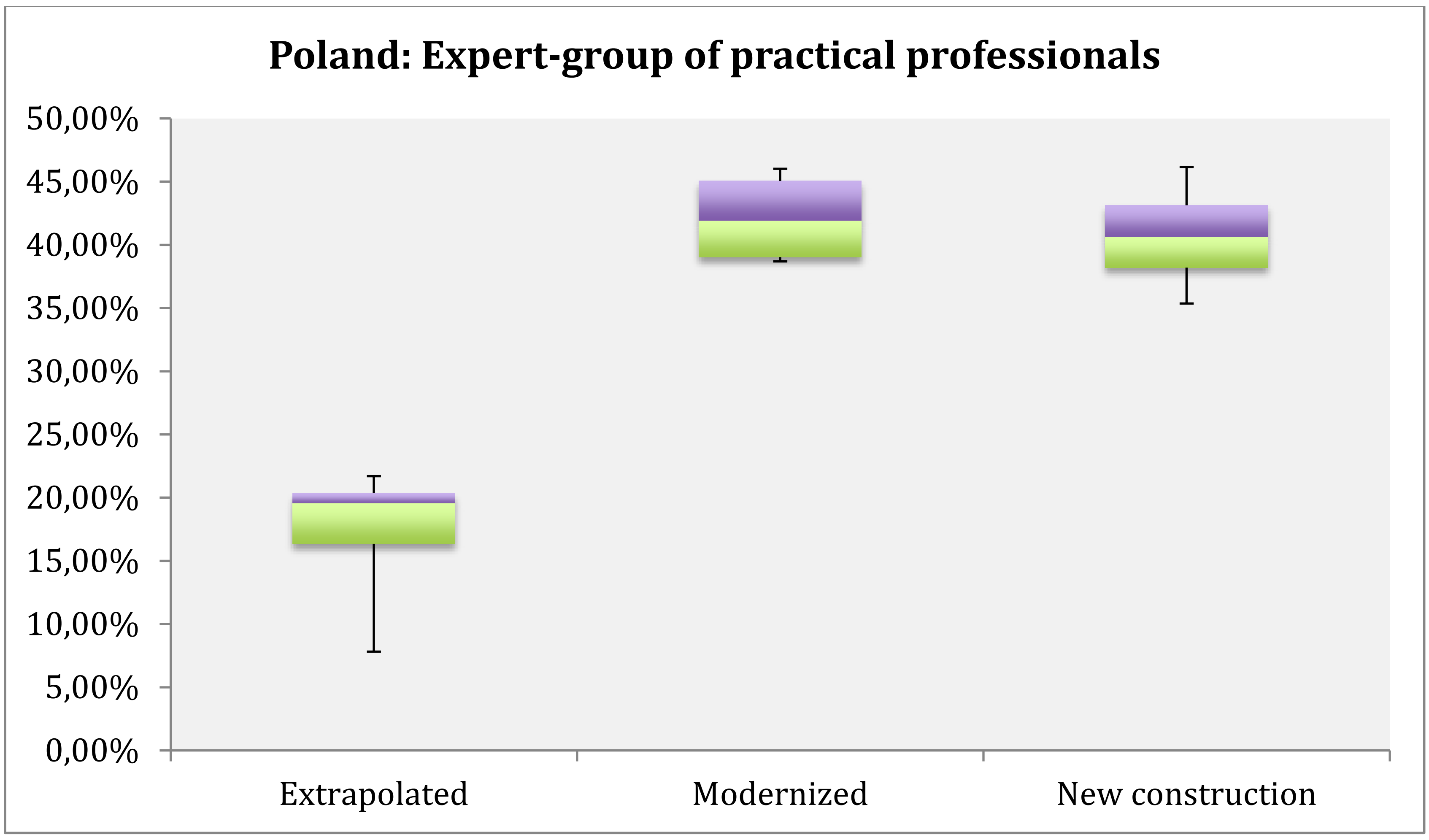
Appendix 119 Box-whisker interview-results, Poland, expert-group: Practical professionals

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
19.19%	38.69%	42.12%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
19.91%	44.73%	35.36%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
11.86%	44.47%	43.68%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
12.37%	34.44%	53.19%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.82%	38.69%	35.36%
25th Percentile	16.35%	39.04%	38.20%
Median	19.55%	41.94%	40.64%
75th Percentile	20.36%	45.05%	43.13%
Maximum	21.70%	46.02%	46.17%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.82%	38.69%	35.36%
Series 2	8.53%	0.35%	2.84%
Series 3	3.20%	2.91%	2.43%
Series 4	0.81%	3.11%	2.50%
Series 5	1.34%	0.97%	3.04%



Source: Own analyses

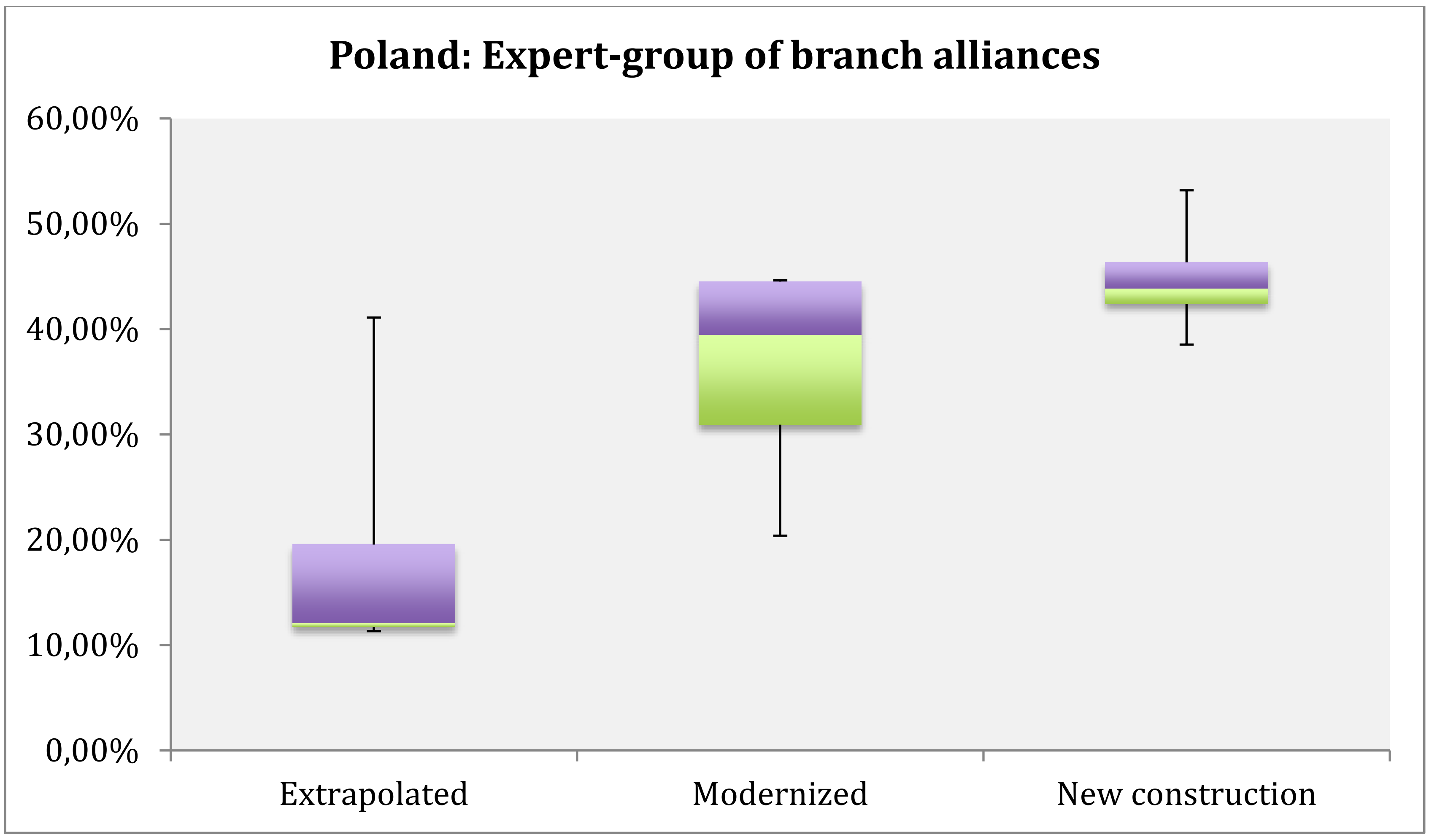
Appendix 120 Box-whisker interview-results, Poland, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
19.19%	38.69%	42.12%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
19.91%	44.73%	35.36%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
11.86%	44.47%	43.68%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
12.37%	34.44%	53.19%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	11.33%	20.39%	38.52%
25th Percentile	11.73%	30.93%	42.39%
Median	12.12%	39.46%	43.87%
75th Percentile	19.55%	44.51%	46.34%
Maximum	41.09%	44.62%	53.19%

Data for chart	Extrapolated	Modernized	New construction
Series 1	11.33%	20.39%	38.52%
Series 2	0.40%	10.54%	3.87%
Series 3	0.39%	8.53%	1.48%
Series 4	7.44%	5.05%	2.47%
Series 5	21.54%	0.11%	6.86%



Source: Own analyses

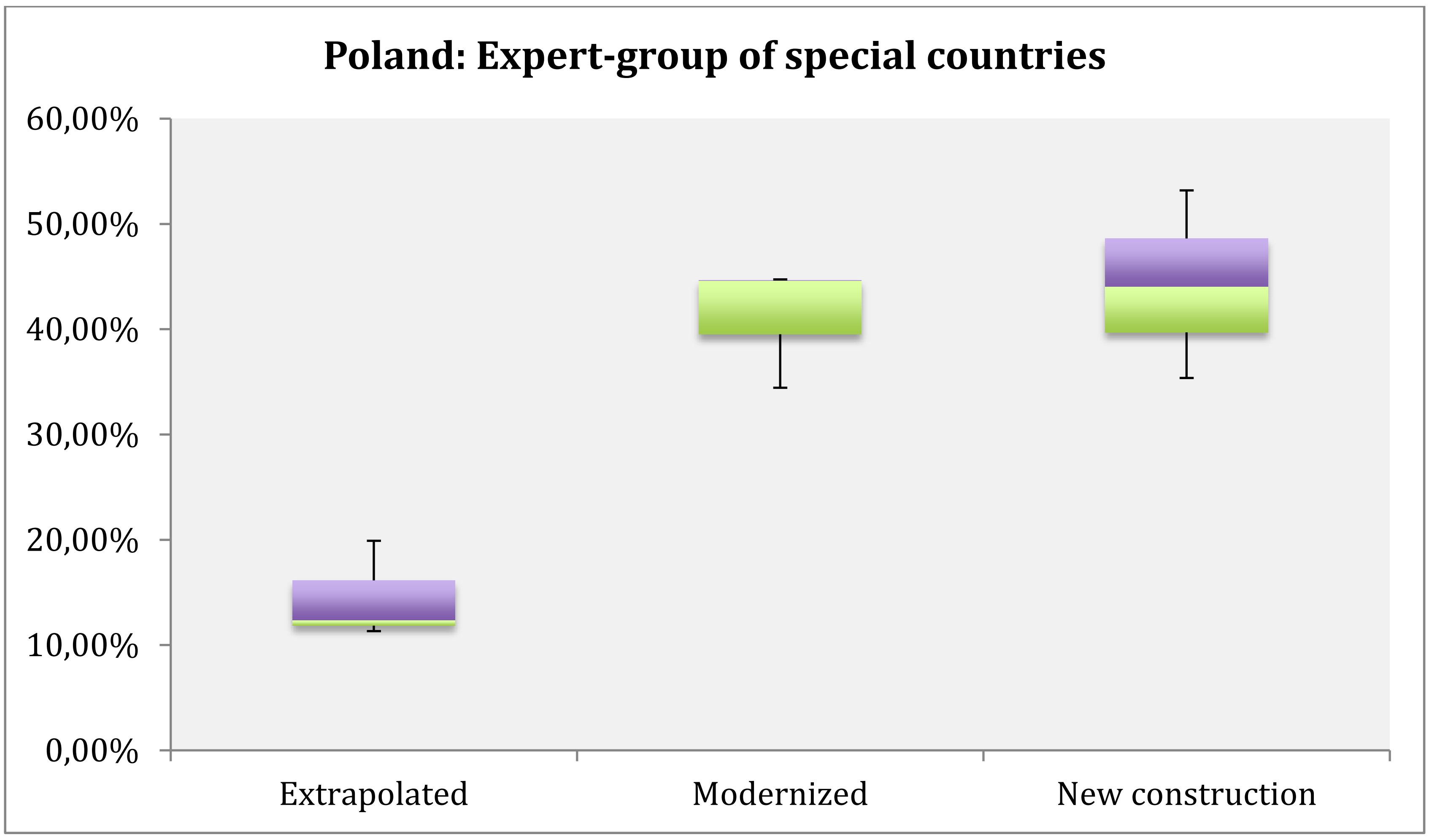
Appendix 121 Box-whisker interview-results, Poland, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
19.91%	44.73%	35.36%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
12.37%	34.44%	53.19%	Klaus Schrader
21.54%	37.76%	40.71%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
19.19%	38.69%	42.12%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
11.86%	44.47%	43.68%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	11.33%	34.44%	35.36%
25th Percentile	11.85%	39.53%	39.71%
Median	12.37%	44.62%	44.05%
75th Percentile	16.14%	44.68%	48.62%
Maximum	19.91%	44.73%	53.19%

Data for chart	Extrapolated	Modernized	New construction
Series 1	11.33%	34.44%	35.36%
Series 2	0.52%	5.09%	4.35%
Series 3	0.52%	5.09%	4.35%
Series 4	3.77%	0.05%	4.57%
Series 5	3.77%	0.05%	4.57%



Source: Own analyses

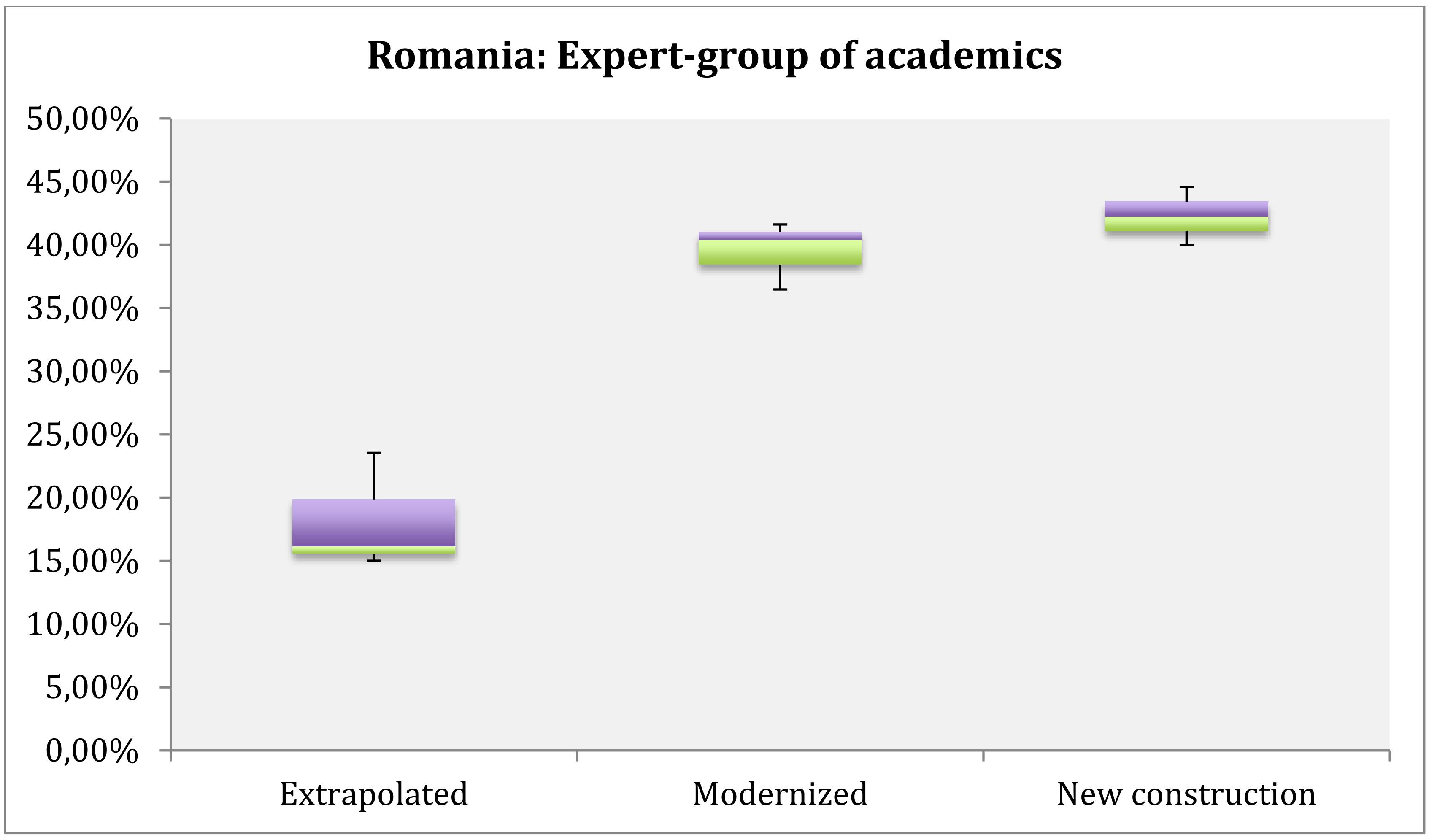
Appendix 122 Box-whisker interview-results, Romania, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
18.74%	24.58%	56.68%	Klaus Kirchhoff

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	15.01%	36.48%	39.97%
25th Percentile	15.58%	38.44%	41.11%
Median	16.15%	40.40%	42.24%
75th Percentile	19.85%	41.01%	43.42%
Maximum	23.55%	41.61%	44.59%

Data for chart	Extrapolated	Modernized	New construction
Series 1	15.01%	36.48%	39.97%
Series 2	0.57%	1.96%	1.14%
Series 3	0.57%	1.96%	1.14%
Series 4	3.70%	0.61%	1.18%
Series 5	3.70%	0.61%	1.18%



Source: Own analyses

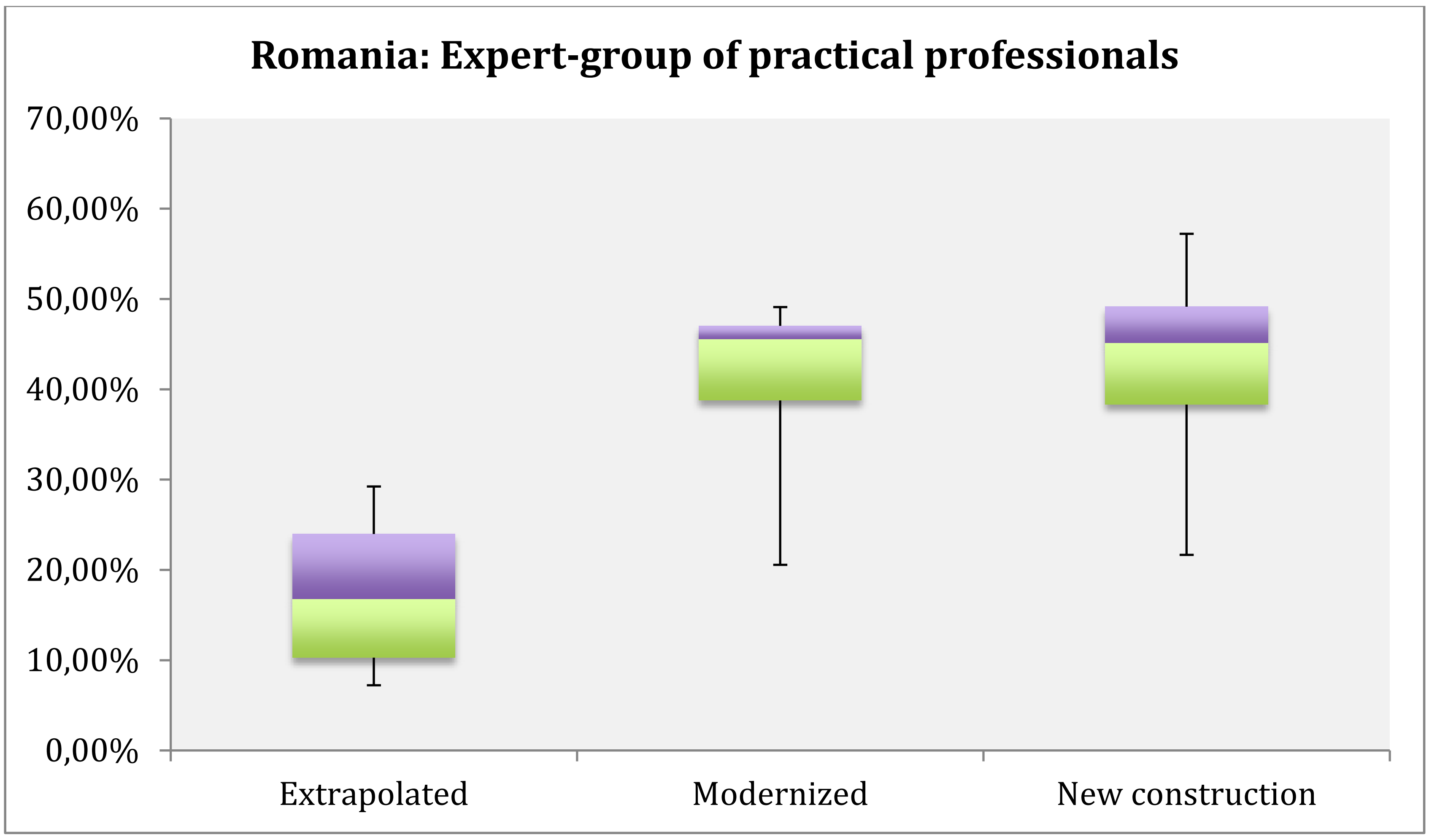
Appendix 123 Box-whisker interview-results, Romania, expert-group: Practical professionals

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
18.74%	24.58%	56.68%	Klaus Kirchhoff

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.22%	20.55%	21.66%
25th Percentile	10.27%	38.77%	38.32%
Median	16.76%	45.59%	45.16%
75th Percentile	23.98%	47.03%	49.15%
Maximum	29.23%	49.11%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.22%	20.55%	21.66%
Series 2	3.05%	18.22%	16.66%
Series 3	6.49%	6.82%	6.84%
Series 4	7.22%	1.44%	3.99%
Series 5	5.25%	2.09%	8.09%



Source: Own analyses

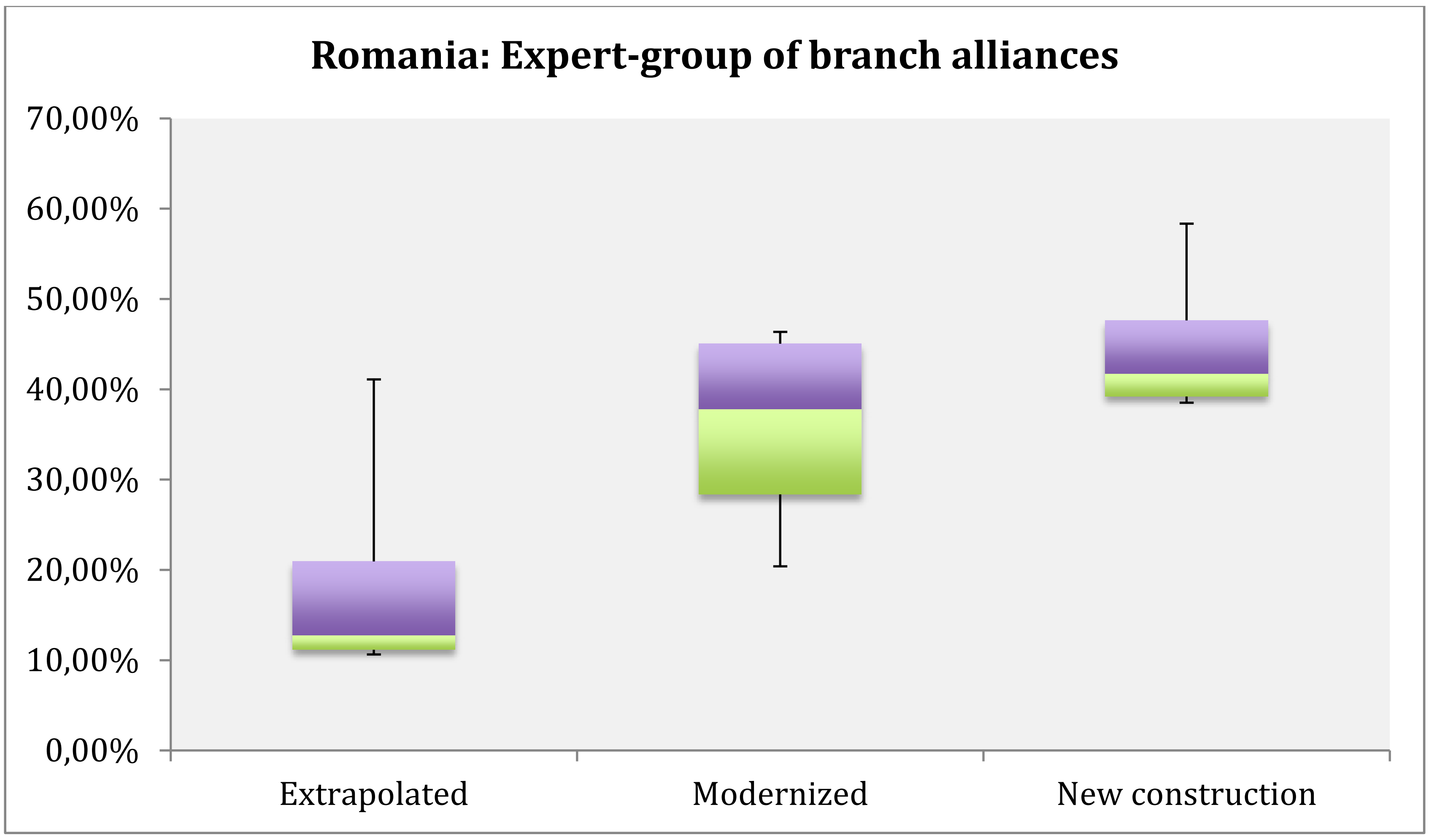
Appendix 124 Box-whisker interview-results, Romania, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
11.29%	44.84%	43.87%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader
18.74%	24.58%	56.68%	Klaus Kirchhoff

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	10.64%	20.39%	38.52%
25th Percentile	11.16%	28.36%	39.20%
Median	12.77%	37.82%	41.74%
75th Percentile	20.93%	45.06%	47.63%
Maximum	41.09%	46.36%	58.35%

Data for chart	Extrapolated	Modernized	New construction
Series 1	10.64%	20.39%	38.52%
Series 2	0.52%	7.97%	0.68%
Series 3	1.61%	9.46%	2.54%
Series 4	8.16%	7.24%	5.89%
Series 5	20.16%	1.31%	10.73%



Source: Own analyses

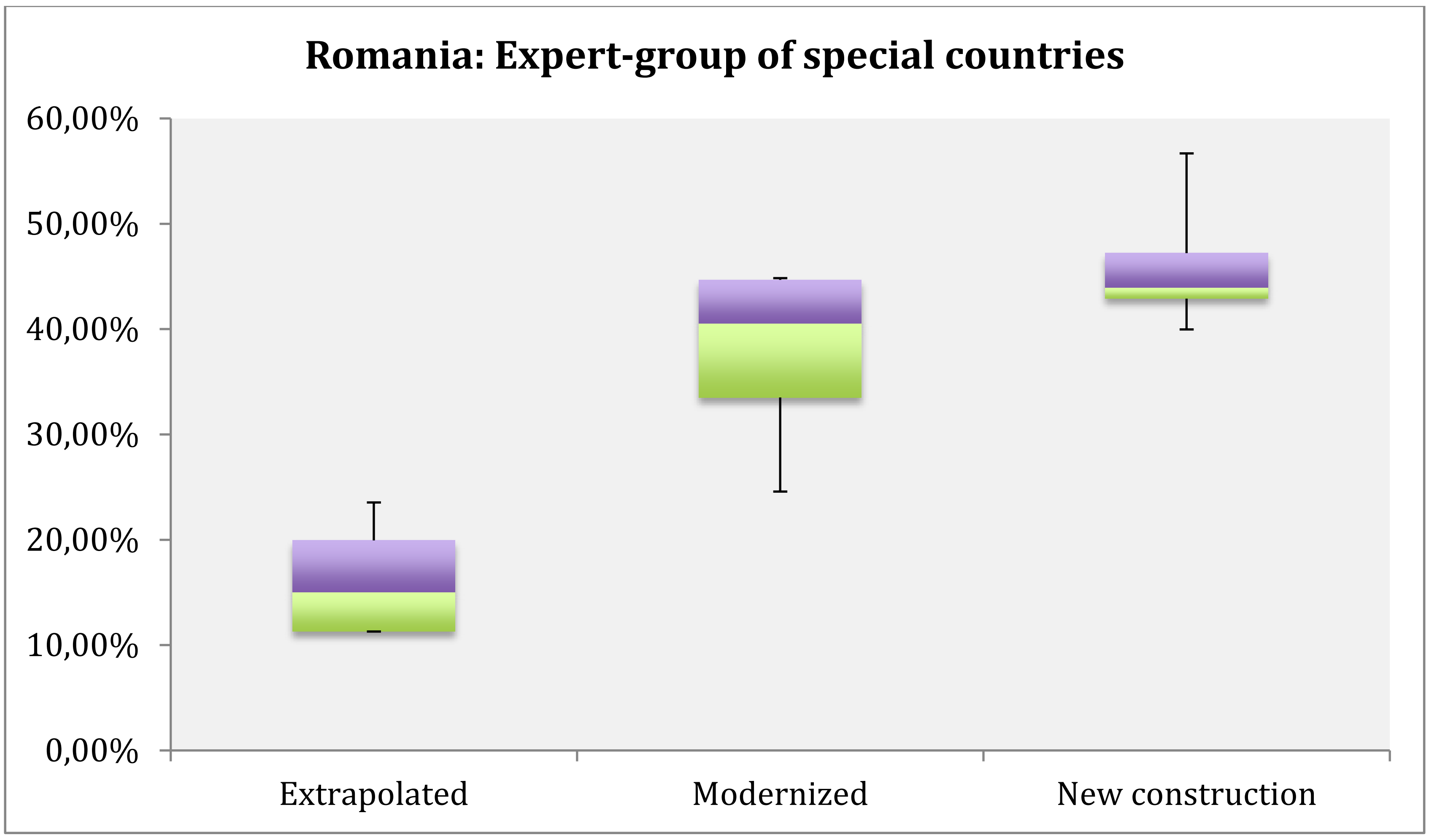
Appendix 125 Box-whisker interview-results, Romania, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
11.29%	44.84%	43.87%	Mara Meinel
11.33%	44.62%	44.05%	Özgür Öner
18.74%	24.58%	56.68%	Klaus Kirchhoff
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
29.23%	49.11%	21.66%	Michael Wulf
7.22%	46.33%	46.45%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
14.21%	46.36%	39.42%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
10.64%	31.01%	58.35%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	11.29%	24.58%	39.97%
25th Percentile	11.32%	33.51%	42.90%
Median	15.04%	40.55%	43.96%
75th Percentile	19.94%	44.68%	47.21%
Maximum	23.55%	44.84%	56.68%

Data for chart	Extrapolated	Modernized	New construction
Series 1	11.29%	24.58%	39.97%
Series 2	0.03%	8.93%	2.93%
Series 3	3.72%	7.05%	1.07%
Series 4	4.91%	4.13%	3.25%
Series 5	3.61%	0.17%	9.47%



Source: Own analyses

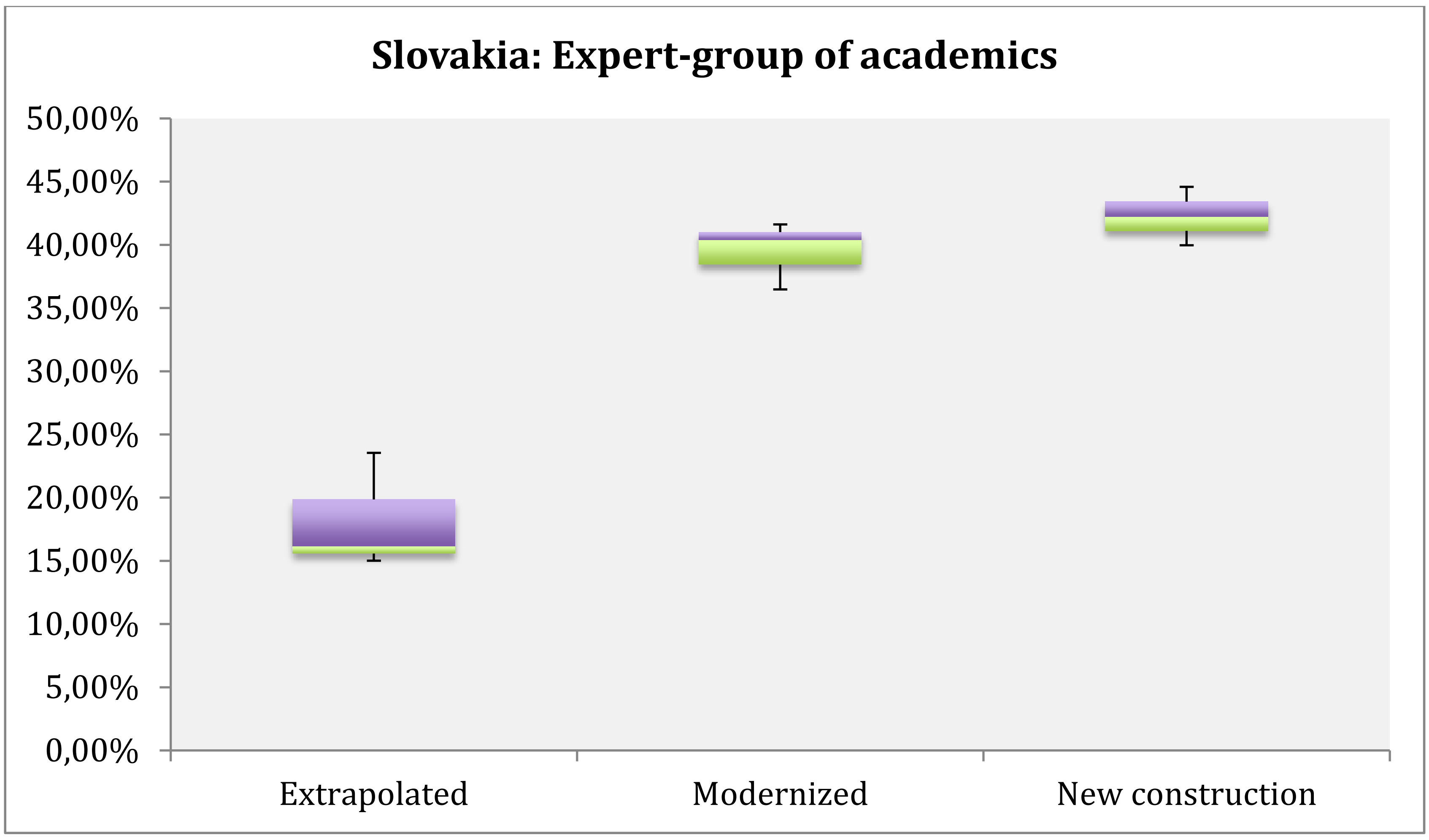
Appendix 126 Box-whisker interview-results, Slovakia, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
10.70%	43.43%	45.87%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	15.01%	36.48%	39.97%
25th Percentile	15.58%	38.44%	41.11%
Median	16.15%	40.40%	42.24%
75th Percentile	19.85%	41.01%	43.42%
Maximum	23.55%	41.61%	44.59%

Data for chart	Extrapolated	Modernized	New construction
Series 1	15.01%	36.48%	39.97%
Series 2	0.57%	1.96%	1.14%
Series 3	0.57%	1.96%	1.14%
Series 4	3.70%	0.61%	1.18%
Series 5	3.70%	0.61%	1.18%



Source: Own analyses

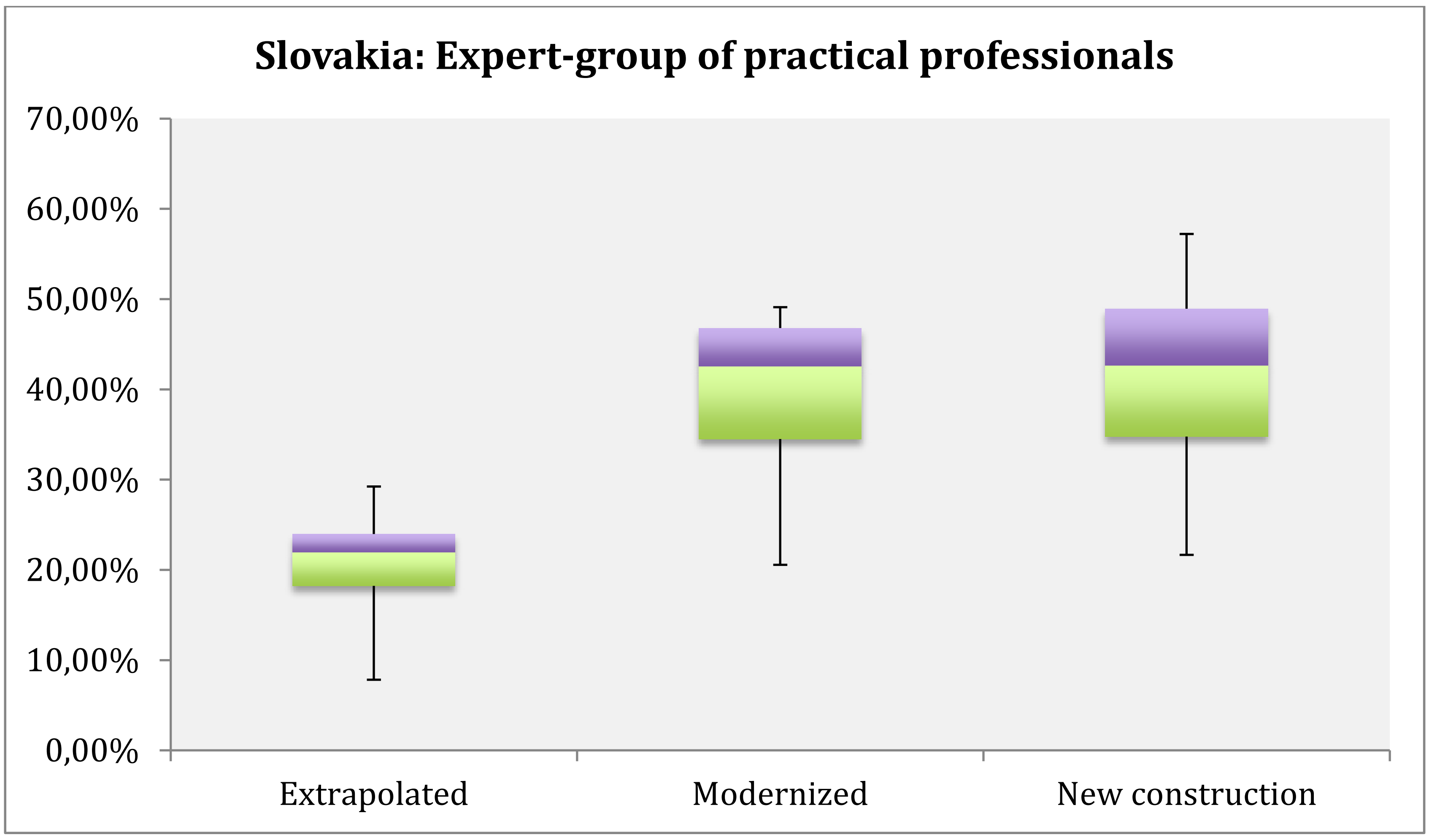
Appendix 127 Box-whisker interview-results, Slovakia, expert-group: Practical professionals

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
10.70%	43.43%	45.87%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	7.82%	20.55%	21.66%
25th Percentile	18.23%	34.50%	34.78%
Median	21.97%	42.59%	42.66%
75th Percentile	23.98%	46.79%	48.94%
Maximum	29.23%	49.11%	57.23%

Data for chart	Extrapolated	Modernized	New construction
Series 1	7.82%	20.55%	21.66%
Series 2	10.41%	13.95%	13.12%
Series 3	3.74%	8.09%	7.88%
Series 4	2.02%	4.21%	6.28%
Series 5	5.25%	2.32%	8.30%



Source: Own analyses

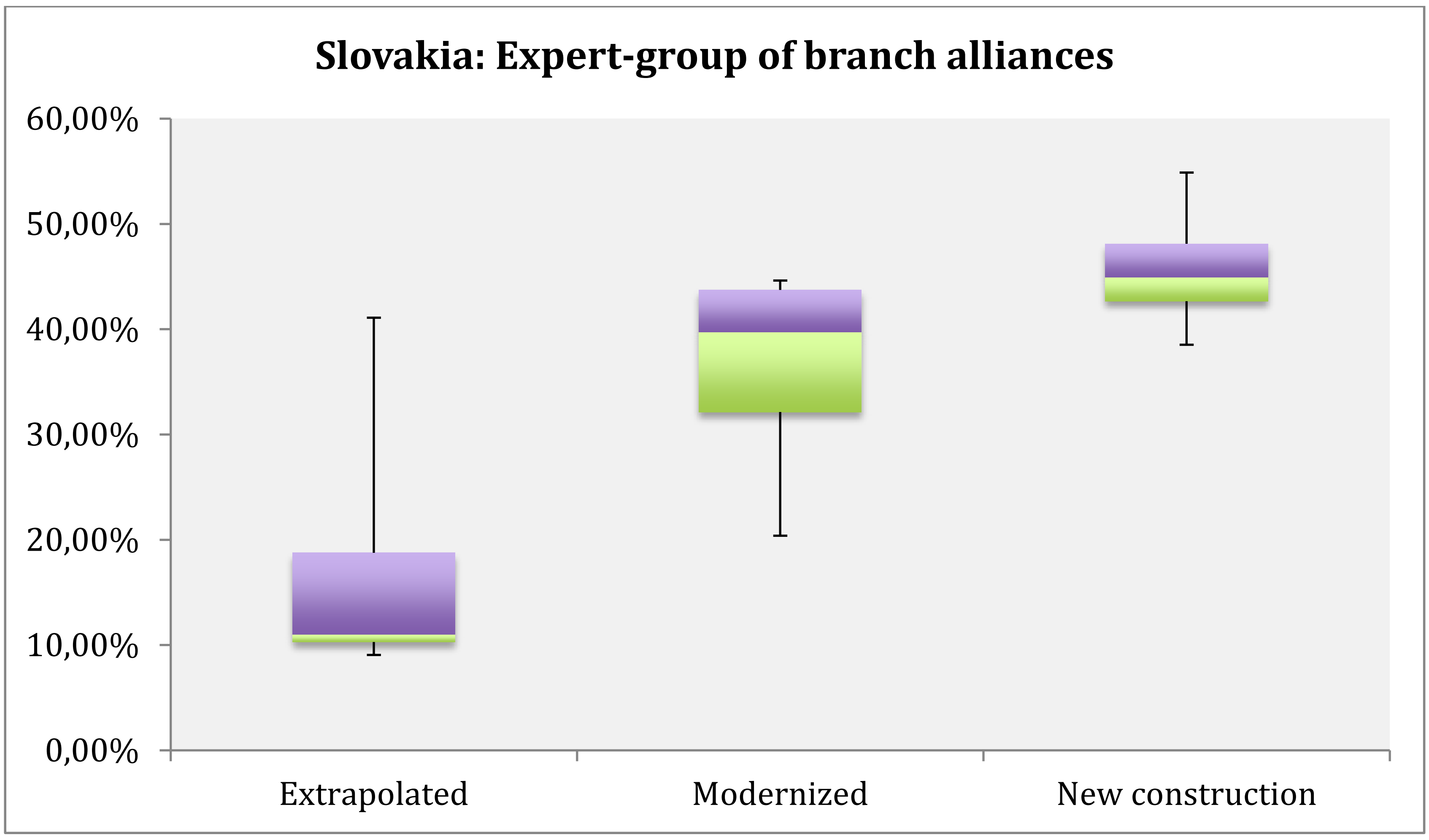
Appendix 128 Box-whisker interview-results, Slovakia, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
10.70%	43.43%	45.87%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	9.07%	20.39%	38.52%
25th Percentile	10.29%	32.14%	42.67%
Median	11.02%	39.74%	44.96%
75th Percentile	18.77%	43.73%	48.12%
Maximum	41.09%	44.62%	54.88%

Data for chart	Extrapolated	Modernized	New construction
Series 1	9.07%	20.39%	38.52%
Series 2	1.22%	11.75%	4.15%
Series 3	0.72%	7.61%	2.29%
Series 4	7.76%	3.99%	3.16%
Series 5	22.32%	0.89%	6.76%



Source: Own analyses

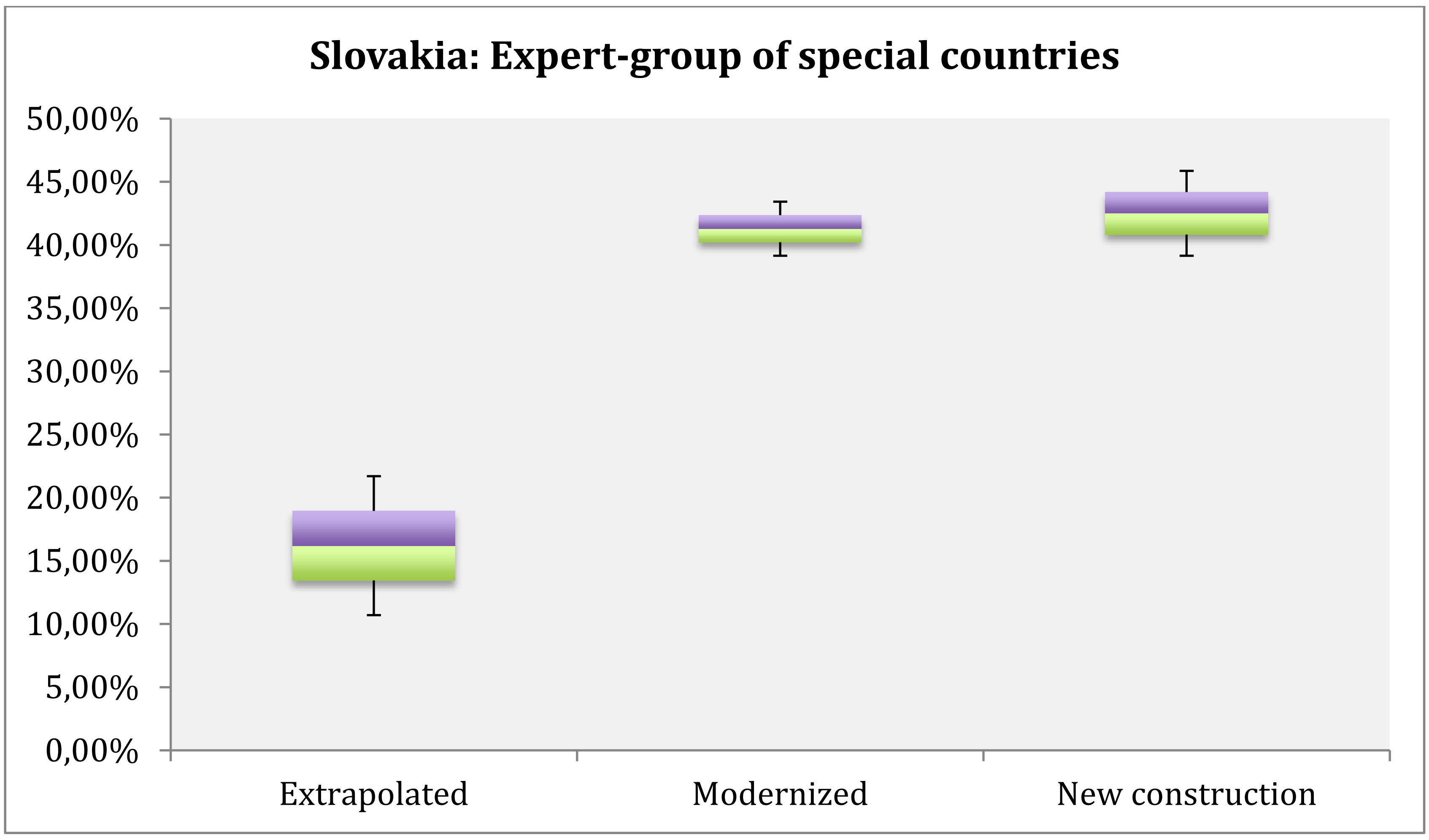
Appendix 129 Box-whisker interview-results, Slovakia, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
21.70%	39.15%	39.15%	Mara Meinel
10.70%	43.43%	45.87%	Alice Pittini
23.55%	36.48%	39.97%	Matthias Ross
16.15%	41.61%	42.24%	Axel Detz
15.01%	40.40%	44.59%	Frank Borrmann
29.23%	49.11%	21.66%	Michael Wulf
7.82%	46.02%	46.17%	Berit Jalas
22.23%	20.55%	57.23%	Richard Winter, Susanne Gentz
11.33%	44.62%	44.05%	Özgür Öner
41.09%	20.39%	38.52%	Michael Pistorius
9.07%	36.05%	54.88%	Klaus Schrader

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	10.70%	39.15%	39.15%
25th Percentile	13.45%	40.22%	40.83%
Median	16.20%	41.29%	42.51%
75th Percentile	18.95%	42.36%	44.19%
Maximum	21.70%	43.43%	45.87%

Data for chart	Extrapolated	Modernized	New construction
Series 1	10.70%	39.15%	39.15%
Series 2	2.75%	1.07%	1.68%
Series 3	2.75%	1.07%	1.68%
Series 4	2.75%	1.07%	1.68%
Series 5	2.75%	1.07%	1.68%



Source: Own analyses

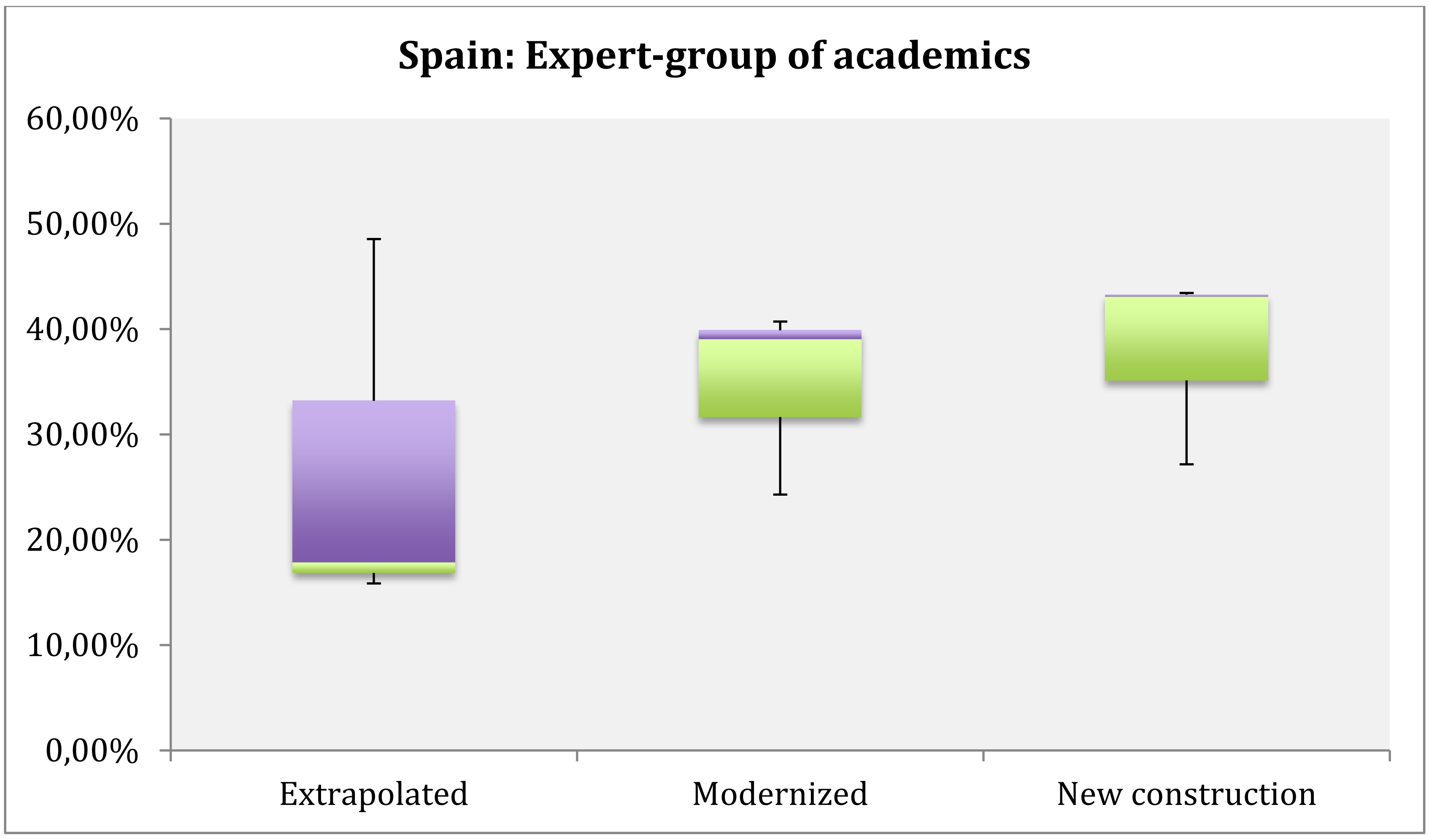
Appendix 130 Box-whisker interview-results, Spain, expert-group: Academics

Extrapolated	Modernized	New construction	Interviewees
48.54%	24.29%	27.17%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
15.85%	40.72%	43.42%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
27.05%	35.10%	37.85%	Michael Wulf
20.19%	59.61%	20.19%	Berit Jalas
33.09%	53.08%	13.84%	Richard Winter, Susanne Gentz
19.27%	41.92%	38.81%	Özgür Öner
33.41%	47.63%	18.96%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
25.63%	18.36%	56.02%	Klaus Schrader
13.22%	61.21%	25.57%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	15.85%	24.29%	27.17%
25th Percentile	16.86%	31.67%	35.14%
Median	17.86%	39.04%	43.10%
75th Percentile	33.20%	39.88%	43.26%
Maximum	48.54%	40.72%	43.42%

Data for chart	Extrapolated	Modernized	New construction
Series 1	15.85%	24.29%	27.17%
Series 2	1.01%	7.38%	7.97%
Series 3	1.01%	7.38%	7.97%
Series 4	15.34%	0.84%	0.16%
Series 5	15.34%	0.84%	0.16%



Source: Own analyses

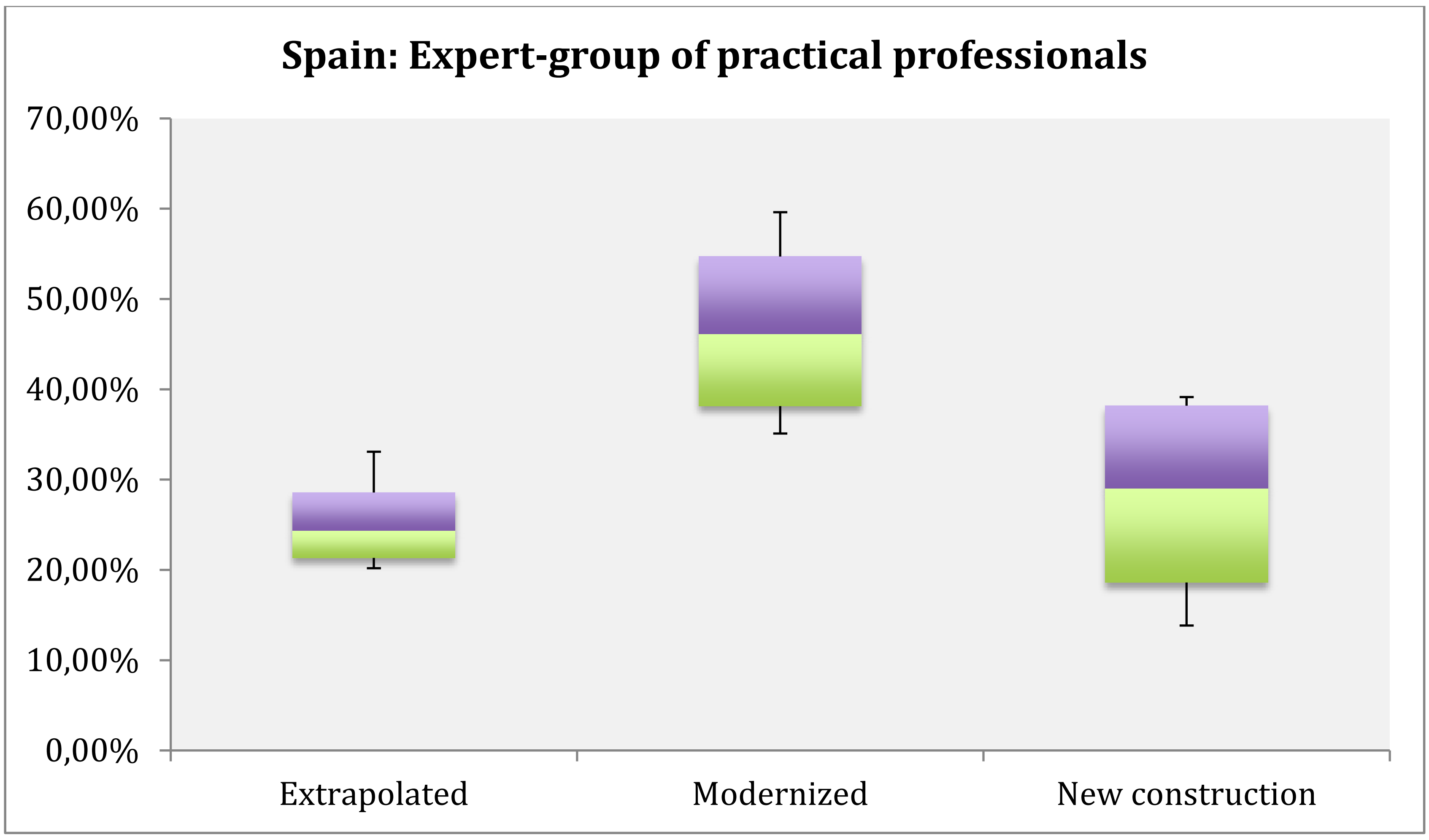
Appendix 131 Box-whisker interview-results, Spain, expert-group: Practical professionals

Extrapolated	Modernized	New construction	Interviewees
48.54%	24.29%	27.17%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
15.85%	40.72%	43.42%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
27.05%	35.10%	37.85%	Michael Wulf
20.19%	59.61%	20.19%	Berit Jalas
33.09%	53.08%	13.84%	Richard Winter, Susanne Gentz
19.27%	41.92%	38.81%	Özgür Öner
33.41%	47.63%	18.96%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
25.63%	18.36%	56.02%	Klaus Schrader
13.22%	61.21%	25.57%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	20.19%	35.10%	13.84%
25th Percentile	21.32%	38.14%	18.60%
Median	24.38%	46.12%	29.02%
75th Percentile	28.56%	54.71%	38.18%
Maximum	33.09%	59.61%	39.15%

Data for chart	Extrapolated	Modernized	New construction
Series 1	20.19%	35.10%	13.84%
Series 2	1.13%	3.04%	4.76%
Series 3	3.05%	7.98%	10.42%
Series 4	4.19%	8.60%	9.16%
Series 5	4.53%	4.90%	0.97%



Source: Own analyses

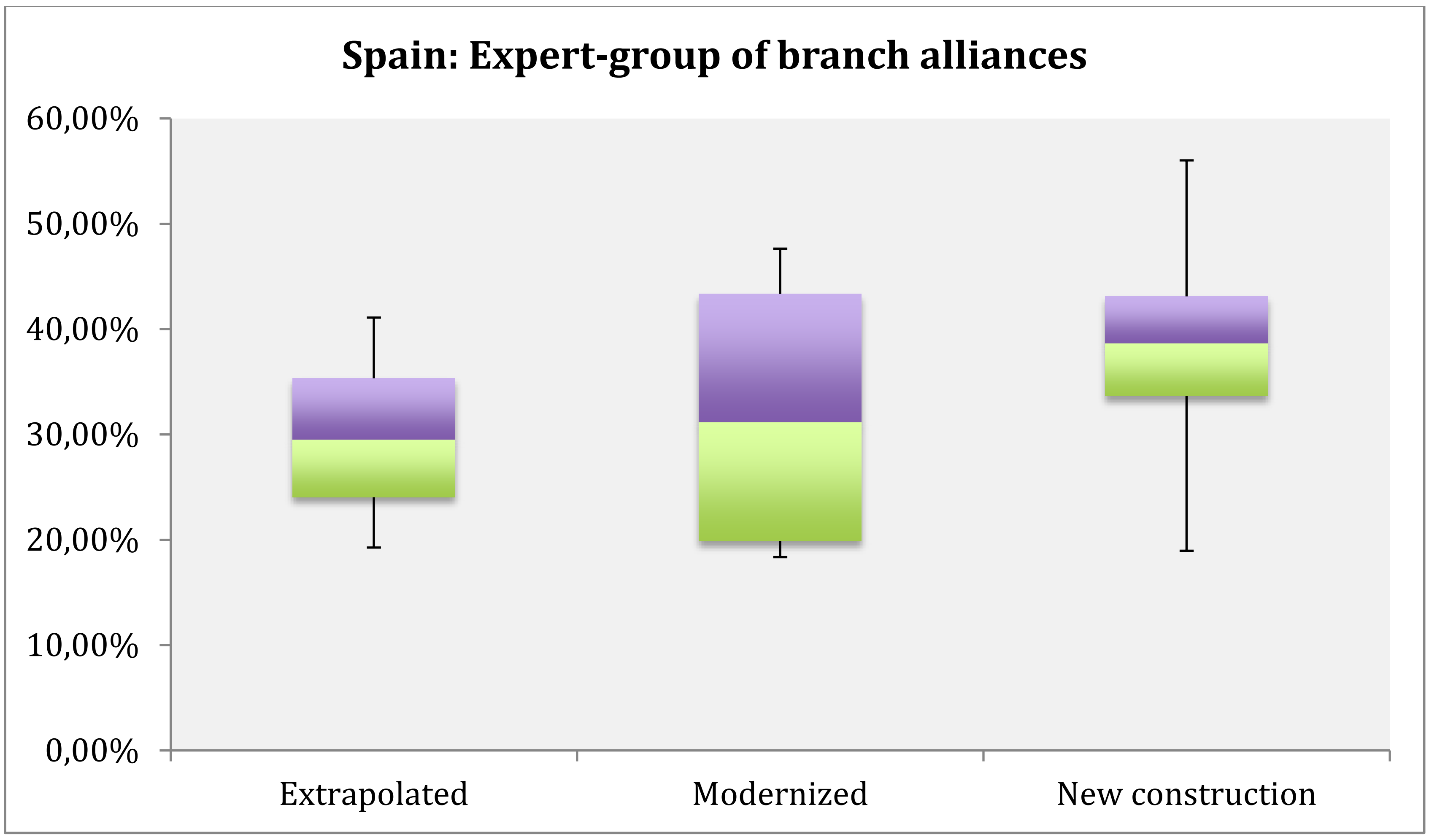
Appendix 132 Box-whisker interview-results, Spain, expert-group: Branch alliances

Extrapolated	Modernized	New construction	Interviewees
48.54%	24.29%	27.17%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
15.85%	40.72%	43.42%	Frank Borrmann
21.70%	39.15%	39.15%	Mara Meinel
27.05%	35.10%	37.85%	Michael Wulf
20.19%	59.61%	20.19%	Berit Jalas
33.09%	53.08%	13.84%	Richard Winter, Susanne Gentz
19.27%	41.92%	38.81%	Özgür Öner
33.41%	47.63%	18.96%	Alice Pittini
41.09%	20.39%	38.52%	Michael Pistorius
25.63%	18.36%	56.02%	Klaus Schrader
13.22%	61.21%	25.57%	Petra Gaugisch

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	19.27%	18.36%	18.96%
25th Percentile	24.04%	19.88%	33.63%
Median	29.52%	31.16%	38.67%
75th Percentile	35.33%	43.35%	43.11%
Maximum	41.09%	47.63%	56.02%

Data for chart	Extrapolated	Modernized	New construction
Series 1	19.27%	18.36%	18.96%
Series 2	4.77%	1.52%	14.67%
Series 3	5.48%	11.27%	5.04%
Series 4	5.81%	12.19%	4.45%
Series 5	5.76%	4.28%	12.91%



Source: Own analyses

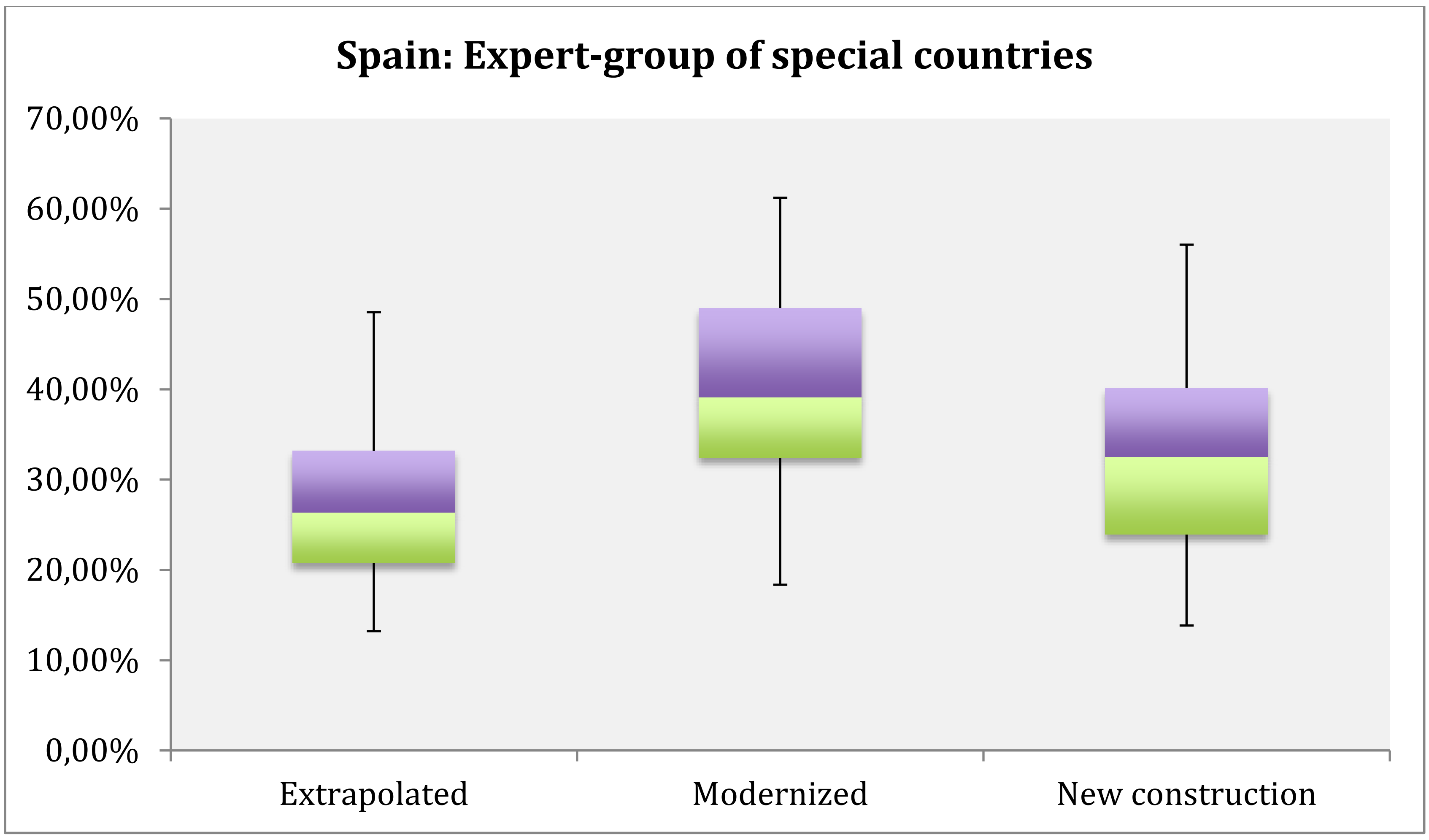
Appendix 133 Box-whisker interview-results, Spain, expert-group: Special countries

Extrapolated	Modernized	New construction	Interviewees
48.54%	24.29%	27.17%	Matthias Ross
17.86%	39.04%	43.10%	Axel Detz
21.70%	39.15%	39.15%	Mara Meinel
27.05%	35.10%	37.85%	Michael Wulf
33.09%	53.08%	13.84%	Richard Winter, Susanne Gentz
33.41%	47.63%	18.96%	Alice Pittini
25.63%	18.36%	56.02%	Klaus Schrader
13.22%	61.21%	25.57%	Petra Gaugisch
15.85%	40.72%	43.42%	Frank Borrmann
20.19%	59.61%	20.19%	Berit Jalas
19.27%	41.92%	38.81%	Özgür Öner
41.09%	20.39%	38.52%	Michael Pistorius

Source: Own analyses

Summary range	Extrapolated	Modernized	New construction
Minimum	13.22%	18.36%	13.84%
25th Percentile	20.74%	32.40%	23.92%
Median	26.34%	39.10%	32.51%
75th Percentile	33.17%	48.99%	40.14%
Maximum	48.54%	61.21%	56.02%

Data for chart	Extrapolated	Modernized	New construction
Series 1	13.22%	18.36%	13.84%
Series 2	7.52%	14.04%	10.08%
Series 3	5.60%	6.70%	8.59%
Series 4	6.83%	9.90%	7.63%
Series 5	15.37%	12.22%	15.88%



Source: Own analyses

Appendix 134 Simulation 1, Bulgaria

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**2 2/3**	0.5620
Portfolio B: Modernized version	2/5	1	**1**	0.2257
Portfolio C: New construction version	3/8	1	1	0.2123
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 3/7**	0.5759
Portfolio B: Modernized version	1/3	1	**4/5**	0.1888
Portfolio C: New construction version	2/5	1 1/4	1	0.2353
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7 1/5**	**5**	0.7469
Portfolio B: Modernized version	1/7	1	**3/4**	0.1060
Portfolio C: New construction version	1/5	1 1/3	1	0.1471
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/3**	**2 2/9**	0.5715
Portfolio B: Modernized version	1/3	1	**2/3**	0.1742
Portfolio C: New construction version	4/9	1 4/9	1	0.2543
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/6**	**2 2/3**	0.5925
Portfolio B: Modernized version	1/3	1	**7/8**	0.1890
Portfolio C: New construction version	3/8	1 1/7	1	0.2185
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 4/5**	**4**	0.7070
Portfolio B: Modernized version	1/6	1	**5/6**	0.1290
Portfolio C: New construction version	1/4	1 1/5	1	0.1640
CR	0.32%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 5/7**	0.5836
Portfolio B: Modernized version	1/3	1	**1**	0.2031
Portfolio C: New construction version	3/8	1	1	0.2133
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions
Portfolio A: Extrapolated version	0.5620	0.5759	0.7469	0.5715	0.5925	0.7070	0.5836
Portfolio B: Modernized version	0.2257	0.1888	0.1060	0.1742	0.1890	0.1290	0.2031
Portfolio C: New construction version	0.2123	0.2353	0.1471	0.2543	0.2185	0.1640	0.2133

Criteria ranking	Subcriteria: Environment social characteristics
0.0810	Population density
0.2362	Income level
0.0624	Land area
0.0941	Supply/ demand
0.1205	Tenure status
0.1755	Levels of rent
0.2303	Economic conditions

	Alternative ranking
Portfolio A: Extrapolated version	0.6118
Portfolio B: Modernized version	0.1781
Portfolio C: New construction version	0.2101

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	19.15%	12.09%	61.18%	32.11%	Demographic characteristics	**35.60%**
Portfolio B: Modernized version	35.70%	39.79%	17.81%	24.62%	Space characteristics	**28.97%**
Portfolio C: New construction version	45.15%	48.12%	21.01%	43.27%	Environment social characteristics	**35.44%**

Source: Own analyses

Appendix 135 Simulation 2, Bulgaria

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**2 3/5**	0.5606
Portfolio B: Modernized version	2/5	1	**1**	0.2248
Portfolio C: New construction version	3/8	1	1	0.2146
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3**	0.5985
Portfolio B: Modernized version	1/3	1	**1**	0.1999
Portfolio C: New construction version	1/3	1	1	0.2015
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2**	0.5443
Portfolio B: Modernized version	1/3	1	**2/3**	0.1846
Portfolio C: New construction version	1/2	1 1/2	1	0.2712
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/5**	**1 5/6**	0.5392
Portfolio B: Modernized version	1/3	1	**3/5**	0.1690
Portfolio C: New construction version	1/2	1 5/7	1	0.2918
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/4**	**2 1/3**	0.5775
Portfolio B: Modernized version	1/3	1	**3/4**	0.1802
Portfolio C: New construction version	3/7	1 1/3	1	0.2423
CR	0.03%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 2/5**	**1 2/7**	0.4015
Portfolio B: Modernized version	5/7	1	**4/5**	0.2715
Portfolio C: New construction version	7/9	1 1/4	1	0.3270
CR	0.20%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 4/5**	**1 5/9**	0.4555
Portfolio B: Modernized version	5/9	1	**1**	0.2606
Portfolio C: New construction version	2/3	1	1	0.2839
CR	0.08%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 1/2**	0.4671
Portfolio B: Modernized version	1/2	1	**5/7**	0.2241
Portfolio C: New construction version	2/3	1 2/5	1	0.3089
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 5/6**	**2**	0.4847
Portfolio B: Modernized version	5/9	1	**1**	0.2655
Portfolio C: New construction version	1/2	1	1	0.2498
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/4**	**1 4/5**	0.4990
Portfolio B: Modernized version	4/9	1	**4/5**	0.2230
Portfolio C: New construction version	5/9	1 1/4	1	0.2780
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 1/4**	**3 2/3**	0.6839
Portfolio B: Modernized version	1/5	1	**3/4**	0.1324
Portfolio C: New construction version	2/7	1 1/3	1	0.1837
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 4/9**	**1 5/8**	0.4945
Portfolio B: Modernized version	2/5	1	**2/3**	0.2055
Portfolio C: New construction version	3/5	1 4/9	1	0.3000
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/3**	**2**	0.5160
Portfolio B: Modernized version	3/7	1	**7/8**	0.2245
Portfolio C: New construction version	1/2	1 1/7	1	0.2595
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 1/4**	**3**	0.6389
Portfolio B: Modernized version	1/4	1	**5/6**	0.1589
Portfolio C: New construction version	1/3	1 1/5	1	0.2022
CR	0.32%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/8**	**2**	0.5068
Portfolio B: Modernized version	1/2	1	**1**	0.2405
Portfolio C: New construction version	1/2	1	1	0.2526
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5606	0.5985	0.5443	0.5392	0.5775	0.1780	Ageing indicators	0.5650
Portfolio B: Modernized version	0.2248	0.1999	0.1846	0.1690	0.1802	0.2133	Household indicators	0.1916
Portfolio C: New construction version	0.2146	0.2015	0.2712	0.2918	0.2423	0.2363	Clusters of households	0.2435
						0.1608	Household composition	
						0.2116	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.4015	0.4555	0.4671	0.5289	Build Quality	0.4295
Portfolio B: Modernized version	0.2715	0.2606	0.2241	0.2502	Age distribution of housing stock	0.2583
Portfolio C: New construction version	0.3270	0.2839	0.3089	0.2209	Average number of rooms per dwelling	0.3122

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.4847	0.4990	0.6839	0.4945	0.5160	0.6389	0.5068	0.0810	Population density	0.5374
Portfolio B: Modernized version	0.2655	0.2230	0.1324	0.2055	0.2245	0.1589	0.2405	0.2362	Income level	0.2121
Portfolio C: New construction version	0.2498	0.2780	0.1837	0.3000	0.2595	0.2022	0.2526	0.0624	Land area	0.2505
								0.0941	Supply/ demand	
								0.1205	Tenure status	
								0.1755	Levels of rent	
								0.2303	Economic conditions	

Source: Own analyses

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	56.50%	42.95%	53.74%	32.11%	Demographic characteristics	**51.97%**
Portfolio B: Modernized version	19.16%	25.83%	21.21%	24.62%	Space characteristics	**21.69%**
Portfolio C: New construction version	24.35%	31.22%	25.05%	43.27%	Environment social characteristics	**26.34%**

Source: Own analyses

Appendix 136 Simulation 1, Estonia, Latvia, Lithuania

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/4**	**3 1/3**	0.6218
Portfolio B: Modernized version	1/3	1	**1**	0.1874
Portfolio C: New construction version	1/3	1	1	0.1908
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**2**	0.5349
Portfolio B: Modernized version	3/8	1	**3/4**	0.1991
Portfolio C: New construction version	1/2	1 1/3	1	0.2659
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 5/6**	**3**	0.6672
Portfolio B: Modernized version	1/6	1	**4/7**	0.1186
Portfolio C: New construction version	1/3	1 3/4	1	0.2141
CR	0.12%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 3/5**	**2 4/9**	0.5941
Portfolio B: Modernized version	2/7	1	**3/4**	0.1718
Portfolio C: New construction version	2/5	1 1/3	1	0.2341
CR	0.13%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 3/7**	**3**	0.6125
Portfolio B: Modernized version	2/7	1	**6/7**	0.1793
Portfolio C: New construction version	1/3	1 1/6	1	0.2082
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 1/3**	**3 2/5**	0.6773
Portfolio B: Modernized version	1/5	1	**3/4**	0.1354
Portfolio C: New construction version	2/7	1 1/3	1	0.1873
CR	0.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 4/5**	**2 4/5**	0.5826
Portfolio B: Modernized version	1/3	1	**1**	0.2057
Portfolio C: New construction version	1/3	1	1	0.2117
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.6218	0.5349	0.6672	0.5941	0.6125	0.6773	0.5826	0.0768	Population density	0.6047
Portfolio B: Modernized version	0.1874	0.1991	0.1186	0.1718	0.1793	0.1354	0.2057	0.2146	Income level	0.1765
Portfolio C: New con-struction version	0.1908	0.2659	0.2141	0.2341	0.2082	0.1873	0.2117	0.0691	Land area	0.2189
								0.0952	Supply/ de-mand	
								0.1410	Tenure status	
								0.1917	Levels of rent	
								0.2116	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	20.05%	12.95%	60.47%	34.60%	Demographic characteristics	**35.31%**
Portfolio B: Modernized version	36.31%	40.82%	17.65%	23.52%	Space characteristics	**29.55%**
Portfolio C: New construction version	43.64%	46.22%	21.89%	41.88%	Environment social characteristics	**35.14%**

Source: Own analyses

Appendix 137 Simulation 2, Estonia, Latvia, Lithuania

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 3/8**	**3**	0.6127
Portfolio B: Modernized version	2/7	1	**7/8**	0.1815
Portfolio C: New construction version	1/3	1 1/7	1	0.2058
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 6/7**	**2 2/5**	0.5661
Portfolio B: Modernized version	1/3	1	**4/5**	0.1958
Portfolio C: New construction version	2/5	1 1/4	1	0.2381
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**2**	0.5316
Portfolio B: Modernized version	3/8	1	**3/4**	0.1998
Portfolio C: New construction version	1/2	1 1/3	1	0.2686
CR	0.10%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 2/5**	**1 5/7**	0.5024
Portfolio B: Modernized version	2/5	1	**4/5**	0.2179
Portfolio C: New construction version	4/7	1 1/4	1	0.2797
CR	0.16%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 4/7**	**2 2/7**	0.5475
Portfolio B: Modernized version	2/5	1	**1**	0.2167
Portfolio C: New construction version	4/9	1	1	0.2358
CR	0.04%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/3**	**1 1/6**	0.3827
Portfolio B: Modernized version	3/4	1	**7/8**	0.2887
Portfolio C: New construction version	6/7	1 1/7	1	0.3286
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 5/7**	**1 5/9**	0.4495
Portfolio B: Modernized version	3/5	1	**1**	0.2652
Portfolio C: New construction version	2/3	1	1	0.2853
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 4/5**	0.4841
Portfolio B: Modernized version	1/2	1	**4/5**	0.2362
Portfolio C: New construction version	5/9	1 1/4	1	0.2797
CR	0.15%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**2 5/9**	0.5584
Portfolio B: Modernized version	2/5	1	**1**	0.2188
Portfolio C: New construction version	2/5	1	1	0.2228
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/9**	**1 1/2**	0.4694
Portfolio B: Modernized version	1/2	1	**3/4**	0.2272
Portfolio C: New construction version	2/3	1 1/3	1	0.3034
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 1/2**	**2 1/3**	0.6067
Portfolio B: Modernized version	2/9	1	**4/7**	0.1402
Portfolio C: New construction version	3/7	1 3/4	1	0.2531
CR	0.12%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**1 7/8**	0.5296
Portfolio B: Modernized version	1/3	1	**3/4**	0.1991
Portfolio C: New construction version	1/2	1 1/3	1	0.2713
CR	0.13%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 5/8**	**2 1/4**	0.5487
Portfolio B: Modernized version	3/8	1	**6/7**	0.2089
Portfolio C: New construction version	4/9	1 1/6	1	0.2424
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**2 3/5**	0.6175
Portfolio B: Modernized version	1/4	1	**3/4**	0.1605
Portfolio C: New construction version	3/8	1 1/3	1	0.2220
CR	0.37%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/7**	**2 1/7**	0.5178
Portfolio B: Modernized version	1/2	1	**1**	0.2377
Portfolio C: New construction version	1/2	1	1	0.2445
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.6127	0.5661	0.5316	0.5024	0.5475	0.1984	Ageing indicators	0.5546
Portfolio B: Modernized version	0.1815	0.1958	0.1998	0.2179	0.2167	0.2178	Household indicators	0.2021
Portfolio C: New construction version	0.2058	0.2381	0.2686	0.2797	0.2358	0.1937	Clusters of households	0.2434
						0.1517	Household composition	
						0.2384	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3827	0.4495	0.4841	0.5011	Build Quality	0.4243
Portfolio B: Modernized version	0.2887	0.2652	0.2362	0.2600	Age distribution of housing stock	0.2700
Portfolio C: New construction version	0.3286	0.2853	0.2797	0.2389	Average number of rooms per dwelling	0.3057

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5584	0.4694	0.6067	0.5296	0.5487	0.6175	0.5178	0.0768	Population density	0.5413
Portfolio B: Modernized version	0.2188	0.2272	0.1402	0.1991	0.2089	0.1605	0.2377	0.2146	Income level	0.2047
Portfolio C: New con-struction version	0.2228	0.3034	0.2531	0.2713	0.2424	0.2220	0.2445	0.0691	Land area	0.2540
								0.0952	Supply/ de-mand	
								0.1410	Tenure status	
								0.1917	Levels of rent	
								0.2116	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	55.46%	42.43%	54.13%	34.60%	Demographic characteristics	**51.84%**
Portfolio B: Modernized version	20.21%	27.00%	20.47%	23.52%	Space characteristics	**21.92%**
Portfolio C: New construction version	24.34%	30.57%	25.40%	41.88%	Environment social characteristics	**26.25%**

Source: Own analyses

Appendix 138 Simulation 1, Germany

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/5**	**3 7/9**	0.6066
Portfolio B: Modernized version	3/8	1	**1 1/2**	0.2340
Portfolio C: New construction version	1/4	2/3	1	0.1595
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 3/8**	**3 3/5**	0.6352
Portfolio B: Modernized version	2/7	1	**1 1/9**	0.1906
Portfolio C: New construction version	2/7	1	1	0.1742
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/3**	**6 5/8**	0.6913
Portfolio B: Modernized version	1/3	1	**1 5/7**	0.1990
Portfolio C: New construction version	1/7	4/7	1	0.1097
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 2/3**	**2**	0.4734
Portfolio B: Modernized version	3/5	1	**1 1/4**	0.2915
Portfolio C: New construction version	1/2	4/5	1	0.2351
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**3**	0.6312
Portfolio B: Modernized version	1/4	1	**5/6**	0.1617
Portfolio C: New construction version	1/3	1 2/9	1	0.2070
CR	0.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 3/5**	**5**	0.7057
Portfolio B: Modernized version	2/9	1	**1 1/7**	0.1555
Portfolio C: New construction version	1/5	7/8	1	0.1388
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 1/4**	**3 1/2**	0.6585
Portfolio B: Modernized version	1/4	1	**1**	0.1618
Portfolio C: New construction version	2/7	1	1	0.1797
CR	0.17%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.6066	0.6352	0.6913	0.4734	0.6312	0.7057	0.6585	0.0979	Population density	0.6258
Portfolio B: Modernized version	0.2340	0.1906	0.1990	0.2915	0.1617	0.1555	0.1618	0.1966	Income level	0.1990
Portfolio C: New construction version	0.1595	0.1742	0.1097	0.2351	0.2070	0.1388	0.1797	0.1003	Land area	0.1752
								0.1677	Supply/ demand	
								0.1096	Tenure status	
								0.1639	Levels of rent	
								0.1639	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	20.79%	19.37%	62.58%	37.42%	Demographic characteristics	**38.39%**
Portfolio B: Modernized version	54.34%	45.83%	19.90%	19.79%	Space characteristics	**37.92%**
Portfolio C: New construction version	24.87%	34.80%	17.52%	42.80%	Environment social characteristics	**23.69%**

Source: Own analyses

Appendix 139 Simulation 2, Germany

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/4**	**2 5/6**	0.4651
Portfolio B: Modernized version	4/5	1	**2**	0.3659
Portfolio C: New construction version	1/3	1/2	1	0.1690
CR	0.10%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/9**	**3 1/2**	0.4621
Portfolio B: Modernized version	8/9	1	**2 8/9**	0.4024
Portfolio C: New construction version	2/7	1/3	1	0.1355
CR	0.07%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 6/7**	**3 1/6**	0.5390
Portfolio B: Modernized version	1/2	1	**1 3/4**	0.2926
Portfolio C: New construction version	1/3	4/7	1	0.1684
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**3 5/6**	0.5676
Portfolio B: Modernized version	1/2	1	**1 8/9**	0.2833
Portfolio C: New construction version	1/4	1/2	1	0.1491
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 3/7**	**4**	0.5201
Portfolio B: Modernized version	2/3	1	**2 1/2**	0.3470
Portfolio C: New construction version	1/4	2/5	1	0.1329
CR	0.17%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/3**	**3**	0.4762
Portfolio B: Modernized version	3/4	1	**2**	0.3569
Portfolio C: New construction version	1/3	1/2	1	0.1670
CR	0.06%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 5/8**	**2**	0.4775
Portfolio B: Modernized version	3/5	1	**1 1/4**	0.2896
Portfolio C: New construction version	1/2	4/5	1	0.2329
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 5/9**	**1 8/9**	0.5202
Portfolio B: Modernized version	2/5	1	**5/7**	0.2021
Portfolio C: New construction version	1/2	1 2/5	1	0.2777
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 3/4**	**2 1/2**	0.5069
Portfolio B: Modernized version	4/7	1	**1 1/2**	0.2933
Portfolio C: New construction version	2/5	2/3	1	0.1999
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/4**	**2 2/5**	0.5373
Portfolio B: Modernized version	4/9	1	**1 1/9**	0.2418
Portfolio C: New construction version	2/5	1	1	0.2210
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/5**	**4 3/7**	0.5989
Portfolio B: Modernized version	4/9	1	**1 5/7**	0.2585
Portfolio C: New construction version	2/9	4/7	1	0.1425
CR	0.25%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1**	**1 1/3**	0.3748
Portfolio B: Modernized version	1	1	**1 1/4**	0.3461
Portfolio C: New construction version	3/4	4/5	1	0.2791
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**2**	0.5330
Portfolio B: Modernized version	3/8	1	**5/6**	0.2048
Portfolio C: New construction version	1/2	1 2/9	1	0.2622
CR	0.21%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3 1/3**	0.6151
Portfolio B: Modernized version	1/3	1	**1 1/7**	0.2033
Portfolio C: New construction version	2/7	7/8	1	0.1815
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 5/6**	**2 1/3**	0.5625
Portfolio B: Modernized version	1/3	1	**1**	0.2073
Portfolio C: New construction version	3/7	1	1	0.2302
CR	0.17%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.4651	0.4621	0.5390	0.5676	0.5201	0.2613	Ageing indicators	0.5099
Portfolio B: Modernized version	0.3659	0.4024	0.2926	0.2833	0.3470	0.1634	Household indicators	0.3368
Portfolio C: New construction version	0.1690	0.1355	0.1684	0.1491	0.1329	0.2001	Clusters of households	0.1532
						0.2082	Household composition	
						0.1671	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.4762	0.4775	0.5202	0.4069	Build Quality	0.4895
Portfolio B: Modernized version	0.3569	0.2896	0.2021	0.2993	Age distribution of housing stock	0.2913
Portfolio C: New construction version	0.1670	0.2329	0.2777	0.2938	Average number of rooms per dwelling	0.2192

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5069	0.5373	0.5989	0.3748	0.5330	0.6151	0.5625	0.0979	Population density	0.5296
Portfolio B: Modernized version	0.2933	0.2418	0.2585	0.3461	0.2048	0.2033	0.2073	0.1966	Income level	0.2500
Portfolio C: New construction version	0.1999	0.2210	0.1425	0.2791	0.2622	0.1815	0.2302	0.1003	Land area	0.2204
								0.1677	Supply/ demand	
								0.1096	Tenure status	
								0.1639	Levels of rent	
								0.1639	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	50.99%	48.95%	52.96%	37.42%	Demographic characteristics	**51.43%**
Portfolio B: Modernized version	33.68%	29.13%	25.00%	19.79%	Space characteristics	**29.07%**
Portfolio C: New construction version	15.32%	21.92%	22.04%	42.80%	Environment social characteristics	**19.50%**

Source: Own analyses

Appendix 140 Simulation 1, Hungary

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 2/5**	**2 3/7**	0.5464
Portfolio B: Modernized version	3/7	1	**1**	0.2252
Portfolio C: New construction version	2/5	1	1	0.2283
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/7**	**1 7/9**	0.5072
Portfolio B: Modernized version	2/5	1	**3/4**	0.2117
Portfolio C: New construction version	5/9	1 1/3	1	0.2811
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 3/4**	**3 2/3**	0.6938
Portfolio B: Modernized version	1/6	1	**3/4**	0.1264
Portfolio C: New construction version	1/4	1 1/3	1	0.1798
CR	0.18%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**1 5/6**	0.5141
Portfolio B: Modernized version	2/5	1	**3/4**	0.2061
Portfolio C: New construction version	1/2	1 1/3	1	0.2798
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 1/3**	0.5680
Portfolio B: Modernized version	1/3	1	**4/5**	0.1909
Portfolio C: New construction version	3/7	1 1/4	1	0.2410
CR	0.05%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 5/6**	**3 2/5**	0.6675
Portfolio B: Modernized version	1/5	1	**5/6**	0.1455
Portfolio C: New construction version	2/7	1 2/9	1	0.1871
CR	0.26%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 4/5**	**2 6/7**	0.5852
Portfolio B: Modernized version	1/3	1	**1**	0.2069
Portfolio C: New construction version	1/3	1	1	0.2079
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5464	0.5072	0.6938	0.5141	0.5680	0.6675	0.5852	0.0836	Population density	0.5761
Portfolio B: Modernized version	0.2252	0.2117	0.1264	0.2061	0.1909	0.1455	0.2069	0.2367	Income level	0.1914
Portfolio C: New con-struction version	0.2283	0.2811	0.1798	0.2798	0.2410	0.1871	0.2079	0.0717	Land area	0.2325
								0.0976	Supply/ de-mand	
								0.1224	Tenure status	
								0.1687	Levels of rent	
								0.2193	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	21.30%	14.23%	57.61%	33.67%	Demographic characteristics	**36.12%**
Portfolio B: Modernized version	35.91%	38.15%	19.14%	21.36%	Space characteristics	**28.85%**
Portfolio C: New construction version	42.79%	47.62%	23.25%	44.98%	Environment social characteristics	**35.03%**

Source: Own analyses

Appendix 141 Simulation 2, Hungary

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/5**	**2 5/9**	0.5622
Portfolio B: Modernized version	2/5	1	**1**	0.2159
Portfolio C: New construction version	2/5	1	1	0.2219
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 2/3**	**2 4/5**	0.5773
Portfolio B: Modernized version	3/8	1	**1**	0.2122
Portfolio C: New construction version	1/3	1	1	0.2105
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**1 4/5**	0.5120
Portfolio B: Modernized version	2/5	1	**5/6**	0.2151
Portfolio C: New construction version	5/9	1 2/9	1	0.2729
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**1 5/7**	0.5233
Portfolio B: Modernized version	1/3	1	**2/3**	0.1855
Portfolio C: New construction version	3/5	1 1/2	1	0.2912
CR	0.26%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 1/6**	0.5574
Portfolio B: Modernized version	1/3	1	**4/5**	0.1922
Portfolio C: New construction version	1/2	1 1/4	1	0.2504
CR	0.06%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/3**	**1 1/7**	0.3832
Portfolio B: Modernized version	3/4	1	**4/5**	0.2765
Portfolio C: New construction version	7/8	1 1/4	1	0.3403
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 1/2**	0.4619
Portfolio B: Modernized version	1/2	1	**5/6**	0.2405
Portfolio C: New construction version	2/3	1 1/5	1	0.2975
CR	0.05%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 1/2**	0.4611
Portfolio B: Modernized version	1/2	1	**4/5**	0.2346
Portfolio C: New construction version	2/3	1 1/4	1	0.3043
CR	0.06%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 4/5**	**1 4/5**	0.4747
Portfolio B: Modernized version	5/9	1	**1**	0.2608
Portfolio C: New construction version	5/9	1	1	0.2645
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 4/5**	**1 1/3**	0.4356
Portfolio B: Modernized version	5/9	1	**3/4**	0.2425
Portfolio C: New construction version	3/4	1 1/3	1	0.3219
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 2/7**	**2 7/9**	0.6295
Portfolio B: Modernized version	1/4	1	**3/4**	0.1530
Portfolio C: New construction version	1/3	1 1/3	1	0.2175
CR	0.18%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 6/7**	**1 3/8**	0.4424
Portfolio B: Modernized version	1/2	1	**3/4**	0.2365
Portfolio C: New construction version	5/7	1 1/3	1	0.3211
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 2/7**	**1 5/7**	0.4966
Portfolio B: Modernized version	4/9	1	**4/5**	0.2225
Portfolio C: New construction version	4/7	1 1/4	1	0.2809
CR	0.05%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 5/8**	**2 1/2**	0.6009
Portfolio B: Modernized version	2/7	1	**5/6**	0.1746
Portfolio C: New construction version	2/5	1 2/9	1	0.2245
CR	0.26%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**2 1/7**	0.5141
Portfolio B: Modernized version	1/2	1	**1**	0.2423
Portfolio C: New construction version	1/2	1	1	0.2435
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5622	0.5773	0.5120	0.5233	0.5574	0.2120	Ageing indicators	0.5483
Portfolio B: Modernized version	0.2159	0.2122	0.2151	0.1855	0.1922	0.2265	Household indicators	0.2057
Portfolio C: New construction version	0.2219	0.2105	0.2729	0.2912	0.2504	0.2137	Clusters of households	0.2460
						0.1442	Household composition	
						0.2036	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3832	0.4619	0.4611	0.4586	Build Quality	0.4256
Portfolio B: Modernized version	0.2765	0.2405	0.2346	0.2953	Age distribution of housing stock	0.2556
Portfolio C: New construction version	0.3403	0.2975	0.3043	0.2461	Average number of rooms per dwelling	0.3188

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.4747	0.4356	0.6295	0.4424	0.4966	0.6009	0.5141	0.0836	Population density	0.5060
Portfolio B: Modernized version	0.2608	0.2425	0.1530	0.2365	0.2225	0.1746	0.2423	0.2367	Income level	0.2231
Portfolio C: New construction version	0.2645	0.3219	0.2175	0.3211	0.2809	0.2245	0.2435	0.0717	Land area	0.2709
								0.0976	Supply/ demand	
								0.1224	Tenure status	
								0.1687	Levels of rent	
								0.2193	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	54.83%	42.56%	50.60%	33.67%	Demographic characteristics	**50.31%**
Portfolio B: Modernized version	20.57%	25.56%	22.31%	21.36%	Space characteristics	**22.42%**
Portfolio C: New construction version	24.60%	31.88%	27.09%	44.98%	Environment social characteristics	**27.28%**

Source: Own analyses

Appendix 142 Simulation 1, Poland

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3 1/5**	0.6086
Portfolio B: Modernized version	1/3	1	**1 1/9**	0.2038
Portfolio C: New construction version	1/3	1	1	0.1876
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 5/8**	**2 1/9**	0.5397
Portfolio B: Modernized version	3/8	1	**4/5**	0.2056
Portfolio C: New construction version	1/2	1 1/4	1	0.2546
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5**	**3 4/9**	0.6739
Portfolio B: Modernized version	1/5	1	**3/4**	0.1378
Portfolio C: New construction version	2/7	1 1/3	1	0.1883
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**2 2/5**	0.5609
Portfolio B: Modernized version	3/8	1	**6/7**	0.2025
Portfolio C: New construction version	3/7	1 1/6	1	0.2366
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3 1/4**	0.6063
Portfolio B: Modernized version	1/3	1	**1 1/7**	0.2090
Portfolio C: New construction version	1/3	7/8	1	0.1846
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 1/2**	**4 2/7**	0.6877
Portfolio B: Modernized version	2/9	1	**1**	0.1579
Portfolio C: New construction version	1/4	1	1	0.1544
CR	0.16%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**3**	0.5936
Portfolio B: Modernized version	1/3	1	**1**	0.1977
Portfolio C: New construction version	1/3	1	1	0.2087
CR	0.06%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.6086	0.5397	0.6739	0.5609	0.6063	0.6877	0.5936	0.0958	Population density	0.6046
Portfolio B: Modernized version	0.2038	0.2056	0.1378	0.2025	0.2090	0.1579	0.1977	0.2130	Income level	0.1901
Portfolio C: New construction version	0.1876	0.2546	0.1883	0.2366	0.1846	0.1544	0.2087	0.0830	Land area	0.2053
								0.1004	Supply/ demand	
								0.1226	Tenure status	
								0.1713	Levels of rent	
								0.2139	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	18.49%	12.89%	60.46%	36.17%	Demographic characteristics	**34.81%**
Portfolio B: Modernized version	37.11%	41.30%	19.01%	21.99%	Space characteristics	**30.46%**
Portfolio C: New construction version	44.40%	45.81%	20.53%	41.83%	Environment social characteristics	**34.73%**

Source: Own analyses

Appendix 143 Simulation 2, Poland

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 5/6**	**2 3/4**	0.6155
Portfolio B: Modernized version	1/4	1	**3/4**	0.1621
Portfolio C: New construction version	3/8	1 1/3	1	0.2224
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/7**	**2 1/5**	0.5364
Portfolio B: Modernized version	2/5	1	**1**	0.2203
Portfolio C: New construction version	4/9	1 1/9	1	0.2433
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**1 3/4**	0.5113
Portfolio B: Modernized version	2/5	1	**3/4**	0.2056
Portfolio C: New construction version	4/7	1 1/3	1	0.2832
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 3/5**	0.4725
Portfolio B: Modernized version	1/2	1	**4/5**	0.2343
Portfolio C: New construction version	5/8	1 1/4	1	0.2932
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 2/9**	**2 1/7**	0.5226
Portfolio B: Modernized version	4/9	1	**1**	0.2372
Portfolio C: New construction version	1/2	1	1	0.2402
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/8**	**1**	0.3567
Portfolio B: Modernized version	8/9	1	**1**	0.3202
Portfolio C: New construction version	1	1	1	0.3231
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 5/6**	0.4872
Portfolio B: Modernized version	1/2	1	**1**	0.2481
Portfolio C: New construction version	1/2	1	1	0.2646
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**1 4/7**	0.4920
Portfolio B: Modernized version	2/5	1	**5/7**	0.2082
Portfolio C: New construction version	2/3	1 3/8	1	0.2997
CR	0.20%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/3**	**2 4/9**	0.5447
Portfolio B: Modernized version	3/7	1	**1 1/9**	0.2371
Portfolio C: New construction version	2/5	1	1	0.2182
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 5/8**	0.4742
Portfolio B: Modernized version	1/2	1	**4/5**	0.2349
Portfolio C: New construction version	5/8	1 1/4	1	0.2909
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**2 2/3**	0.6139
Portfolio B: Modernized version	1/4	1	**3/4**	0.1632
Portfolio C: New construction version	3/8	1 1/3	1	0.2229
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/9**	**1 5/6**	0.4956
Portfolio B: Modernized version	1/2	1	**6/7**	0.2327
Portfolio C: New construction version	1/2	1 1/6	1	0.2717
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/4**	**2 1/2**	0.5423
Portfolio B: Modernized version	4/9	1	**1 1/7**	0.2430
Portfolio C: New construction version	2/5	7/8	1	0.2147
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/2**	**3 2/7**	0.6288
Portfolio B: Modernized version	2/7	1	**1**	0.1876
Portfolio C: New construction version	1/3	1	1	0.1836
CR	0.16%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/4**	**2 1/4**	0.5291
Portfolio B: Modernized version	4/9	1	**1**	0.2291
Portfolio C: New construction version	4/9	1	1	0.2418
CR	0.06%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.6155	0.5364	0.5113	0.4725	0.5226	0.1563	Ageing indicators	0.5287
Portfolio B: Modernized version	0.1621	0.2203	0.2056	0.2343	0.2372	0.2019	Household indicators	0.2147
Portfolio C: New construction version	0.2224	0.2433	0.2832	0.2932	0.2402	0.2164	Clusters of households	0.2566
						0.1744	Household composition	
						0.2509	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3567	0.4872	0.4920	0.5253	Build Quality	0.4198
Portfolio B: Modernized version	0.3202	0.2481	0.2082	0.2319	Age distribution of housing stock	0.2763
Portfolio C: New construction version	0.3231	0.2646	0.2997	0.2428	Average number of rooms per dwelling	0.3039

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Criteria ranking	Subcriteria: Environment social charac-teristics	Alternative ranking
Portfolio A: Extrapolated version	0.5447	0.4742	0.6139	0.4956	0.5423	0.6288	0.5291	0.0958	Population density	0.5413
Portfolio B: Modernized version	0.2371	0.2349	0.1632	0.2327	0.2430	0.1876	0.2291	0.2130	Income level	0.2206
Portfolio C: New con-struction version	0.2182	0.2909	0.2229	0.2717	0.2147	0.1836	0.2418	0.0830	Land area	0.2381
								0.1004	Supply/ de-mand	
								0.1226	Tenure status	
								0.1713	Levels of rent	
								0.2139	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	52.87%	41.98%	54.13%	36.17%	Demographic characteristics	**51.00%**
Portfolio B: Modernized version	21.47%	27.63%	22.06%	21.99%	Space characteristics	**23.07%**
Portfolio C: New construction version	25.66%	30.39%	23.81%	41.83%	Environment social characteristics	**25.93%**

Source: Own analyses

Appendix 144 Simulation 1, Romania

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/3**	**2 1/2**	0.5449
Portfolio B: Modernized version	3/7	1	**1**	0.2345
Portfolio C: New construction version	2/5	1	1	0.2206
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/3**	**2 2/7**	0.5748
Portfolio B: Modernized version	1/3	1	**5/7**	0.1748
Portfolio C: New construction version	4/9	1 3/7	1	0.2504
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7 1/3**	**4 1/7**	0.7275
Portfolio B: Modernized version	1/7	1	**5/8**	0.1021
Portfolio C: New construction version	1/4	1 5/8	1	0.1704
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/9**	**2**	0.5521
Portfolio B: Modernized version	1/3	1	**2/3**	0.1814
Portfolio C: New construction version	1/2	1 4/9	1	0.2665
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/2**	**2 1/2**	0.5943
Portfolio B: Modernized version	2/7	1	**3/4**	0.1709
Portfolio C: New construction version	2/5	1 1/3	1	0.2348
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 5/9**	**3 7/8**	0.6970
Portfolio B: Modernized version	1/6	1	**5/6**	0.1332
Portfolio C: New construction version	1/4	1 1/5	1	0.1698
CR	0.34%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/3**	**2 3/5**	0.5946
Portfolio B: Modernized version	1/3	1	**4/5**	0.1803
Portfolio C: New construction version	3/8	1 1/4	1	0.2251
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5449	0.5748	0.7275	0.5521	0.5943	0.6970	0.5946	0.0846	Population density	0.6093
Portfolio B: Modernized version	0.2345	0.1748	0.1021	0.1814	0.1709	0.1332	0.1803	0.2113	Income level	0.1693
Portfolio C: New construction version	0.2206	0.2504	0.1704	0.2665	0.2348	0.1698	0.2251	0.0596	Land area	0.2213
								0.0897	Supply/ demand	
								0.1100	Tenure status	
								0.1860	Levels of rent	
								0.2587	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	20.29%	13.08%	60.93%	32.32%	Demographic characteristics	**36.78%**
Portfolio B: Modernized version	33.63%	37.73%	16.93%	23.01%	Space characteristics	**27.12%**
Portfolio C: New construction version	46.08%	49.19%	22.13%	44.66%	Environment social characteristics	**36.10%**

Source: Own analyses

Appendix 145 Simulation 2, Romania

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 1/2**	0.5748
Portfolio B: Modernized version	1/3	1	**7/8**	0.1973
Portfolio C: New construction version	2/5	1 1/7	1	0.2280
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 2/7**	**3**	0.6069
Portfolio B: Modernized version	1/3	1	**7/8**	0.1833
Portfolio C: New construction version	1/3	1 1/7	1	0.2098
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 4/5**	**1 7/8**	0.5290
Portfolio B: Modernized version	1/3	1	**2/3**	0.1908
Portfolio C: New construction version	1/2	1 1/2	1	0.2803
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 2/5**	**1 2/3**	0.5309
Portfolio B: Modernized version	2/7	1	**5/9**	0.1626
Portfolio C: New construction version	3/5	1 4/5	1	0.3065
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 1/8**	0.5541
Portfolio B: Modernized version	1/3	1	**3/4**	0.1902
Portfolio C: New construction version	1/2	1 1/3	1	0.2557
CR	0.03%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/2**	**1 1/5**	0.4003
Portfolio B: Modernized version	2/3	1	**4/5**	0.2687
Portfolio C: New construction version	5/6	1 2/9	1	0.3309
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 1/2**	0.4598
Portfolio B: Modernized version	1/2	1	**5/6**	0.2415
Portfolio C: New construction version	2/3	1 1/5	1	0.2987
CR	0.15%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/5**	**1 3/8**	0.4586
Portfolio B: Modernized version	1/2	1	**5/8**	0.2095
Portfolio C: New construction version	5/7	1 3/5	1	0.3319
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 2/3**	**1 7/9**	0.4610
Portfolio B: Modernized version	3/5	1	**1**	0.2777
Portfolio C: New construction version	4/7	1	1	0.2613
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/8**	**1 5/8**	0.4913
Portfolio B: Modernized version	3/7	1	**5/7**	0.2091
Portfolio C: New construction version	5/8	1 3/7	1	0.2996
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 1/4**	**3**	0.6560
Portfolio B: Modernized version	1/5	1	**5/8**	0.1289
Portfolio C: New construction version	1/3	1 5/8	1	0.2151
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 2/9**	**1 4/9**	0.4682
Portfolio B: Modernized version	4/9	1	**2/3**	0.2153
Portfolio C: New construction version	2/3	1 4/9	1	0.3164
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/2**	**1 4/5**	0.5114
Portfolio B: Modernized version	2/5	1	**3/4**	0.2058
Portfolio C: New construction version	5/9	1 1/3	1	0.2828
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4**	**2 3/4**	0.6216
Portfolio B: Modernized version	1/4	1	**5/6**	0.1664
Portfolio C: New construction version	1/3	1 1/5	1	0.2120
CR	0.34%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/8**	**1 7/8**	0.5116
Portfolio B: Modernized version	3/7	1	**4/5**	0.2171
Portfolio C: New construction version	1/2	1 1/4	1	0.2712
CR	0.01%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5748	0.6069	0.5290	0.5309	0.5541	0.1984	Ageing indicators	0.5588
Portfolio B: Modernized version	0.1973	0.1833	0.1908	0.1626	0.1902	0.1932	Household indicators	0.1855
Portfolio C: New construction version	0.2280	0.2098	0.2803	0.3065	0.2557	0.2171	Clusters of households	0.2557
						0.1782	Household composition	
						0.2131	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.4003	0.4598	0.4586	0.5250	Build Quality	0.4283
Portfolio B: Modernized version	0.2687	0.2415	0.2095	0.2464	Age distribution of housing stock	0.2485
Portfolio C: New construction version	0.3309	0.2987	0.3319	0.2287	Average number of rooms per dwelling	0.3232

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac- teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.4610	0.4913	0.6560	0.4682	0.5114	0.6216	0.5116	0.0846	Population density	0.5282
Portfolio B: Modernized version	0.2777	0.2091	0.1289	0.2153	0.2058	0.1664	0.2171	0.2113	Income level	0.2045
Portfolio C: New con- struction version	0.2613	0.2996	0.2151	0.3164	0.2828	0.2120	0.2712	0.0596	Land area	0.2673
								0.0897	Supply/ de- mand	
								0.1100	Tenure status	
								0.1860	Levels of rent	
								0.2587	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	55.88%	42.83%	52.82%	32.32%	Demographic characteristics	**51.51%**
Portfolio B: Modernized version	18.55%	24.85%	20.45%	23.01%	Space characteristics	**20.85%**
Portfolio C: New construction version	25.57%	32.32%	26.73%	44.66%	Environment social characteristics	**27.64%**

Source: Own analyses

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Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 4/5**	0.5877
Portfolio B: Modernized version	1/3	1	**1**	0.2002
Portfolio C: New construction version	1/3	1	1	0.2121
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 2/9**	0.5626
Portfolio B: Modernized version	1/3	1	**3/4**	0.1879
Portfolio C: New construction version	4/9	1 1/3	1	0.2495
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7**	**4 1/2**	0.7327
Portfolio B: Modernized version	1/7	1	**5/7**	0.1095
Portfolio C: New construction version	2/9	1 2/5	1	0.1578
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 1/8**	0.5559
Portfolio B: Modernized version	1/3	1	**5/7**	0.1842
Portfolio C: New construction version	1/2	1 2/5	1	0.2599
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 4/7**	**2 1/2**	0.5978
Portfolio B: Modernized version	2/7	1	**3/4**	0.1691
Portfolio C: New construction version	2/5	1 1/3	1	0.2330
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5 1/2**	**4**	0.6983
Portfolio B: Modernized version	1/5	1	**5/6**	0.1329
Portfolio C: New construction version	1/4	1 2/9	1	0.1688
CR	0.15%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 3/7**	**3 2/7**	0.6261
Portfolio B: Modernized version	2/7	1	**1**	0.1829
Portfolio C: New construction version	1/3	1	1	0.1910
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Alternative ranking
Portfolio A: Extrapolated version	0.5877	0.5626	0.7327	0.5559	0.5978	0.6983	0.6261	0.6204
Portfolio B: Modernized version	0.2002	0.1879	0.1095	0.1842	0.1691	0.1329	0.1829	0.1692
Portfolio C: New construction version	0.2121	0.2495	0.1578	0.2599	0.2330	0.1688	0.1910	0.2104

Criteria ranking	**Subcriteria: Environment social characteristics**
0.0801	Population density
0.2213	Income level
0.0770	Land area
0.0908	Supply/ demand
0.1197	Tenure status
0.1802	Levels of rent
0.2310	Economic conditions

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	20.50%	13.49%	62.04%	34.13%	Demographic characteristics	**36.67%**
Portfolio B: Modernized version	34.66%	37.57%	16.92%	23.06%	Space characteristics	**27.74%**
Portfolio C: New construction version	44.84%	48.94%	21.04%	42.81%	Environment social characteristics	**35.59%**

Source: Own analyses

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Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 7/8**	**2 5/9**	0.5752
Portfolio B: Modernized version	1/3	1	**6/7**	0.1970
Portfolio C: New construction version	2/5	1 1/6	1	0.2277
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3**	**2 6/7**	0.5926
Portfolio B: Modernized version	1/3	1	**1**	0.1974
Portfolio C: New construction version	1/3	1	1	0.2100
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**1 5/6**	0.5268
Portfolio B: Modernized version	3/8	1	**3/4**	0.2005
Portfolio C: New construction version	1/2	1 1/3	1	0.2728
CR	0.20%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/3**	**1 3/4**	0.5371
Portfolio B: Modernized version	1/3	1	**5/8**	0.1726
Portfolio C: New construction version	4/7	1 3/5	1	0.2904
CR	0.34%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/3**	**2 2/9**	0.5717
Portfolio B: Modernized version	1/3	1	**3/4**	0.1787
Portfolio C: New construction version	4/9	1 1/3	1	0.2496
CR	0.10%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/2**	**1 2/9**	0.3984
Portfolio B: Modernized version	2/3	1	**2/3**	0.2523
Portfolio C: New construction version	5/6	1 1/2	1	0.3492
CR	0.39%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 5/9**	0.4628
Portfolio B: Modernized version	1/2	1	**7/8**	0.2476
Portfolio C: New construction version	2/3	1 1/7	1	0.2896
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/6**	**1 4/7**	0.4765
Portfolio B: Modernized version	1/2	1	**3/4**	0.2243
Portfolio C: New construction version	2/3	1 1/3	1	0.2992
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 6/7**	0.4872
Portfolio B: Modernized version	1/2	1	**1**	0.2490
Portfolio C: New construction version	1/2	1	1	0.2638
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 1/2**	0.4617
Portfolio B: Modernized version	1/2	1	**3/4**	0.2313
Portfolio C: New construction version	2/3	1 1/3	1	0.3071
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4 3/5**	**3**	0.6463
Portfolio B: Modernized version	2/9	1	**5/7**	0.1448
Portfolio C: New construction version	1/3	1 2/5	1	0.2089
CR	0.09%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2**	**1 2/5**	0.4549
Portfolio B: Modernized version	1/2	1	**5/7**	0.2261
Portfolio C: New construction version	5/7	1 2/5	1	0.3190
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/8**	**1 2/3**	0.4978
Portfolio B: Modernized version	3/7	1	**3/4**	0.2112
Portfolio C: New construction version	3/5	1 1/3	1	0.2910
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 2/3**	**2 2/3**	0.6068
Portfolio B: Modernized version	2/7	1	**5/6**	0.1732
Portfolio C: New construction version	3/8	1 2/9	1	0.2200
CR	0.15%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 2/7**	**2 1/5**	0.5274
Portfolio B: Modernized version	4/9	1	**1**	0.2312
Portfolio C: New construction version	1/2	1	1	0.2414
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5752	0.5926	0.5268	0.5371	0.5717	0.2003	Ageing indicators	0.5623
Portfolio B: Modernized version	0.1970	0.1974	0.2005	0.1726	0.1787	0.2258	Household indicators	0.1904
Portfolio C: New construction version	0.2277	0.2100	0.2728	0.2904	0.2496	0.2167	Clusters of households	0.2473
						0.1473	Household composition	
						0.2099	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.3984	0.4628	0.4765	0.4567	Build Quality	0.4365
Portfolio B: Modernized version	0.2523	0.2476	0.2243	0.3132	Age distribution of housing stock	0.2444
Portfolio C: New construction version	0.3492	0.2896	0.2992	0.2301	Average number of rooms per dwelling	0.3190

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.4872	0.4617	0.6463	0.4549	0.4978	0.6068	0.5274	0.0801	Population density	0.5230
Portfolio B: Modernized version	0.2490	0.2313	0.1448	0.2261	0.2112	0.1732	0.2312	0.2213	Income level	0.2127
Portfolio C: New con-struction version	0.2638	0.3071	0.2089	0.3190	0.2910	0.2200	0.2414	0.0770	Land area	0.2643
								0.0908	Supply/ de-mand	
								0.1197	Tenure status	
								0.1802	Levels of rent	
								0.2310	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	56.23%	43.65%	52.30%	34.13%	Demographic characteristics	**51.65%**
Portfolio B: Modernized version	19.04%	24.44%	21.27%	23.06%	Space characteristics	**21.24%**
Portfolio C: New construction version	24.73%	31.90%	26.43%	42.81%	Environment social characteristics	**27.11%**

Source: Own analyses

Appendix 148 Simulation 1, Spain

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/2**	**1 2/3**	0.4433
Portfolio B: Modernized version	2/3	1	**1**	0.2906
Portfolio C: New construction version	3/5	1	1	0.2661
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 3/7**	**1 2/5**	0.7804
Portfolio B: Modernized version	1/7	1	**1**	0.1104
Portfolio C: New construction version	1/7	1	1	0.1093
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/9**	**1 1/6**	0.3619
Portfolio B: Modernized version	1	1	**1**	0.3287
Portfolio C: New construction version	6/7	1	1	0.3094
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/9**	**1 1/5**	0.3651
Portfolio B: Modernized version	8/9	1	**1**	0.3272
Portfolio C: New construction version	5/6	1	1	0.3077
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/6**	**2 2/5**	0.5317
Portfolio B: Modernized version	1/2	1	**1**	0.2402
Portfolio C: New construction version	3/7	1	1	0.2281
CR	0.05%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.4433	0.7804	0.3619	0.3651	0.5317	0.1825	Ageing indicators	0.4858
Portfolio B: Modernized version	0.2906	0.1104	0.3287	0.3272	0.2402	0.1801	Household indicators	0.2649
Portfolio C: New construction version	0.2661	0.1093	0.3094	0.3077	0.2281	0.2236	Clusters of households	0.2493
						0.2198	Household composition	
						0.1941	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	48.58%	23.62%	26.35%	43.60%	Demographic characteristics	**35.41%**
Portfolio B: Modernized version	26.49%	43.59%	40.07%	22.91%	Space characteristics	**34.96%**
Portfolio C: New construction version	24.93%	32.79%	33.58%	33.49%	Environment social characteristics	**29.63%**

Source: Own analyses

Appendix 149 Simulation 2, Spain

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/4**	**2 1/2**	0.5443
Portfolio B: Modernized version	4/9	1	**1**	0.2379
Portfolio C: New construction version	2/5	1	1	0.2178
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/7**	**2 1/9**	0.5160
Portfolio B: Modernized version	1/2	1	**1**	0.2432
Portfolio C: New construction version	1/2	1	1	0.2408
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 2/3**	**1 3/4**	0.4597
Portfolio B: Modernized version	3/5	1	**1**	0.2783
Portfolio C: New construction version	4/7	1	1	0.2620
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 2/3**	**1 4/5**	0.4631
Portfolio B: Modernized version	3/5	1	**1**	0.2767
Portfolio C: New construction version	5/9	1	1	0.2602
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/4**	**3 4/7**	0.6300
Portfolio B: Modernized version	1/3	1	**1**	0.1898
Portfolio C: New construction version	2/7	1	1	0.1802
CR	0.05%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/6**	**2**	0.4246
Portfolio B: Modernized version	6/7	1	**1 2/3**	0.3587
Portfolio C: New construction version	1/2	3/5	1	0.2167
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 4/7**	**2 3/7**	0.4895
Portfolio B: Modernized version	5/8	1	**1 1/2**	0.3086
Portfolio C: New construction version	2/5	2/3	1	0.2019
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 5/9**	**2**	0.5350
Portfolio B: Modernized version	2/5	1	**6/7**	0.2124
Portfolio C: New construction version	1/2	1 1/6	1	0.2526
CR	0.02%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**3 1/9**	0.5932
Portfolio B: Modernized version	3/8	1	**1**	0.2129
Portfolio C: New construction version	1/3	1	1	0.1939
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 5/7**	**1 8/9**	0.4723
Portfolio B: Modernized version	3/5	1	**1 1/7**	0.2796
Portfolio C: New construction version	1/2	7/8	1	0.2481
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3 1/9**	**3 1/5**	0.6120
Portfolio B: Modernized version	1/3	1	**1**	0.1995
Portfolio C: New construction version	1/3	1	1	0.1885
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 1/7**	**2 2/3**	0.5427
Portfolio B: Modernized version	1/2	1	**1 1/4**	0.2549
Portfolio C: New construction version	3/8	4/5	1	0.2024
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 2/5**	**1 2/3**	0.4319
Portfolio B: Modernized version	5/7	1	**1**	0.3000
Portfolio C: New construction version	3/5	1	1	0.2680
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**2 3/4**	**2 8/9**	0.5839
Portfolio B: Modernized version	3/8	1	**1 1/8**	0.2179
Portfolio C: New construction version	1/3	8/9	1	0.1982
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1 1/3**	**1 5/6**	0.4343
Portfolio B: Modernized version	3/4	1	**1 1/2**	0.3354
Portfolio C: New construction version	1/2	2/3	1	0.2303
CR	0.05%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Criteria ranking	Subcriteria: Demographic characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.5443	0.5160	0.4597	0.4631	0.6300	0.1825	Ageing indicators	0.5191
Portfolio B: Modernized version	0.2379	0.2432	0.2783	0.2767	0.1898	0.1801	Household indicators	0.2471
Portfolio C: New construction version	0.2178	0.2408	0.2620	0.2602	0.1802	0.2236	Clusters of households	0.2338
						0.2198	Household composition	
						0.1941	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.4246	0.4895	0.5350	0.3622	Build Quality	0.4793
Portfolio B: Modernized version	0.3587	0.3086	0.2124	0.3444	Age distribution of housing stock	0.2985
Portfolio C: New construction version	0.2167	0.2019	0.2526	0.2933	Average number of rooms per dwelling	0.2221

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.5932	0.4723	0.6120	0.5427	0.4319	0.5839	0.4343	0.1022	Population density	0.5126
Portfolio B: Modernized version	0.2129	0.2796	0.1995	0.2549	0.3000	0.2179	0.3354	0.1674	Income level	0.2657
Portfolio C: New con-struction version	0.1939	0.2481	0.1885	0.2024	0.2680	0.1982	0.2303	0.0933	Land area	0.2217
								0.1374	Supply/ de-mand	
								0.1359	Tenure status	
								0.1643	Levels of rent	
								0.1995	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	51.91%	47.93%	51.26%	43.60%	Demographic characteristics	**50.78%**
Portfolio B: Modernized version	24.71%	29.85%	26.57%	22.91%	Space characteristics	**26.51%**
Portfolio C: New construction version	23.38%	22.21%	22.17%	33.49%	Environment social characteristics	**22.71%**

Source: Own analyses

Appendix 150 Holistic real estate portfolio system, excluding Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space characteristics	Environment social characteristics	Eigenvector
Demographic characteristics	1	**1 5/9**	**7/9**	0.3443
Space characteristics	2/3	1	**5/9**	0.2274
Environment social characteristics	1 2/7	1 5/6	1	0.4282
CR	0.09%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**6/7**	**1 1/4**	**1**	0.1997
Household indicators	1	1	**1**	**1 1/3**	**1**	0.2091
Clusters of households	1 1/6	1	1	**1 1/4**	**8/9**	0.2106
Household composition	4/5	3/4	4/5	1	**3/4**	0.1623
Housing indicators	1	1	1 1/8	1 1/3	1	0.2183
CR	0.12%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1 4/5**	**2**	0.4876
Age distribution of housing stock	5/9	1	**1 1/9**	0.2692
Average number of rooms per dwelling	1/2	1	1	0.2432
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**2/7**	**2**	**6/7**	**2/3**	**3/7**	**1/4**	0.0841
Income level	3 3/7	1	**2 5/9**	**1 6/7**	**1 8/9**	**1**	**1 1/8**	0.2184
Land area	1/2	2/5	1	**5/7**	**3/5**	**1/2**	**3/8**	0.0725
Supply/ demand	1 1/6	1/2	1 2/5	1	**2/3**	**3/5**	**1/2**	0.1011
Tenure status	1 1/2	1/2	1 2/3	1 4/9	1	**5/8**	**2/3**	0.1258
Levels of rent	2 1/3	1	2	1 2/3	1 5/8	1	**7/8**	0.1819
Economic conditions	4	8/9	2 2/3	2	1 3/7	1 1/7	1	0.2162
CR	1.47%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/7**	**4/7**	0.2216
Portfolio B: Modernized version	1 3/4	1	**1**	0.3848
Portfolio C: New construction version	1 3/4	1	1	0.3937
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**5/9**	0.2139
Portfolio B: Modernized version	1 8/9	1	**1**	0.4008
Portfolio C: New construction version	1 7/9	1	1	0.3853
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**2/5**	0.1870
Portfolio B: Modernized version	1 6/7	1	**4/5**	0.3587
Portfolio C: New construction version	2 1/2	1 1/4	1	0.4543
CR	0.08%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**3/8**	0.1845
Portfolio B: Modernized version	1 5/6	1	**7/9**	0.3499
Portfolio C: New construction version	2 5/8	1 2/7	1	0.4656
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.2047
Portfolio B: Modernized version	2	1	**1**	0.3929
Portfolio C: New construction version	2	1	1	0.4024
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/4**	**2/7**	0.1208
Portfolio B: Modernized version	3 2/3	1	**1**	0.4290
Portfolio C: New construction version	3 3/5	1	1	0.4503
CR	0.14%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/8**	**1/3**	0.1511
Portfolio B: Modernized version	2 2/3	1	**1**	0.4141
Portfolio C: New construction version	3	1	1	0.4348
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**1/3**	0.1607
Portfolio B: Modernized version	2 1/4	1	**3/4**	0.3594
Portfolio C: New construction version	3	1 1/3	1	0.4799
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**4/9**	0.1786
Portfolio B: Modernized version	2 1/3	1	**1**	0.4209
Portfolio C: New construction version	2 1/4	1	1	0.4006
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/7**	**1/3**	0.1611
Portfolio B: Modernized version	2 2/7	1	**4/5**	0.3703
Portfolio C: New construction version	3	1 1/4	1	0.4685
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7/8**	**3/5**	0.2637
Portfolio B: Modernized version	1 1/7	1	**3/4**	0.3074
Portfolio C: New construction version	1 2/3	1 3/8	1	0.4289
CR	0.04%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**1/3**	0.1602
Portfolio B: Modernized version	2 1/4	1	**7/9**	0.3656
Portfolio C: New construction version	3	1 2/7	1	0.4742
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**2/5**	0.1835
Portfolio B: Modernized version	2	1	**6/7**	0.3723
Portfolio C: New construction version	2 1/2	1 1/6	1	0.4441
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**7/9**	**5/9**	0.2476
Portfolio B: Modernized version	1 2/7	1	**6/7**	0.3353
Portfolio C: New construction version	1 7/9	1 1/6	1	0.4171
CR	0.30%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**3/7**	0.1853
Portfolio B: Modernized version	2 1/9	1	**1**	0.3979
Portfolio C: New construction version	2 2/7	1	1	0.4167
CR	0.04%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2216	0.2139	0.1870	0.1845	0.2047	0.1997	Ageing indicators	0.2030
Portfolio B: Modernized version	0.3848	0.4008	0.3587	0.3499	0.3929	0.2091	Household indicators	0.3787
Portfolio C: New construction version	0.3937	0.3853	0.4543	0.4656	0.4024	0.2106	Clusters of households	0.4183
						0.1623	Household composition	
						0.2183	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Space characteristics**

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	**Criteria ranking**	**Subcriteria: Space characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1208	0.1511	0.1607	0.4876	Build Quality	0.1387
Portfolio B: Modernized version	0.4290	0.4141	0.3594	0.2692	Age distribution of housing stock	0.4080
Portfolio C: New construction version	0.4503	0.4348	0.4799	0.2432	Average number of rooms per dwelling	0.4533

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1786	0.1611	0.2637	0.1602	0.1835	0.2476	0.1853	0.0841	Population density	0.1937
Portfolio B: Modernized version	0.4209	0.3703	0.3074	0.3656	0.3723	0.3353	0.3979	0.2184	Income level	0.3694
Portfolio C: New con-struction version	0.4006	0.4685	0.4289	0.4742	0.4441	0.4171	0.4167	0.0725	Land area	0.4369
								0.1011	Supply/ de-mand	
								0.1258	Tenure status	
								0.1819	Levels of rent	
								0.2162	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	**Criteria ranking**	**Criteria**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2030	0.1387	0.1937	0.3443	Demographic characteristics	**0.1844**
Portfolio B: Modernized version	0.3787	0.4080	0.3694	0.2274	Space characteristics	**0.3814**
Portfolio C: New construction version	0.4183	0.4533	0.4369	0.4282	Environment social characteristics	**0.4342**

Source: Own analyses

Appendix 151 Holistic real estate portfolio system, including Spain

Matrix of pairwise comparisons

Compare the relative importance with respect to the goal: **Valuation of properties**

Criteria

	Demographic characteristics	Space charac-teristics	Environment social characteristics	Eigenvector
Demographic character-istics	1	**1 3/5**	**4/5**	0.3534
Space characteristics	5/8	1	**5/9**	0.2280
Environment social characteristics	1 2/9	1 7/9	1	0.4186
CR	0.10%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Demographic characteristics**

Subcriteria demographic characteristics

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	Eigenvector
Ageing indicators	1	**1**	**6/7**	**1 1/5**	**1**	0.1980
Household indicators	1	1	**1**	**1 1/4**	**1**	0.2060
Clusters of households	1 1/6	1	1	**1 2/9**	**1**	0.2122
Household composition	5/6	4/5	5/6	1	**3/4**	0.1670
Housing indicators	1	1	1	1 1/3	1	0.2167
CR	0.11%	< 10%				1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Space characteristics**

Subcriteria space characteristics

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Eigenvector
Build Quality	1	**1 5/7**	**2**	0.4743
Age distribution of housing stock	3/5	1	**1 1/9**	0.2772
Average number of rooms per dwelling	1/2	1	1	0.2485
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance with respect to the criterion: **Environment social characteristics**

Subcriteria environment social characteristics

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	Eigenvector
Population density	1	**1/3**	**2**	**5/6**	**2/3**	**4/9**	**1/4**	0.0860
Income level	3 1/5	1	**2 2/5**	**1 4/5**	**1 5/6**	**1**	**1 1/9**	0.2130
Land area	1/2	2/5	1	**5/7**	**3/5**	**1/2**	**2/5**	0.0745
Supply/ demand	1 1/5	5/9	1 2/5	1	**5/7**	**5/8**	**1/2**	0.1045
Tenure status	1 1/2	5/9	1 2/3	1 2/5	1	**5/8**	**2/3**	0.1267
Levels of rent	2 1/4	1	2	1 3/5	1 3/5	1	**7/8**	0.1805
Economic conditions	3 4/5	8/9	2 3/5	2	1 3/7	1 1/7	1	0.2148
CR	1.34%	< 10%						1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Ageing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**3/5**	**3/5**	0.2273
Portfolio B: Modernized version	1 5/7	1	**1**	0.3831
Portfolio C: New construction version	1 2/3	1	1	0.3897
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**4/7**	0.2185
Portfolio B: Modernized version	1 7/8	1	**1**	0.3976
Portfolio C: New construction version	1 5/6	1	1	0.3838
CR	0.01%	< 5%		0.9999

Compare the relative preference with respect to the subcriterion: **Clusters of households (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**2/5**	0.1902
Portfolio B: Modernized version	1 6/7	1	**5/6**	0.3622
Portfolio C: New construction version	2 2/5	1 1/5	1	0.4476
CR	0.06%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Household composition (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**2/5**	0.1884
Portfolio B: Modernized version	1 5/6	1	**4/5**	0.3544
Portfolio C: New construction version	2 1/2	1 1/4	1	0.4572
CR	0.10%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Housing indicators (from the criterion demographic characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**5/9**	**5/9**	0.2173
Portfolio B: Modernized version	1 4/5	1	**1**	0.3883
Portfolio C: New construction version	1 4/5	1	1	0.3944
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Build Quality (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**2/7**	**1/3**	0.1277
Portfolio B: Modern-ized version	3 5/9	1	**1**	0.4378
Portfolio C: New con-struction version	3 2/7	1	1	0.4345
CR	0.12%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Age distribution of housing stock (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrap-olated version	Portfolio B: Mod-ernized version	Portfolio C: New con-struction version	Eigenvector
Portfolio A: Extrapo-lated version	1	**3/8**	**3/8**	0.1587
Portfolio B: Modern-ized version	2 3/5	1	**1**	0.4204
Portfolio C: New con-struction version	2 2/3	1	1	0.4209
CR	0.02%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Average number of rooms per dwelling (from the criterion space characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/3**	0.1701
Portfolio B: Modernized version	2 1/9	1	**3/4**	0.3574
Portfolio C: New construction version	2 7/9	1 1/3	1	0.4725
CR	0.00%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative preference with respect to the subcriterion: **Population density (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**1/2**	0.1911
Portfolio B: Modernized version	2 1/7	1	**1**	0.4134
Portfolio C: New construction version	2	1	1	0.3954
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Income level (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/9**	**3/8**	0.1674
Portfolio B: Modernized version	2 1/4	1	**5/6**	0.3749
Portfolio C: New construction version	2 3/4	1 2/9	1	0.4578
CR	0.00%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Land area (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**8/9**	**5/8**	0.2705
Portfolio B: Modernized version	1 1/8	1	**3/4**	0.3105
Portfolio C: New construction version	1 4/7	1 1/3	1	0.4190
CR	0.03%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Supply/ demand (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**3/8**	0.1706
Portfolio B: Modernized version	2 1/7	1	**5/6**	0.3709
Portfolio C: New construction version	2 5/7	1 2/9	1	0.4584
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Tenure status (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**3/7**	0.1860
Portfolio B: Modernized version	2	1	**6/7**	0.3755
Portfolio C: New construction version	2 3/8	1 1/6	1	0.4385
CR	0.01%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Levels of rent (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**4/5**	**3/5**	0.2556
Portfolio B: Modernized version	1 1/4	1	**7/8**	0.3372
Portfolio C: New construction version	1 2/3	1 1/7	1	0.4072
CR	0.29%	< 5%		1.0000

Compare the relative preference with respect to the subcriterion: **Economic conditions (from the criterion environment social characteristics)**

Alternatives

	Portfolio A: Extrapolated version	Portfolio B: Modernized version	Portfolio C: New construction version	Eigenvector
Portfolio A: Extrapolated version	1	**1/2**	**4/9**	0.1873
Portfolio B: Modernized version	2 1/9	1	**1**	0.4054
Portfolio C: New construction version	2 2/9	1	1	0.4073
CR	0.05%	< 5%		1.0000

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Demographic characteristics**

Alternatives

	Ageing indicators	Household indicators	Clusters of households	Household composition	Housing indicators	**Criteria ranking**	**Subcriteria: Demographic characteristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.2273	0.2185	0.1902	0.1884	0.2173	0.1980	Ageing indicators	0.2090
Portfolio B: Modernized version	0.3831	0.3976	0.3622	0.3544	0.3883	0.2060	Household indicators	0.3780
Portfolio C: New construction version	0.3897	0.3838	0.4476	0.4572	0.3944	0.2122	Clusters of households	0.4130
						0.1670	Household composition	
						0.2167	Housing indicators	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives:
Space characteristics

Alternatives

	Build Quality	Age distribution of housing stock	Average number of rooms per dwelling	Criteria ranking	Subcriteria: Space characteristics	Alternative ranking
Portfolio A: Extrapolated version	0.1277	0.1587	0.1701	0.4743	Build Quality	0.1468
Portfolio B: Modernized version	0.4378	0.4204	0.3574	0.2772	Age distribution of housing stock	0.4130
Portfolio C: New construction version	0.4345	0.4209	0.4725	0.2485	Average number of rooms per dwelling	0.4402

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the subcriteria with respect to the alternatives: **Environment social characteristics**

Alternatives

	Population density	Income level	Land area	Supply/ demand	Tenure status	Levels of rent	Economic conditions	**Criteria ranking**	**Subcriteria: Environment social charac-teristics**	**Alternative ranking**
Portfolio A: Extrapolated version	0.1911	0.1674	0.2705	0.1706	0.1860	0.2556	0.1873	0.0860	Population density	0.2000
Portfolio B: Modernized version	0.4134	0.3749	0.3105	0.3709	0.3755	0.3372	0.4054	0.2130	Income level	0.3728
Portfolio C: New con-struction version	0.3954	0.4578	0.4190	0.4584	0.4385	0.4072	0.4073	0.0745	Land area	0.4272
								0.1045	Supply/ de-mand	
								0.1267	Tenure status	
								0.1805	Levels of rent	
								0.2148	Economic conditions	

Source: Own analyses

Matrix of pairwise comparisons

Compare the relative importance of the criteria with respect to the alternatives: **Total ranking**

Alternatives

	Demographic characteristics	Space characteristics	Environment social characteristics	Criteria ranking	Criteria	Alternative ranking
Portfolio A: Extrapolated version	0.2090	0.1468	0.2000	0.3534	Demographic characteristics	**0.1910**
Portfolio B: Modernized version	0.3780	0.4130	0.3728	0.2280	Space characteristics	**0.3838**
Portfolio C: New construction version	0.4130	0.4402	0.4272	0.4186	Environment social characteristics	**0.4251**

Source: Own analyses