China-USA Business Review, May.-Jun. 2021, Vol. 20, No. 3, 138-150
doi: 10.17265/1537-1514/2021.03.003

Impact of External Characteristics on Housing Rental Prices in the City of Valencia

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The aim of the paper is to analyze the impact of external or locational characteristics on the housing rental price. We try to determine factors that are most important for the housing rental prices by using the multiple linear regression. We have used a sample of 2,678 rental properties and start with 18 neighbourhood variables relating to the socio-economic level of the population, facilities, environmental surroundings and accessibility. In order to reduce the number of explanatory variables and avoid multicollinearity problems, we carry out a factor analysis which leads us to select seven variables for future introduction into a housing price model. The analysis points out that socio-economic variables of the neighbourhood are the relevant and explanatory elements of the rental price. We also appreciate that centrality analysed from the distance to the CBD has not relevance. The results are of interest to the housing rental market, both for investor's decision-making and for the design of marketing and communication strategies. Also, the results are useful to the design of urban policies relating to public housing for rent. The housing area has a very important weight in the model; if we limit it in the selected sample, we think that we will be able to measure to a greater extent the impact of external variables.

Keywords: housing market, rental price, externalities, accessibility

Introduction

In Spain, the proportion of housing for rent in relation to the housing owned has always been lower than in other neighbouring countries. However, over the past decade, demand and price for rental housing has increased significantly. The housing rental market is of great interest to the private developers and public sector, as well as for the real estate investment sector. In this context, knowledge of the aspects that add value to rental housing demanders is of great interest. Thus, the following work aims to identify the relevant variables capable of explaining the incidence of location on the price of renting housing in the City of Valencia. To carry out the study, the rentalprices of 2,678 housing have been extracted during the month of July 2019 from the real estate portal *idealista.com*. The location variables, such as demographic and socio-economic characteristics of the population, facilities and accessibility have been obtained from the Valencia City Council Statistical Office. Demographic data come from the *Padrón de Habitantes in 2017* and the *Censo de Población*

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y Vivienda 2011; other sources used are *the Impuesto de vehículos y el Censo de Actividades Económicas in 2017*.

The starting point comes from a selection of 18 variables; on these, a factorial analysis is performed. Some of these price explanatory variables will be incorporated into a future pricing model. Thus, the number of factors obtained in factorial analysis will limit the number of explanatory variables to be applied in the model.

The literature shows that most studies about rental housing prices are based on the analysis of characteristics on the price of the property. Even though, in this work, we focus on the price of the rent, we understand that variables that influence the purchase price will also be applicable for explaining rental prices. Although there is no single relationship between the housing price and the rental price in the urban space, we start from the hypothesis that variables explaining property price will be the same as those that determine rental price. Housing prices depends on many characteristics linked both to internal aspects and its location. Although we know that internal aspects, such as the total area of the house, the number of rooms and bathrooms, the quality of materials, and the state of conservation, among others, influence the price of the house, in this research we will focus on external aspects.

Literature Review

With regard to the impact of external factors on housing prices, different models revolve around two approaches or theories: accessibility and externalities (Núñez Tabales, Caridad y Ocerín, & Ceular Villamandos, 2009). It would be expected that the aspects that imply greater accessibility, in public or private facilities, to work, shops, leisure centres and parks, will represent a greater value of the environment. This will be reflected in a higher price of the land, property and rented housing. In the opposite direction, there are other environmental factors that negatively affect property prices, such as noise and environmental pollution, insecurity and crime.

Starting with the analysis of accessibility in housing price, urban income and housing prices have been a topic of interest in economic literature since the second half of the 20th century. The first researchers to address this issue relied on the model developed by von Thünen (1826) focusing on the relationship between the accessibility and housing prices. They all start from the idea that housing with poor accessibility have higher transport costs, consequently they should be provided at a lower price to compensate the costs of their poor accessibility (Alonso, 1964; Mills, 1967; Muth, 1975; Wingo, 1972). These monocentric models consider that accessibility means savings in the costs of access to the centre, understood to the place where work, commerce or amenities are located. The sorter the distance the greater the savings in transport cost. A better accessibility generates an economic value in land rent and therefore in the price of the house. The value of housing decreases significantly with the distance to the centre and to the places where employment is concentrated (Munroe, 2007). Conversely, different studies do not support the hypothesis of models in which the price decreases according to the distance from (Bender & Hwang, 1985). If we measure accessibility from distance to work centres the conclusions are not coincidental. Different works focus on finding other accessibility measures (Song, 1996; Katz & Rosen, 1987); some of them indicate travel time reflects better accessibility than distance (Golledge & Stimson 1997). Other studies conclude that the value of accessibility is not an independent factor from the income level and changes throughout the urban space. Thereby, in low-income areas, accessibility to work is an important aspect, unlike in high-income areas (Quigley, 1985).

On the other hand, from the publication of Rosen's work in 1974 with the hedonist methodology, in addition to the accessibility measured by distance or travel time to the centre, other variables related to the environment and neighbourhood are also introduced. Many approaches, beginning with Tiebout (1956), consider residential location decisions are not based on distance to the centre, but on preferences of other location aspects, such as the environmental surroundings, quality of education, public facilities and shops, among others.

Again, in relation to accessibility, access to public transport should be taken into account as a determining factor in the housing price. The results of several studies on this issue are inconclusive. Some of them conclude that access to the metro and urban train positively affects housing prices (Cervero, 1994; 1996; Cervero & Duncan, 2002; Chatman & Tulach, 2012; Chen & Haynee, 2015; Hess & Almeida, 2007; C. M. Hewitt & W. E. Hewitt, 2012; Zhang, Liu, Hang, Yao, & Shi, 2016). Conversely, other studies question the positive influence of access to public transport on housing prices (Forrest, Glen, & Ward, 1996; Henneberry, 1998). On the other hand, some studies indicate that the effects are both positive (saving time) and negative (noise and landscape pollution). If the positive effect takes precedence over the negative, proximity will positively affect the price of the house and vice versa. Negative externalities will be higher in those housing that are very close to railroad tracks, especially on surface-running trains (Al-Mosaind, Dueker, & Strathan, 1993; Chen, Dueker, & Rufolo, 1997; Laakso, 1992; Munroe, 2007; So, Tse, & Ganesan, 1997).

The relationship between accessibility and green spaces, as well as the environmental quality of the surroundings, it has been studied by researchers. Many studies conclude that neighbourhoods with green spaces and environmental quality incline buyers to pay a higher price (Bengochea, 2003; Brasington & Hite, 2005; Bolitzer & Netusil, 2000; Panduro & Veie, 2013; Jim, & Chen, 2006; Gibbons, Mourato, & Resende, 2014; Kong & Nakagoshi, 2007; Luttik, 2000; Se Can & Megbolugbe, 1997; Tajima, 2003; Tyrväinen, 1997; Geoghegan, Wainger, & Bockstael, 1997; Wyatt, 1996).

An educational facility is another aspect that can positively affect the housing prices. Many works find a positive value between educational equipment and housing prices (Chin & i Foong, 2006; Fack & Grenet, 2010; Gibbons & Machin, 2003; Haurin & Brasington 1996; Jud & Watts, 1981; Kestens, Theriault, & Des Rosiers, 2005; Owusu-Edusei, Espey, & Lin, 2015; Feng & Ming, 2013; Sedgley, Williams, & Derrick, 2008; Velma & Turnbull, 2009; Zheng, Hu, & Wang, 2015; Wen, Y. Zhang, & L. Zhang, 2014).

In terms of negative externalities, a pioneering work of analyses the influence of environmental noise and air quality (Ridker & Henning, 1967); other works focus on aircraft noise (Blanco Matos, Flindell, Le Masurier, & Pownall, 2013; Steimetz, 2010). A review of the literature can be found (Boyle & Kiel, 2001).

So far, we have referred to characteristics of the environment relating to physical aspects, such as distance to work centres or access to public transport. In addition to physical externalities, there are other types of externalities, such as social and economic (Caballer & Rodríguez, 2002). We focus on socio-economic nature, on aspects related to the status of the neighbourhood or social class. This is valued from variables relative to characteristics of the population, such as income, level of studies or professional activity (Fitch Osuna & Garcia-Almirall, 2008). In cities, to a greater or lesser extent, there is residential segregation that depends on social class, ethnicity or religion. Social segregation is related to the dynamism of the real estate market. People with higher income and ability to pay occupy the places with best characteristics; therefore they achieve better land and housing. On the contrary, people with lower incomes will occupy the rest

of the spaces. In addition to ethnic, social or market dynamics, as the Chicago School points out, urban planning and housing policy also affect segregation. Housing prices per square meter grow in a higher proportion in areas with a higher socio-economic level than in areas with a lower level (Leal, 2005). The variables housing price and income level in the neighbourhood, chosen to represent the socio-economic level, follow a positive correlation with the housing price (Manning, 1988; Ridker & Henning, 1967; Toussaint-Comeau & Lee, 2018). In addition, high neighbourhood incomes are often associated with higher levels of education. Some studies find significant effect on the income and level of education of the population on the price of rent (Kestens et al., 2005). Also, studies reveal that areas with higher income attract better equipment and generate more income for nearby businesses; consequently, this causes higher land prices and urban income (Wen et al., 2014). To end, the relationship between housing prices and various socio-economic variables has been studied in the province of Barcelona. The results find a positive relationship between higher degree of studies and economic level with housing price (Fitch Osuna & Garcia-Almirall, 2008). Other characteristics considered are the ethnicity and race (Caballer & Rodríguez, 2002; Cervero & Duncan, 2004; Kain & Quigley, 1975).

Methodology

First of all, this work tries to determine those external factors that are most important for the housing rental prices using factorial analysis and multiple linear regression. We have used a sample of 2,678 rental properties and start with 18 variables selected taking into account the available statistical information and literature review. We carry out an exploratory factor analysis in order to reduce the number of explanatory variables and avoid multicollinearity problems. It is also analyse the structure of correlations between variables, identifying and establishing underlying dimensions called factors (Field et al., 2000).

Variables are grouped into three initial dimensions socio-economic level of neighbourhood population, physical characteristics of the neighborhood (like facilities and green spaces) and distance to the centre. The initial variables for measuring the impact or the three dimensions considered are as follows.

The variables initially considered are as follows:

- Average number of people per housing in the neighbourhood according to the 2017 census.
- Total population in the neighbourhood according to the 2017 census.
- Average rental price in the neighbourhood.
- Percentage of the population in the neighbourhood with a high school diploma or higher studies.
- Percentage of cars with a higher power than 16 HP in the neighbourhood.
- Percentage of the residents in the neighbourhood working as directors, managers or professional, scientific and intellectual technicians.
- Percentage of unemployed population over 16 years old in the neighbourhood who has not worked before.
- Square metre of park per inhabitant, including Jardín del Turia.
- Neighbourhoods with a frontage to *Jardin del Turia.*
- Average traffic intensity (vehicles/month).
- Number of museums in the district per 1,000 inhabitants.
- Number of libraries in the district per 1,000 inhabitants.
- Total number of child education units in the district

- Total number of primary and secondary education units required in the district.
- Total number of bachelor's teaching units and higher training cycles in the district.
- Number of hospitals in the district.
- Number of commercial activities, restaurants and lodgings in the district per inhabitant.
- Distance to CBD.

It is used the Principal Components Method to extract the factors and apply an Orthogonal Varimax Rotation with Kaiser because this one maximizes the variance of the factors by making the variables have a high weight in a single factor and small in the rest. Then, when the external characteristics variables are selected, it is performed a regression analysis with rental price as a dependent variable and one representative of each factor as independent variables.

Results

After several tests, the rotation has converged in seven iterations; it has been chosen to extract seven components or factors. These seven factors explain 88.024% of the total variance; a sufficient percentage to ensure that the number of factors is appropriate (see Table 1) Therefore, it is reduced from 18 variables to 7 components (see Table 2). With the Varimax method, it has been achieved that each of the variables has a correlation as close as possible to unity with one of the factors and close to zero with the rest.

Table 1

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Square Loadings			Rotation Sums of Square Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7,176	39,866	39,866	7,176	39,866	39,866	4,104	22,798	22,798
2	2,749	15,274	55,140	2,749	15,274	55,140	4,026	22,367	45,165
3	1,753	9,740	64,880	1,753	9,740	64,880	2,166	12,035	57,199
4	1,196	6,644	71,524	1,196	6,644	71,524	2,132	11,846	69,045
5	1,130	6,278	77,802	1,130	6,278	77,802	1,279	7,104	76,149
6	,989	5,496	83,298	,989	5,496	83,298	1,135	6,307	82,456
7	,851	4,726	88,024	,851	4,726	88,024	1,002	5,568	88,024
8	,772	4,289	92,313						
9	,365	2,027	94,341						
10	,306	1,698	96,039						
11	,208	1,155	97,194						
12	,180	1,002	98,196						
13	,111	,615	98,810						
14	,095	,529	99,339						
15	,073	,405	99,744						
16	,024	,134	99,879						
17	,020	,111	99,989						
18	,002	,011	100,000						

Extraction method: Principal Component Analysis.

The factorial analysis obtained has resulted in the following grouping of variables into latent factors (see Table 2):

Table 2

The Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
Average number of people per housing in the neighbourhood	-,832	,203	-,255	,022	,323	,013	-,008
Number of libraries in the district per 1000 inhab.	,793	,216	,435	-,007	-,086	,112	-,018
Total number of bachelor's teaching units and higher training cycles in the district	,781	,426	-,032	,228	-,176	-,039	,035
Number of museums in the district per 1000 inhab.	,764	,189	,475	-,004	-,021	,125	-,028
Total number of primary and secondary education units required in the district.	,668	,158	,097	,314	,495	-,103	,030
Distance to CBD (Km)	-,631	-,613	-,047	-,114	,264	,023	-,013
% of the residents in the neighbourhood working as Directors, Managers or Professional, Scientific and Intellectual Technicians.	,040	,949	,052	,169	-,025	-,118	-,001
% of cars with a higher power than 16 HP in the neighbourhood	,118	,945	,112	,075	,018	,150	-,001
% of population in the neighbourhood with a high school diploma or higher studies.	,154	,860	,112	,310	-,038	-,134	,012
Number of commercial activities, restaurants and lodgings in the district per inhabitant	,531	,649	,267	-,244	-,062	-,025	-,015
Average traffic intensity in the neighbourhood (vehicles/month).	-,260	,022	-,884	,071	,122	-,079	-,016
Total population in the neighbourhood according to the 2017 census.	-,232	-,356	-,721	-,224	-,117	,194	-,034
Average rental price in the neighbourhood	,427	,382	,482	,143	-,147	,321	-,021
Neighbourhoods with a frontage to Jardin del Turia.	,015	,233	-,084	,924	,098	,033	,005
Square metre of park per inhabitant, including Jardín del Turia	,122	,102	,155	,919	-,008	,047	-,004
Number of hospitals in the district.	-,324	-,146	-,092	,046	,869	-,017	,017
% of unemployed population over 16 years old in the neighbourhood who has not worked before	,028	-,076	,015	,054	-,019	,943	,001
Total number of child education units in the district	,005	,004	,021	,001	,017	-,001	,998

Extraction method: Principal Component Analysis.Varimax standardization with Kaiser

Note. [a] The rotation has converged in seven iterations.

- Factor 1: Average number of people per home (-0.832), number of libraries in the district (0.793), number of high school and education cycle units in the district (0.781), number of museums in the district (0.764), number of primary and compulsory secondary education units in the district (0.688) and distance to the CBD (-0.631). The factor indicates the accessibility, which is understood in a double dimension: general accessibility to the CBD and to cultural and educational facilities, as well as data from the census.
- Factor 2: % of the population in the neighbourhood whose activity is management, professional technicians, scientists and intellectuals (0.949), % of the number of cars in the neighbourhood with a power greater than 16 HP (0.945), % of the population in the neighbourhood with a high school education or higher

(0.860) and number of commercial, restaurant and accommodation activities in the neighbourhood (0.649). It is a dimension that informs us about the socio-economic level of the neighbourhood and allows us to differentiate some neighbourhoods from others.

- Factor 3: Traffic intensity in the neighbourhood (-0.844), total residents in the neighbourhood (-0.721) and average rent in the neighbourhood (0.482). This factor combines environmental, demographic and economic variables of the neighbourhood.
- Factor 4: Neighbourhood with façade to the *Jardin del Turia* (0.924) and m^2 of green space per inhabitant, including the *Jardin del Turia* (0.919). This is a factor relating to the environmental characteristics of the surroundings.
- Factor 5: Number of hospitals in the district (0.869).
- Factor 6: % of population in the neighbourhood over 16 years old who are unemployed and never worked before (0.943).
- Factor 7: Number of pre-school education teaching units.

Once the latent factors summarizing all the location information have been identified, we have built a model by selecting variables representatives of each factor. To assess the predictive capacity of the selected variables, it has been made a regression analysis of the variables regarding to price logarithm. After different tests, the variables selected as predictors were the following:

- Factor 1: Distance to CBD;
- Factor 2: % of population in the neighbourhood with management, professional technicians, scientists, and intellectuals;
- Factor 3: Average rent in the neighbourhood;
- Factor 4: m^2 of green space per inhabitant, including the Jardín del;
- Factor 5: Number of hospitals in the district.
- Factor 6: % of unemployed population in the neighbourhood over 16 years old and they have not worked before.
- Factor 7: Number of pre-school education teaching units.

Although the goodness-of-fit in the regression model is low, 24.8% (see Table 3), the information obtained is useful and allows us to reach certain conclusions.

Table 3

Model Summary

Model	R	R square	Corrected R Square	Standard error of the estimate
1	,500[a]	,250	,248	,039473443040818

Table 4 shows the value of the Beta coefficients obtained. It is noted that socio-economic factors have a relevant impact on rental price. The variable % of residents in the neighbourhood whose activity is management, professional technicians, scientists and intellectuals is the one with the highest associated Beta coefficient. Another important point is the average rental price in the neighbourhood. It also appears as an important explanatory factor, in addition to the percentage of unemployed population who has not worked before. On the other hand, we observe that the rest of the explanatory variables have not turned out to be statistically significant, especially the hospital centres in the district, the number of pre-school education

teaching units in the district and the area of green space per inhabitant in the neighbourhood. Also, distance to the centre (CBD) has a low explanatory power in the set of all the variables.

Table 4

Explanatory Model: Coefficients

	Unstandarized coefficients		Standarized coefficients			Collinearity Statistics	
	B	Std.Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	,703	,008		91,162	,000		
Distance to CBD (Km)	,009	,004	,052	2,017	,044	,424	2,361
% of the residents in the neighbourhood working as Directors, Managers or Professional, Scientific and Intellectual Technicians.	,072	,004	,401	17,439	,000	,533	1,875
Average rental price in the neighbourhood	,075	,008	,202	9,728	,000	,652	1,534
Square metre of park per inhabitant, including Jard韓del Turia	,004	,003	,027	1,469	,142	,851	1,175
Number of hospitals in the district.	,000	,003	,002	,100	,921	,680	1,471
% of unemployed population over 16 years old in the neighbourhood who has not worked before	,026	,004	,108	6,105	,000	,906	1,104
Total number of child education units in the district	-,005	,005	-,015	-,881	,378	,998	1,002

Note. Dependent variable: Log rental price.

The analysis of the *F* statistic ANOVA yields a critical value of significance 0.000. So, the existence of a significant linear relationship between the dependent variable Rental Price per square metre and the linear combination of the independent variables and the residual is guaranteed (see Table 5).

Mean Residuals Histogram and Normal Probability Plot of the Residuals allow us to corroborate the normality and the scatter diagram of the residuals the homoscedasticity (see Figure 1). On the other hand, no collinearity between the independent variables is verified. All values of the variance inflation factor (VIF) are less than 10 while all tolerance indices are greater than 0.10.

Table 5

ANOVA

Model		Sums of squares	df	Mean Square	F	Sig.
1	Regresi髇	1,378	7	,197	126,344	,000[a]
	Residual	4,145	2660	,002		
	Total	5,523	2667			

Predictor variables are: (Constant), Distance to CBD (Km), % of the residents in the neighbourhood working as directors, managers or professional, scientific and intellectual technicians, average rental price in the neighbourhood square meter of park per inhabitant, including Jardín del Turia, number of hospitals in the district, % of unemployed population over 16 years old in the neighbourhood who has not worked before, total number of child education units in the district.

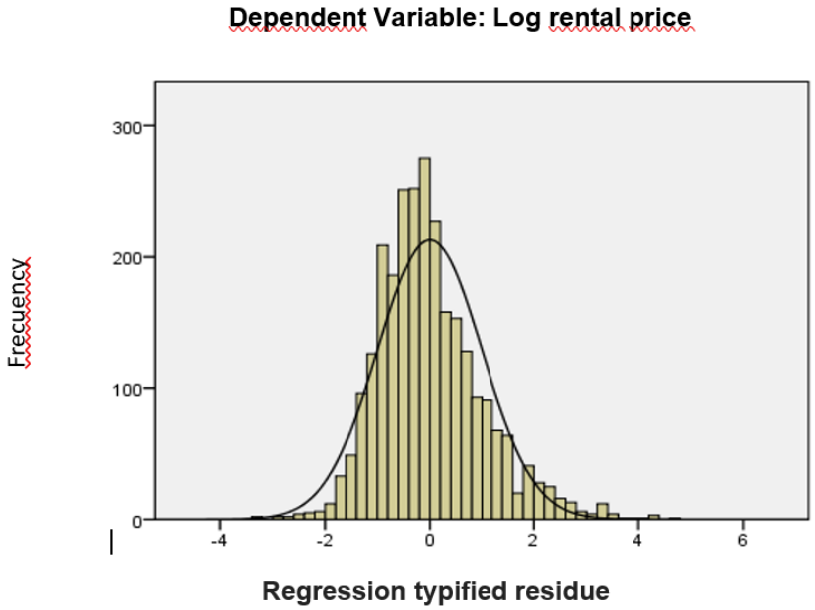

Figure 1. Histogram.

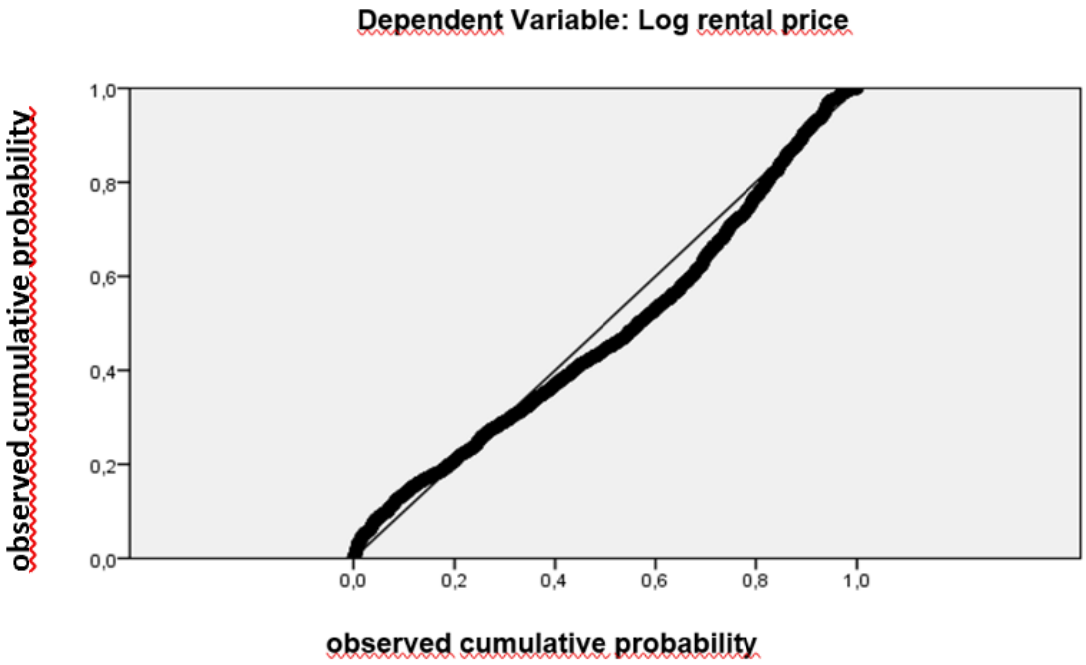

Figure 2. Regression typified residue.

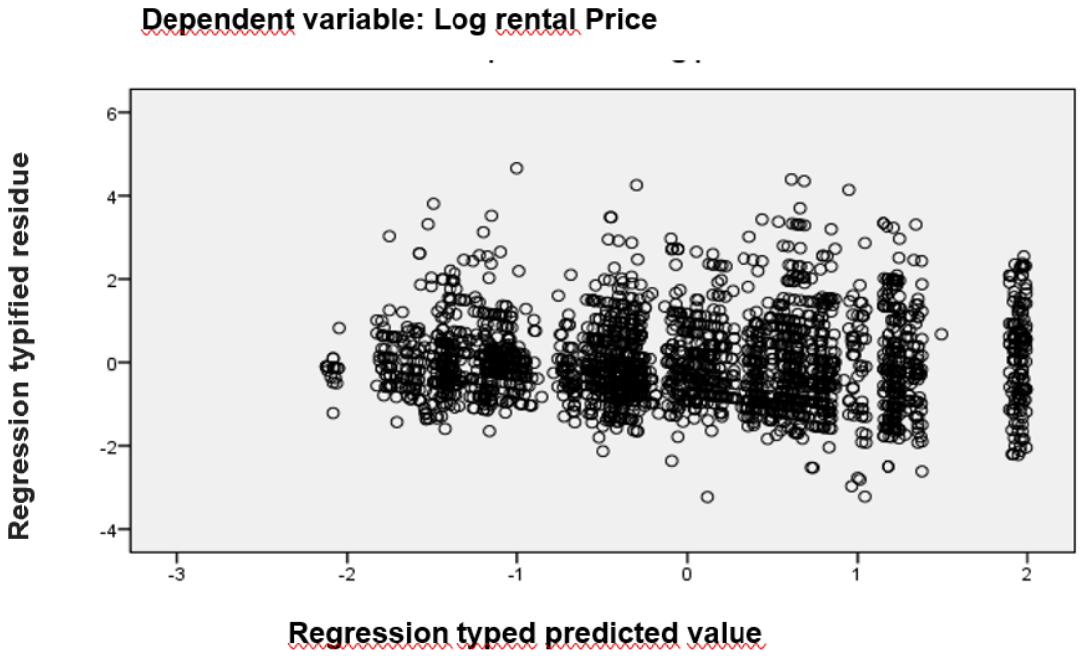

Figure 3. Scatter plot.

Conclusions

It has been carried out a multiple linear regression model, whose rental price of the housing is the variable to be explained, and the explanatory variables are different external characteristics. These variables are chosen according to the model formed. After analysing all the results, it is concluded that among the variables of external character considered the socio-economic variables of the neighbourhood are the relevant and explanatory elements of the rental price. Thus, the professional category and the level of employment are explanatory variables. The results point out to higher rental price housing is related to the average price of the neighbourhood were concentrate residents with higher income and lower levels of unemployment. Thus, we consider that the chosen variables are good indicators of the socio-economic level of the neighbourhood. Individuals with higher job levels prefer to pay higher rental price to be located in the sectors with higher housing prices.

These results are consistent with the conclusions of economic theories about residential location decisions. Market system gives rise to a space segregated city based on urban rent as a result of the dynamics of the residential sector within the framework. Quality and price of housing that developers offer depends on what the demanders are willing to pay with as much profit as possible. The most valued locations andthe highest quality homes will be occupied by those who can pay the most.

We also appreciate the centrality; this is analysed from the distance to the CBD which has lost weight in the final result. This may be due to the appearance of new neighbourhoods and areas further away from the centre, relatively well-connected with the CBD and with higher building and urbanisation qualities, and therefore higher prices. Likewise, the results of the analysis indicate that there is little influence of the level of equipment (educational, cultural, health) and environmental surroundings on the price of housing rent in the City of Valencia.

The model obtained gives us low results with the linear regression model since the value obtained of R^2 reaches only 25%, insufficient value to consider the function obtained useful or applicable to the professional field. Logically, for the definition of a housing rental price model would be necessary to work with the variables related to internal characteristics of the housing to obtain a complete model. This aspect will be developed in the next stage of the research. The introduction of the internal and external variables will allow to define a complete model for estimating housing rental prices. In future work we will also expand the sample and select more variables to improve the adjusted R^2 and obtain an outcome that increases the explanatory percentage. Comparing the results obtained for renting and the previous works, the analyses carried out show a less influence of the environmental factors in the case of rental than in the case of the trade price.

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