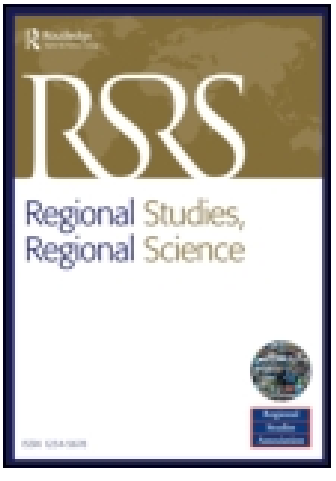

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'Turning the tables': regions shaping university performance

Mabel Sánchez-Barrioluengo[a]
[a] INGENIO (CSIC-UPV) Universitat Politècnica de València, Valencia, Spain
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EARLY CAREER ARTICLE

'Turning the tables': regions shaping university performance

Mabel Sánchez-Barrioluengo*

INGENIO (CSIC-UPV) Universitat Politècnica de València, Valencia, Spain

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This paper straddles the systems of innovation and the economic geography theories that conceptualize universities as engines of regional development and drivers of growth. However, these approaches overlook the heterogeneity of universities in the process of engagement, assuming their equal capacity to contribute to their region. In the view proposed here, not only does the university influence the surrounding region, but also regional characteristics shape university performance. The paper puts into perspective differences between university profiles in Spain based on their strategies and performance, and the scale and scope of the capabilities to contribute to their regions.

Keywords: university mission; university performance; regional development

Introduction

Over the last 20 years universities and higher education institutions (HEIs) have been expected to act as strategic knowledge hubs for the development of regional innovation systems. But with regards to how this expectation is to be fulfilled, significant differences persist between the policy debate, which emphasizes the necessity of redefining the role of HEIs (Organisation for Economic Co-operation and Development (OECD), 2007), and the academic discourse, which instead raises the issue of how an ever-growing spectrum of activities and capabilities can be managed efficiently (Landry, Saïhi, Amara, & Ouiemet, 2010). The view proposed here is that both these arguments are grounded in an unwarranted premise, namely that universities generate spillovers regardless of their internal characteristics and of specific regional/local societal needs (Metcalfe, 2010; Uyarra, 2010; Whitley, 2008). The present paper enters this debate by raising the question of whether the axiomatic homogeneity of university contribution to the surrounding region is realistic or not. Specifically, it seeks (1) to capture cross-university differences in the ability to meet local needs and (2) to ascertain to what extent university performance is influenced by regional characteristics. To this end this empirical study uses a reversed version of the spillovers theory (Casper, 2013) to propose an alternative perspective wherein not only the university has an effect on the surrounding region but also where regional characteristics influence university performance.

The paper is organized as follows. The literature on the contribution of universities to regional innovation systems is reviewed in the next section to set the ground for the empirical study. Subsequently cluster analysis and multivariate regression techniques are applied to the data in the third section to detect different profiles of Spanish universities

*Email: msbarrioluengo@ingenio.upv.es

and regions and to determine the profiles of the university groups. The final section concludes and summarizes.

Universities as key hubs for regional growth

The conceptual backdrop of the present work sits at the interface of the systems of innovation approach and the economic geography literature. The former articulates the elements and relationships involved in the production, diffusion and use of new and (non-strictly) economically useful knowledge (Cooke, 1995; Freeman, 1995; Nelson, 1993). Actors are key elements and their cooperation and interactions are both input to and output of innovation policies. Along this chain of relationships, durable networks between various actors involved in innovation emerge with the goal of producing and exploiting unique knowledge assets (Benneworth & Hospers, 2007). The literature on economic geography elucidates how local or regional environments shape 'path dependent' technological change (Romer, 1990) whereby more intensive knowledge-based locations are seen as having sufficient economic variety and institutional dynamism to support innovation and adjust to changing market conditions (Goddard, Robertson, & Vallance, 2012). The heuristic emerging from this perspective is that global knowledge flowing within the region creates beneficial spillovers for local agents.

Both streams of literature concur in understanding knowledge as the backbone of economic growth and universities as providing a major impulse in the capacity of knowledge providers (Goddard & Chatterton, 1999). This literature thereby articulates the multiple ways in which these institutions shape society by stimulating technical innovation, by promoting higher productivity and positive externalities in the form of spillovers (Anselin, Varga, & Acs, 1997). The studies about the role of universities inherently involve the identification of a multilevel reality: the more specific the level (national, regional or local), the more active role the university is expected to play. In the regional innovation system perspective, universities shape regional outcomes and network structures rather than merely being pathways that link together other actors (Arbo & Benneworth, 2007). Thus they are not only producers of basic research, but also create human capital (HC) in the form of higher skilled labour.

The contribution of HEIs is conceptualized here as flowing through three main channels: the three university missions, namely the provision of teaching and training (first mission); scientific research (second mission); and the promotion of university–society synergies (third mission or interaction with the socio-economic environment, ISEE). Understanding university missions as the strategies to contribute to society, three main objectives are derived. Teaching is aimed at the creation of HC in the form of higher skilled labour. The second and third missions include a specific knowledge component. The purpose of research is the production of knowledge and, because a huge part of this knowledge is tacit, embodied in individuals rather than being easily codified and transferred, the third mission goal is mainly knowledge transfer.

Regions as shapers of university performance

The paper focuses on universities as one of the key actors in the innovation system and identifies the region as the environment in which the university is located. Previous literature argues the importance of universities in shaping regional outcomes and generating socio-economic development and growth. This study proposes an alternative perspective where the university influences not only the region, but also where regional

characteristics have an effect on university performance. The concept of 'regional identity' proposed by Boucher (2003) is used to operationalize this idea. Boucher argues that regional identity refers to three concepts: the geographical location of the region (core or peripheral); the age of the region (older regions, with entrenched governance structures compared with regions that have forged or renewed their institutional structures more recently); and regional size. Taking account of the above framework, activities developed by universities are significantly influenced by the environment in which the university is geographically localized. In consequence, arguments move from a 'push' vision were universities influence the region to a 'pull' approach where the university context shapes its performance following the spillover theory reversed (Casper, 2013).

This study is then concerned with the inherent diversity that characterises the higher education complex. Specifically, it proposes two research questions:

> Are there any differences between universities' capabilities in the ways they seek to contribute to their region?
>
> To what extent is university performance influenced by the surrounding environment?

To solve them, two types of analysis are carried out: (1) a cluster analysis to group universities within the Spanish higher education system (HES); and (2) a multivariate regression to regress factor missions on cluster universities and a *t*-test to compare university strategies and performance that will be interpreted as the scale and scope of institutional capabilities to contribute to their regions. Explanations about the differences in HEIs' profiles depend on the regional identity as proxy of the contextual characteristics of the surrounding environment.

The empirical framework for this study is Spain. The development of the Spanish innovation system has entailed a series of multilevel transformations driven by the redistribution of competences from the central state to regional governments for accommodating broad supranational directives by means of local policies. Since 1983 Spanish public universities have acquired a more autonomous status with administrative and financial management depending on the regional government. This change coincided with the first national science and technology policy (1986), which sought to create a basis for the development of the Spanish innovation system by stimulating research and, at the same time, promoting the transfer of results to the productive sector. Despite these changes, the governance of HEIs has preserved a 'one size fits all' ethos independently of the context and of the changing needs of the attendant local socio-economic context.

The Spanish HES consists of 47 public universities that develop strategic priorities and seek a balance between teaching, research and ISEE to fulfil national, regional and local goals: to create skilled HC, produce knowledge and transfer know-how. The present study is based on the premise that missions can be understood as constructs that reflect university strategies and that tangible university activities measured by performance indicators are an adequate way to systematize these strategies.[1] The performance indicators selected for the analysis are grouped in factors by means of factor analysis (Sánchez-Barrioluengo, 2014): enrolled students, number of graduates, teaching revenues and training students result in the *teaching factor*; postgraduate students (masters and doctorates) and numbers of theses, research projects (number and income) and papers published in scientific journals (Spanish, foreign and ISI journals) result in the *research factor*; and patents, projects in collaboration with firms, contract research

Table 1. Clusters of universities.

Cluster 1: Geographically Localized - Traditionally Positioned (GL-TP)	**Cluster 2**: Non Geographically Localized - Traditionally Positioned (Non-GL-TP)	
Autonomous University of Barcelona (UAB)	Carlos III University of Madrid (UCAR)	University of Córdoba (UCO)
Autonomous University of Madrid (UAM)	Miguel Hernández University (UMH)	University of Extremadura (UEX)
Complutense University of Madrid (UCM)	Pablo de Olavide University (UPO)	University of Girona (UDG)
Polytechnic University of Valencia (UPVA)	Pompeu Fabra University (UPF)	University of Huelva (UHU)
Technical University of Catalonia (UPC)	Public University of Navarra (UPN)	University of Jaén (UJA)
Technical University of Madrid (UPM)	Rey Juan Carlos University (URJC)	University of La Laguna (ULL)
University of Barcelona (UBA)	Rovira i Virgili University (URV))	University of La Rioja (URI)
University of Granada (UGR)	Technical University of Cartagena (UPCR)	University of Las Palmas de Gran Canaria (ULPGC)
University of Santiago de Compostela (USC)	Universitat d'Alacant (UA)	University of León (ULE)
University of Sevilla (USE)	University de Cádiz (UCA)	University of Lleida (UDL)
University of the Basque Country (UPV)	University Jaume I of Castellón (UJI)	University of Málaga (UMA)
University of Valencia –General Studies (UV)	University of A Coruña (UDC)	University of Murcia (UMU)
University of Zaragoza (UZA)	University of Alcalá (UAH)	University of Oviedo (UOV)
	University of Almeria (UAL)	University of Salamanca (USAL)
	University of Burgos (UBU)	University of the Balearic Islands (UIB)
	University of Cantabria (UCN)	University of Valladolid (UVA)
	University of Castile-La-Mancha (UCLM)	University of Vigo (UVI)

Table 2. Profiles of universities according to their strategies.

	GL-TP Universities	Non-GL-TP Universities
First Mission	-0.018 (0.030)	0.018 (0.030)
Second Mission	0.334 (0.030)***	-0.334 (0.030)***
Third Mission	0.233 (0.030)***	-0.233 (0.030)***
Constant	0.277 (0.030)***	0.723 (0.030)***
Observations	47	47
R2	0.812	0.812
Breusch-Pagan test	χ^2 (1) = 47.000***	
Tests of equality of coefficients		
[Cluster 1] Factor 2 vs [Cluster 1] Factor 3 --> F(1,43) = 5.69**		
[Cluster 2] Factor 2 vs [Cluster 2] Factor 3 --> F(1,43) = 5.69**		

Note: **p-value<0.05; ***p-value<0.01.

income, research and development (R&D) contracts and consultancies (number and revenues), royalties and spin-offs result in the *third mission factor*. The data are the cumulative and normalized values of the indicators measured in each university for 2007 and 2008.[2] To avoid biased results and to control for university size, the indicators for students (enrolled and graduates) and teaching revenues are also divided by the number of researchers. Cluster and regression analysis are calculated with the factor scores obtained in previous factor analysis.

Cluster analysis groups those universities with homogeneous performance but which, at the same time, present some degree of heterogeneity with respect to the universities included in the other cluster(s). Table 1 shows that Spanish universities cluster in two groups. To describe the profile of universities in each group, this paper adopts the concept of regional identity. The three elements of location, age and size allow one to define HEIs grouped in cluster 1 as geographically localized, traditionally positioned (GL-TP) because they are located in core metropolitan areas, most of them in central cities and regions (Madrid, Barcelona, Seville, Valencia, Santiago de Compostela, Basque Country); they are old universities (13 out of the 18 oldest in Spain) established between 1430 and 1971, before the Spanish reform of higher education; and, in terms of size, the group contains 13 out of the 14 HEIs with the highest volume of outputs in teaching, research and innovation (Pérez, 2013). Cluster 2 includes the other universities that do not fully fit with this definition, i.e. non-GL-TP universities.

Following the above groups, mission factors are regressed[3] on university clusters to analyse the likelihood of belonging to a particular cluster against the mission constructs. Results in Table 2 show differences in the profiles of both groups according to university strategies. GL-TP universities focus their strategies on research and ISEE, while non-GL-TP universities tend to focus on teaching (although this last result is not significant).

Finally, Table 3 includes descriptive statistics for the 22 performance indicators on average values and the *t*-test analysis to check differences in university performance between both groups. Results show that three out of four indicators of teaching activities

Table 3. Profiles of universities according to their performance.

		GL-TP Universities	Non-GL-TP Universities	Difference	Sig.
TEACHING	Enrolled students	36.78	38.48	-4.6%	
	Graduates	4.72	5.52	-16.9%	**
	Teaching revenues	16.77	17.59	-4.9%	
	Training students	3,339	1,301	61.0%	**
RESEARCH	Master students	2,893	929	67.9%	**
	PhD students	5,462	1,423	73.9%	**
	Theses	297	89	70.0%	**
	Research project income (€000s)	41,163.89	12,254.97	70.2%	**
	Research projects	99	57	42.4%	**
	Spanish publications	695	265	61.9%	**
	Foreign publications	1,371	703	48.7%	**
	ISI publications	1,379	654	52.6%	**
INTERACTION WITH SOCIOECONOMIC ENVIRONMENT (ISEE)	Applied patents	40	12	70.0%	**
	Granted patents	20	5	75.0%	**
	Collaboration with firms (€000s)	8,619.4	3,688.24	57.2%	**
	Contract research income (€000s)	43,647	8,724	80.0%	**
	R&D contracts	904	229	74.7%	**
	Revenues R&D contract (€000s)	259,230.5	54,463.6	79.0%	**
	Consultancy	730.91	195.12	73.3%	**
	Revenues consultancy (€000s)	4,818.37	1,114.83	76.9%	**
	Royalties (€000s)	204	40	80.4%	**
	Spin-off	11	3	72.7%	**

Note: **p-value<0.05

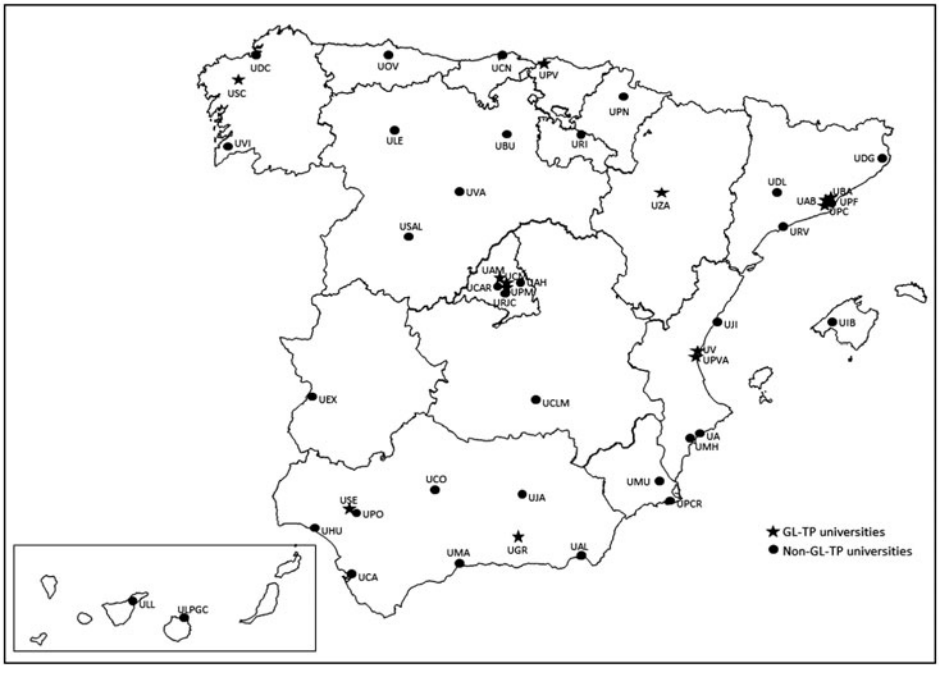

Figure 1. Location of geographically localized, traditionally positioned (GL-TP) and non-GL-TP universities.

are slightly higher for non-GL-TP universities, specifically graduates. For what concerns research performance indicators, significant differences appear and GL-TP universities are more involved in these activities. However, in absolute terms the lowest difference is observed for the main knowledge dissemination channel: international publications. Higher differences emerge for third-mission activities too: granted patents, contracts, consultancy, revenues and royalties. All these indicators present differences beyond 75% between both clusters. In this case, GL-TP universities develop greater efforts to interact with external agents than non-GL-TP ones. These results signal that the main differences in university performance concern activities where HEIs require other regional actors with which to interact. An interesting result is the lowest absolute value of the indicator for projects in collaboration with firms (57.2%) compared with other third-mission indicators, which highlights the effectiveness of Spanish policies with regards to building capabilities for interaction activities between the academic and the business worlds.

These results highlight the importance of the regional identity in shaping university strategy and performance (Figure 1). Indeed, GL-TP universities are located in regions (e.g. Madrid or Basque Country) that demand knowledge-intensive activities and HEIs respond by focusing on research and ISEE. On the contrary, universities within the non-GL-TP group are located in peripheral regions (e.g. Andalusia) that require HC development through teaching activities. This result is in line with the literature finding a low level of interaction between academic and non-academic actors in peripheral regions (Pinto, Fernandez-Esquinas, & Uyarra, 2013).

Conclusions

Spain is a clear instance of top-down policies designed around national institutional configurations applied to regional levels, rather than favouring the emergence of bottom-up localized learning processes. Although currently universities depend on regional governments, the 'one size fits all' model wherein universities are centres of excellence in education, research and social engagement remains prevalent in the Spanish HES. It was argued here that this model overlooks the inherent differences that characterize universities' ability to meet societal needs in terms of both strategy and performance. Building on the concept of 'regional identity' (Boucher, 2003) that stresses the importance of independent effects of regional identity in shaping the embeddedness of local universities, two profiles of HEIs shaped by the surrounding regions were identified. These alternative clusters contribute differently to their region: while GL-TP universities are located in 'identity regions' that demand more knowledge-intensive activities, they need the presence of non-academic agents with which to interact because they are focused on research and ISEE; non-GL-TP universities, located in peripheral regions, may be more effective in HC development through teaching activities. This result is symptomatic of the importance of regional characteristics to influence the strategies and performance of HEIs.

The identified profiles imply also the necessity to recognize that alternative university models are possible where institutions articulate their strategies taking into account specialization tasks to generate a competitive advantage. Differentiation strategies should highlight institutional capabilities as well as the characteristics and needs of the region. At the same time, this alternative point of view requires the adaptation of different policies, specifically at the regional level capturing the spatial/territorial dimensions that national policies tend to ignore, to emphasize the role of universities and their strategic priorities guaranteeing their role as leaders of regional development. In so doing this work has proposed a perspective that hints at a virtuous circle wherein universities are drivers of innovation policy change while, at the same time, regional innovation policy guides university strategy for specialization. It is hoped that further empirical studies will contribute to explore in more detail the nuances that emerge from this novel view of the relationship between HEIs and their attendant socio-economic context.

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Notes

1. This paper does not distinguish between input, output, outcome or impact indicators. It consider all HEI activities as part of university performance.

2. The main data sources were: Ministry of Education (ME), National Statistics Institute (INE), Conference of Spanish Rectors (CRUE) biannual report *La Universidad Española en cifras* (Spanish Universities in Figures), Spanish Patent and Trademark (OEPM) and RedOTRI, the Spanish Network of University Knowledge Transfer Offices. A detailed definition of the indicators appears in Appendix A1 and more specifically in Sánchez-Barrioluengo (2014).
3. The Breusch–Pagan test, significant at the 1% level, indicates that the residuals of the two clusters are not independent and justifies the use of multivariate regression (Consoli & Rentocchini, 2013).

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Appendix

Table A1. Definition of the variables.

Variable	Definition
Enrolled students	Number of enrolled students in pre-graduated courses divided by number of doctors
Graduates	Number of graduated students in pre-graduated courses divided by number of doctors
Teaching revenues	Revenues (thousands of Euros) from teaching activities divided by number of doctors
Training students	Number of students carrying out practices at enterprises during their pre-graduated studies
Master students	Number of master students
PhD students	Number of PhD students
Theses	Number of doctoral theses that was reading
Research project income	Revenues (thousands of Euros) from research activities (projects. subventions. …) from public administrations fundamentally
Research projects	Granted research projects
Spanish publications	Number of publications in Spanish journals
Foreign publications	Number of publications in foreign journals
ISI publications	Number of publications that were published in journals included in Journal Citation Report (JCR)
Applied patents	Number of applied patents
Granted patents	Number of granted patents by Spanish Patent and Trademark
Collaboration with firms	Revenues (thousands of Euros) from research projects where firms participate
Contract research income	Revenues (thousands of Euros) from contracts research
R&D contracts	Number of R&D contracts
Revenues R&D contract	Revenues (thousands of Euros) from R&D contracts
Consultancy	Number of consulting activities
Revenues consultancy	Revenues (thousands of Euros) from consulting activities
Royalties	Patents revenues
Spin-off	Number of new spin-off