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Comparing university performance by legal status: a Malmquist-type index approach for the case of the Spanish higher education system

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New public management and increasing levels of competition driven by global rankings are bringing the managerial practices of public and private higher education institutions closer together. However, these two types of institutions still maintain different objectives and traditions and enjoy different degrees of autonomy that are reflected in their internal organisational structures. We study the relative efficiency and productivity performance of private and public universities in Spain through two adaptations of the Malmquist Index. Results show that, in 2009/2010, the greater flexibility of private universities meant a better adjustment between inputs and outputs in the private sector. However, in 2013/2014, public universities had caught up with private universities. Because of the economic crisis, the inputs of public universities have decreased, but this decrease had not fully impacted their results in 2013/2014.

Keywords: efficiency; productivity; higher education; university management; legal status; Malmquist Index

Introduction

In recent decades, national and international competition among higher education institutions has significantly increased, not only because of increasing economic internationalisation and the emergence of global university rankings, but also because of the extensive acknowledgement of their socioeconomic relevance. Society demands increasing competition among institutions, and this is facilitated by the current economic trends. International competition and the rankings have forced university leaders to implement new management techniques in order to compete with other institutions for human and financial resources in the knowledge economy. This has forced higher education institutions' managers to improve the performance of their universities by attracting and retaining the best staff and students, and raising the largest possible amount of funds.

Competition has highlighted the need for new performance measures and for innovative tools for the evaluation of both private and public universities. Consequently, the methods for assessing higher education institutions' performance are increasingly subject to revision, and scientists and practitioners are exploring new metrics, in many cases applying approaches typical of the private sector (Balabonienė & Večerskienė, 2014). There has been a trend to introduce market mechanisms into the public higher education sector and to professionalise public universities' leadership and management, which is

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reinforced by the application of the new public management approach to the higher education sector. The result has been an unprecedented growth of the private higher education sector in Europe and some developing countries – most of them for-profit organisations (Casani, De Filippo, Garcia-Zorita, & Sanz-Casado, 2014).

In Spain, private and public universities are embedded within the same legal framework, which assigns them the same basic duties: teaching, research and the third mission. However, public universities are constrained by greater regulation and control mechanisms than private universities. These differences in autonomy, together with their different nature, objectives and traditions, entail distinct internal organisational structures for the development of the same tasks, i.e. different managerial procedures for the consumption of the same inputs to produce the same outputs.

This study intends to contribute to the debate about the different managerial procedures of private and public universities and their results in terms of efficiency and productivity. Although the private sector of higher education has grown rapidly in Europe, and the presence of different managerial approaches for public and private institutions is universally acknowledged – if not explicitly then, at least, implicitly – only the differences between the teaching in the two types of higher education institutions have been widely studied, and there are no comparative studies on the overall efficiency of the two types of universities. This paper compares the overall performance of public and private universities in Spain. Whilst private university leaders and managers understand managerialism almost as *freedom to manage*, Spanish public universities are forced to face the following pressures: (i) fiscal pressures as a consequence of the budgetary crisis, which lead to acute concerns among university leaders about public spending, and to the search for new income streams such as cost-sharing with families through the increase of tuition fees; (ii) organisational pressures through new incentive systems to innovate and improve teaching, research and third mission activities; and (iii) internal stakeholder pressures because of the job security and involvement in decision-making processes of (academic and administrative) civil servants. We also study the performance evolution of Spanish public and private universities in two academic years, 2009/2010 and 2013/2014.

This empirical study aims to provide preliminary evidence on the performance of public and private universities that may help policy makers to take their managerial differences into account in the definition of higher education policies.

We first review the literature on the sources of the different strategic and managerial approaches of public and private higher education institutions, with special attention to the Spanish case. Secondly, we compare the performance of public and private universities from the point of view of efficiency through the extensions of the Malmquist index (MI) proposed by Camanho and Dyson (2006), CDMI from now on, which measures the relative performance of two or more groups of decision-making units (DMUs) within a period. Various studies have already tested the suitability of CDMI for the analysis of performance differentials between two or more groups of DMUs for diverse sectors – e.g. Vaz and Camanho (2012) for retailing stores and Ferreira and Marques (2015) for the case of Portuguese hospitals – but never for the higher education sector. We also compare the evolution of the efficiency and productivity of public and private universities through the pseudo-panel Malmquist index proposed by Aparicio, Crespo-Cebada, Pedraja-Chaparro, and Santín (2016) – PPMI from now on.

The analysis is innovative because of its extensive search for data on private Spanish universities, a cumbersome task**,** given their lack of transparency – at least regarding their financial dimension.

Introducing new public management criteria and fostering competition in Europe and Spain: some features of public and private higher education institutions

Homogenising trends in European higher education

In the 1980s, the search for more efficient management and organisational practices for the public sector led to the new public management approach for the provision of services that were traditionally public. The new public management paradigm is in line with the neoclassical and neoliberal movements, which systematically question both the various forms of government intervention in the market economy and bureaucratic governance (Barzelay, 2000). Consequently, new public management has encouraged the private production of services otherwise traditionally public, and the introduction of business management criteria and consumer orientation in public institutions.

In the case of higher education, universities gradually adopted private sector management procedures to compete under quasi-market conditions (Casani et al., 2014). To encourage this competition and the expected increase in efficiency, the number of private institutions in higher education systems rapidly increased, and governments have implemented reforms on the governance (strategic planning) and funding of higher education institutions (performance-based funding schemes) following so-called *new managerialism* models.

Many higher education systems have implemented new public management criteria – although in different ways and to different extents. These criteria have especially influenced the evolution of European higher education systems, where higher education was traditionally considered a public service. Figure 1 shows the evolution of the number of public and private higher education institutions in Europe from 1850 to 2015, while Figure 2 illustrates the number of public and private Spanish universities from 1940 to 2015, the Spanish higher education system being the case of our study. Both figures clearly portray an increase in private institutions precisely from the introduction of new public management in the higher education sector after the 1990s.

However, the relative importance of higher education institutions by legal status strongly differs by country, and only in Cyprus, the Czech Republic, Poland, Portugal and Serbia are there more private than public higher education institutions. Nevertheless,

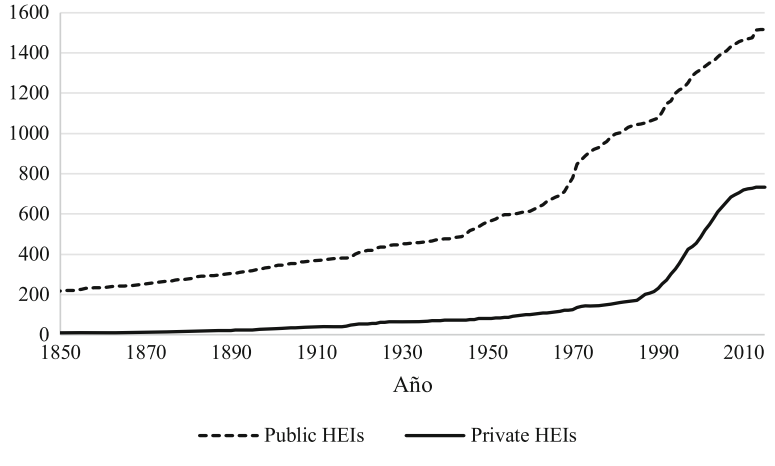

Figure 1. Number of public and private higher education institutions in Europe. 1850–2015. Source: authors' elaboration based on European Tertiary Education Register project (ETER, 2016)

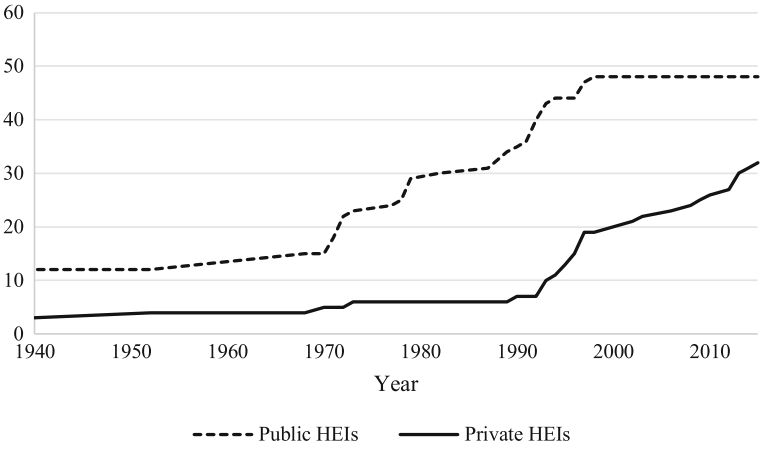

Figure 2. Number of public and private higher education institutions in Spain. 1940–2015. Source: authors' elaboration based on Spanish Register of Universities, Centres and Titles (*Registro de Universidades, Centros y Títulos*, 2016).

this majority of private higher education institutions is not usually reflected in the number of students enrolled (*European Tertiary Education Register* 2016 – data for 2013).

In 2015/2016 the Spanish higher education system consisted of 82 universities recognised by the Ministry of Education: 50 public and 32 private. Private universities accounted for 40% of the Spanish universities but only for 13% of the enrolment.

The increase of private higher education institutions is not limited to developed countries. It is particularly important in emerging countries, where governments lack the resources to satisfy the demand for higher education services, and the meagre and immature higher education systems have to be complemented with private institutions (Jamshidi, Arasteh, NavehEbrahim, Zeinabadi, & Rasmussen, 2012). Hence, many studies comparing public and private higher education institutions focus on higher education systems from developing countries.

New public management is not the only homogenising trend in the higher education sector. At least in Europe, public and private universities generally share the same fundamental tasks: teaching, research and the third mission. Nevertheless, there are different degrees of specialisation by mission and by activity within each mission. World rankings have also fostered the consolidation of a global market for higher education, where public and private universities from developed and emerging countries compete on the basis of the same criteria or performance outputs (Gómez-Sancho & Perez-Esparrells, 2012).

Some features of public and private higher education institutions that may affect their organisational structure and performance

Despite the homogenising trends described in the previous section, public and private universities have peculiarities in their objectives and management practices that could lead to differences in their effectiveness and efficiency. Many of these differences are explained by organisational the behaviour theory (Coase, 1937). According to this theory, the different governance structure of public and private organisations – in our case

universities – entail different individual personal incentives, which result in different institutional behaviour. Public and private managerial behaviour is influenced in private institutions by having to achieve output targets while trying to minimise the input consumption (Sengupta, 1987), while public institutions have a given input and aim to produce the most with it (Tone & Sahoo, 2003).

Thus, although private universities benefit from a greater hiring flexibility that allows them to respond more rapidly and efficiently to market conditions, they usually focus on the most profitable activities (Wilkinson & Yussof, 2005), i.e. teaching in knowledge areas with low capital investment (James, 1991), usually avoiding costly degrees such as engineering or medicine (Tilak, 1991). On the contrary, public universities include criteria related to the social benefits of their activity in their decision-making process (Johnstone, 1998), and are subjected to more rigidity – greater control and monitoring of public activities, budget and finances. Thus, in scenarios of low competition and high-level public funding, public universities tend to focus mainly on undergraduate teaching and research (Lowry, 2004). Consequently, private universities theoretically have at their disposal a wider range of possibilities to adapt to market conditions and to achieve higher levels of technical efficiency.

Additionally, private universities are usually not engaged in third mission activities (Casani et al., 2014). Consequently, the debate on the ability of private higher education institutions to attend to economic and societal needs is still very much alive. Even arguments regarding their better fit to students' needs and their consequent lower unemployment rates, higher wages (Jimenez & Tan, 1987; Patrinos, 1990) and higher graduation rates (Sisk, 1981) are called into question – it is still unclear to what extent these results are related to the opportunities offered by private higher education institutions or to the socioeconomic status of their students (Angoitia & Rahona, 2007).

In the Spanish higher education system trends are no different. Private and public universities are embedded within the same legal framework, which assigns them the same basic duties: teaching, research and the third mission (Law of Universities Act – LOU, 2001 – together with its modification – LOMLOU, 2007). However, public universities are constrained by greater regulation and control mechanisms than private universities. These differences in autonomy, together with their different natures, objectives and traditions, entail distinct internal organisational structures for the development of the same activities, i.e. different managerial procedures for the consumption of the same inputs to produce the same outputs. The main differences are related to hiring constraints, the range and tuition fees of degrees and programmes offered, and income streams.

Private institutions enjoy greater flexibility in the design of their hiring strategies, since their labour force does not include civil servants. The restrictions on the structure of the labour force of public universities are closely related to the time dedicated to teaching and research duties by the academic staff since, for each academic position, the Spanish legal framework determines the ECTS credits (European Credit Transfer and Accumulation System) to be annually taught (Royal Decree Law 14/2012). Additionally, public Spanish universities cannot count on wages to attract highly competitive researchers because the national and regional governments set them. Thus, private universities are subject to fewer restrictions in the structure and size of their labour force, the wages set, and the time dedication of academics to teaching and research activities.

Both the private and public university degrees must be approved by the National Agency for Quality Assessment and Accreditation (*Agencia Nacional de Evaluación de*

la Calidad y Acreditación – ANECA), and are subject to the same restrictions and regulation. However, private universities usually focus on very specific areas of knowledge (e.g. business and management courses) and freely set their tuition fees and the time dedicated by academics to teaching. On the contrary, public universities are typically comprehensive universities, and their tuition fees are set by regional governments.

Last but not least, private and public universities rely on different funding sources. The bulk of the income of public universities is the block grant assigned by their respective regional governments (80% approximately), which is complemented by the tuition fees paid by students – fundraising sources are still anecdotal in public universities (Perez-Esparrells & Torre, 2012, 2013). By contrast, the main income stream of private universities is the tuition fees paid by students, followed by certain research funds – e.g. company-sponsored chairs or research projects – and other sources related to sponsorships and donations. It should be noted that about 57% of the research funds of private universities are public research funds. Considering that, in the case of public universities, 47% of their research funds are public (Hernández Armenteros & Pérez García, 2015), the research funding sources of public and private universities are not significantly different.

Comparing public and private higher education institutions' performance

The different nature of public and private higher education institutions, together with the increasing size and importance of the private sector, has led to several studies in different countries comparing the two subsectors from various perspectives. However, the study of the private higher education sector is still limited in Europe due to the lack of data. There are few studies on the differences in the efficiency and productivity of public and private higher education institutions, and they basically focus on their teaching activity. After the initial work in the 1980s of Rhodes and Southwick (1986) and Ahn, Charnes, and Cooper (1988) for the United States, the latest studies analyse the private and public higher education sectors of developing countries, where private higher education institutions are increasingly important. However, to our knowledge there is no contemporary European study.

The results of these studies are varied. Rhodes and Southwick (1986) found higher levels of efficiency in private universities because of their greater reliance on private funding, i.e. their stronger market orientation. However, Ahn et al. (1988) obtained conflicting results in their data envelopment analysis (DEA) models, depending on the inputs and outputs chosen and the presence or absence of medical schools. In the case of Malaysia, the descriptive analysis of Wilkinson and Yussof (2005) concludes that public universities are more efficient in terms of educational quality because their higher spending levels allow better facilities and senior and more qualified professors. In the Philippines, Rufino (2006) employs a flexible fixed cost quadratic cost function to define the cost function of higher education teaching for public and private higher education institutions, proving not only that the two types of higher education institutions have different cost functions, but also that public higher education institutions achieve better results regarding cost efficiency and economies of scale. Finally, the meta-frontier cost-function model of Lu and Chen (2013) suggests that private institutes of technology and universities of technology in Taiwan show better cost efficiency performance than public ones, as well as a smaller gap between the existing operated technology and the potential (best practice) technology.

Evaluating efficiency in public and private universities. The case of the Spanish higher education system

Systems of performance assessment in the public and private sectors usually differ because of their different natures and traditions: the private sector focuses on maximising profits and owner satisfaction while public organisations concentrate on evaluating the service provision (Balabonienė & Večerskienė, 2014). Given the importance of the public sector for higher education and the lack of data on private higher education institutions, efficiency analyses of higher education systems typically focus on technical efficiency. The latter is more related to the assessment of the efficiency of the (public) service provision, while the allocative efficiency is more related to market criteria.

Methodology: comparing groups of universities through a Malmquist Index approach

To determine whether public and private Spanish universities have different levels of efficiency and productivity and their evolution, we use data envelopment analysis (DEA) and the Malmquist index (MI), two methods widely employed for the analysis of technical efficiency. DEA is a non-parametric and frontier method used to assess the relative technical efficiency of homogeneous institutions or DMUs, employing the same inputs to produce the same outputs through the same processes. The frontier produced by the DEA method delimits all the possible combinations of inputs and outputs for a given technology. Different technologies must be measured by different frontiers. Therefore, in this paper, we first run two different DEA analyses, one for public universities and the other for private universities (assuming constant returns to scale). We employ an output-oriented DEA model: efficient universities will obtain efficiency scores equal to 1 (the production of outputs cannot be increased without increasing the level of inputs) and inefficient universities will score under 1. For each university, these scores measure the distance between its combination of inputs and outputs and the frontier (best practices).

Since public and private universities have different technologies and, consequently, different frontiers, we cannot directly compare the efficiency scores for public and private universities because they refer to different frontiers and are calculated according to different samples. Therefore, to compare the performance level of the two sectors, we use the MI adaptations proposed by Camanho and Dyson (2006) and Aparicio et al. (2016) to analyse the differences in total factor productivity (TFP) between our two groups of DMUs – public and private universities – over time.

The MI (Caves, Christensen, & Diewert, 1982; Färe, Grosskopf, Lindgren, & Roos, 1994) measures the changes in productivity over time of DMUs by comparing two different DEA efficiency frontiers – each one for two different moments in time e.g. t and $t + 1$ – and the relative position of the DMUs to these frontiers. Since the MI essentially compares two different efficiency frontiers, it can be modified to study the differences in TFP of any other analysis in which two different frontiers are involved; e.g. DMUs using different technologies, belonging to different countries or, in the case of our study, applying different management models.

The MI produced by Camanho and Dyson (2006) considers the distance of each university to both (public and private) efficiency frontiers and then aggregates these distances by calculating their geometric mean. This approach avoids the artificial production of a typical public and a typical private university, and allows us to apply the usual

formulation of the MI, slightly modified (Berg, Førsund, Hjalmarsson, & Suominen, 1993; Pastor, Pérez, & Quesada, 1997). Consequently, the CDMI does not introduce the subjective assumptions necessary for the production of these typical universities and the biases they may entail. Several studies have already proven the appropriateness of the CDMI for the analysis of the TFP differentials between two or more groups of DMUs in various sectors (e.g. Vaz & Camanho, 2012; Ferreira & Marques, 2015; Thanassoulis, Shiraz, & Maniadakis, 2015).

The CDMI can be decomposed into two sub-indexes, one that compares within-group efficiency dispersion (IE) and one that compares the frontier productivity achieved by each group (IF) – see Equation (1). Hence, the compared performance of the two groups of universities depends on: (i) the structure of groups' efficiency; and (ii) their production-possibility frontier and the universities that determine it (best practice frontier). For an output-oriented CDMI comparing public and private universities ($CDMI^{PrivPub}$), values of $CDMI^{PrivPub}$ below one entail a better overall performance of public universities in $100 \times \left(1 - CDMI^{PrivPub}\right)$.

Additionally, values of $IE^{PrivPub}$ below one indicate that the dispersion of the DEA efficiency scores of public universities is lower than that of private universities, i.e. public universities show more similar efficiency performance, whereas a $IF^{PrivPub}$ below one suggests better productivity performance of public universities.

$$CDMI^{PrivPub} = IE^{PrivPub} \times IF^{PrivPub} \tag{1}$$

Aparicio et al. (2016) proposed a further extension of the MI that allows the analysis of the evolution of the TFP gap between two groups of DMUs across two periods. This methodological extension analyses the evolution of CDMI as the ratio of two CDMIs calculated for period t and period $t + 1$ – see Equation (2).

$$PPMI_{t,t+1}^{PrivPub} = \frac{CDMI_{t+1}^{PrivPub}}{CDMI_{t}^{PrivPub}} \tag{2}$$

Values of $PPMI_{t,t+1}^{PrivPub}$ over 1 could mean either that the gap between the public and the private sectors has opened or that it has closed over time. Following the advice of Aparicio et al. (2016), our interpretation of the PPMI is based on the values of the CDMI for each period.

PPMI can also be decomposed into two sub-indexes (Equation (3)), one measuring the change in the efficiency gap between public and private universities between two periods ($EGC_{t,t+1}^{PrivPub}$) and one assessing the change in the technological gap between the periods ($TGC_{t,t+1}^{PrivPub}$), where DC is a divergence coefficient that indicates which percentage of the frontier gap change is explained by technological changes. Once again, values of $EGC_{t,t+1}^{PrivPub}$ and $TGC_{t,t+1}^{PrivPub}$ over 1 could mean either that the gap between the public and the private sectors has opened or that it has closed over time. Following the advice of Aparicio et al. (2016), our interpretation of the EGC and TGC is based on the values of the components of the CDMI (IE and IF) for each period.

$$PPMI_{t,t+1}^{PrivPub} = \frac{IE_{t+1}^{PrivPub}}{IE_{t}^{PrivPub}} \times \left(\frac{IF_{t+1}^{PrivPub}}{IF_{t}^{PrivPub}} \times DC\right) = EGC_{t,t+1}^{PrivPub} \times TGC_{t,t+1}^{PrivPub} \tag{3}$$

Data and model specification

The combination of inputs and outputs in a DEA analysis proxies the production process of the DMUs under analysis. In the particular case of universities, they combine labour and capital inputs to produce two main outputs, human capital and scientific knowledge. Consequently, and following previous literature, our final DEA specification combines two inputs, total academic staff full-time equivalent (FTE) and total (bachelor and master) enrolment, with two outputs, number of (bachelor and master) graduates and the number of academic publications in the Web of Science (WoS). All these proxies are widely used in the DEA literature. For the academic staff FTE and enrolment, see, for example, Fandel (2007), Rayeni and Saljooghi (2010), Agasisti and Pérez-Esparrells (2010), Kuah and Wong (2011), Duh, Chen, Lin, and Kuo (2014), and Johnes (2014). For the number of graduates and the number of publications, see, among the most recent references, Kuah and Wong (2011), Wolszczak-Derlacz and Parteka (2011), and Duh et al. (2014).

Data refers to the academic years 2009/2010 and 2013/2014. The data about academic staff and student numbers is published by the Spanish Ministry of Education (Integrated University Information System – SIIU), while the number of publications is produced by the IUNE Observatory. These data sources have increased data availability for the Spanish higher education sector.

Our sample consists of 47 public universities and 22 private universities. We have excluded any university with special characteristics that affect its production process, i.e. all six universities that offer distance education and two public universities that do not have academic staff but that provide postgraduate courses through outsourced academics. Table 1 shows the main descriptive statistics for the sample and for the proxies included in the DEA model. Our sample contains almost 100% of the teaching and research production of the public sector and almost 90% of the students enrolled in public universities. For the private higher education sector in Spain, our sample contains around 90% of the academic staff FTE and publications and around 70% of the (enrolled and graduated) students.

Table 1 confirms some of the differences between public and private universities in Spain already described. The private higher education sector in Spain is smaller than the public one, showing significantly lower values for all the proxies considered, but particularly for the number of publications. Private Spanish universities are specialised in teaching activities, except some particular cases such as the *Universidad de Navarra* and the *Instituto de Empresa (IE) Universidad*.

Results

Tables 2 and 3 present the results of two DEA analyses: one for public universities and the other for private universities. According to Table 2, private universities show a higher dispersion in efficiency results than public institutions. Additionally, the smaller universities (both in terms of students enrolled and academic staff FTE) that achieved the efficiency frontier in 2009/2010 were no longer among the best performing universities in 2013/2014 (i.e. *Universidad Pablo de Olavide, Universidad de Vigo* and *Universidad Pontificia de Salamanca*), and only bigger and more research intensive universities kept their status as efficient institutions (i.e. *Universidad Autónoma de Barcelona, Universidad Autónoma de Madrid, Universidad Pompeu Fabra, IE Universidad* and *Universidad de Navarra*) – see Table 3. For Europe, Van Vught, File, Kaiser,

Table 1. Inputs and outputs of the universities included in the sample. Main statistics.

Statistics		Total	% of the public sector	Mean	SD	Min	Max	Total	% of the public sector	Mean	SD	Min	Max
Public universities (47)													
				a.y. 2009/2010						a.y. 2013/2014			
Inputs	Enrolment	1,155,765	88.71	24,590.74	15,669.01	2354	75,830	1,162,497	87.72	24,733.98	15,006.49	4630	72,353
	Academic staff FTE	83,457.75	98.45	1775.70	1094.02	415.00	4416	69,644.81	98.26	1481.80	918.46	337.07	4206.63
Outputs	Graduates	200,524	97.39	4,266.47	2613.69	1024	12,473	234,892	96.06	4997.70	3151.93	924	16,773
	Publications (Wos)	45,047	99.20	958.45	784.21	150	3565	60,156	99.26	1279.91	1085.64	217	5137
Private universities (22)													
				a.y. 2009/2010						a.y. 2013/2014			
Inputs	Enrolment	120,340	71.29	5470	3856.79	906	13,654	147,056	68.89	6684.36	3795.37	932	13,750
	Academic staff FTE	6734.26	91.79	306.10	208.27	34.88	809.50	7569.52	91.74	344.07	266.55	44.07	1019.05
Outputs	Graduates	30,127	89.74	136,941	901.71	121	3107	43,632	76.46	1983.27	1231.14	103	4786
	Publications (Wos)	1647	96.43	74.86	175.31	6	841	2673	94.29	121.50	196.86	5	948

Source: Authors' elaboration based on Integrated University Information System (SIIU) and IUNE Observatory.

Table 2. Descriptive statistics on the DEA efficiency scores by management model.

		Mean	SD	Q1	Q3	Max	Min
A.y. 2009/2010	Public universities	0.794	0.139	0.720	0.905	1	0.455
	Private universities	0.566	0.230	0.424	0.625	1	0.209
A.y. 2013/2014	Public universities	0.701	0.134	0.603	0.767	1	0.400
	Private universities	0.578	0.178	0.480	0.581	1	0.354

Source: Authors' elaboration.

Table 3. Efficient (public and private) universities.

A.y. 2009/2010 Public universities	Private universities
1. Universitat Autònoma de Barcelona	1. IE Universidad
2. Universidad Autónoma de Madrid	2. Universidad de Navarra
3. Universitat Pompeu Fabra	3. Universidad Pontificia de Salamanca
4. Universidad Pablo de Olavide	
5. Universidad de Vigo	
A.y. 2013/2014 Public universities	Private universities
1. Universitat Autònoma de Barcelona	1. IE Universidad
2. Universidad Autónoma de Madrid	2. Universidad de Navarra
3. Universitat Pompeu Fabra	

Source: Authors' elaboration.

Jongbloed, and Faber (2011) defined small universities as those institutions with fewer than 5000 students enrolled, while Daraio et al. (2011) established that small universities were those with 500–2000 students enrolled or those with 50–200 academic staff.

However, we cannot directly compare the efficiency scores for two different periods, since they are calculated on the basis of different samples and environmental conditions and, therefore, different frontiers. Table 4 shows the results of the CDMI and PPMI analyses. According to the CDMI results, private universities had a better relative performance than public universities in 2009/2010: there was a performance gap of 29.5% ($CDMI^{PrivPub}_{2009/2010} = 1.295 > 1$). These better performance levels were due to the productivity gap between private and public universities ($IF^{PrivPub}_{2009/2010}$ is higher than one), but is restrained by the higher technical efficiency spread of private universities ($IE^{PrivPub}_{2009/2010}$ below 1).

However, in 2013/2014, the results portray quite a different picture. The public sector now outperforms the private one by 3.3% ($CDMI^{PrivPub}_{2013/2014} = 0.967 < 1$), because their

Table 4. CDMI and PPMI results.

	A.y. 2009/2010	A.y. 2013/2014	Evolution 2009/2010–2013/2014			
$CDMI^{PrivPub}$	1.295	0.967	$PPMI^{PrivPub}$	0.746		
$IE^{PrivPub}$	0.670	0.808	$EGC^{PrivPub}$	1.206		
$IF^{PrivPub}$	1.933	1.196	$TGC^{PrivPub}$	0.619	$\frac{IF^{PrivPub}_{t+1}}{IF^{PrivPub}_{t}}$	0.790
					DC	0.784

Source: Authors' elaboration.

lower technical efficiency spread ($IE^{PrivPub}_{2013/2014} < 1$) compensates their lower productivity ($IF^{PrivPub}_{2013/2014}$ slightly higher than 1).

Given that the private sector had a better relative performance than the public sector in 2009/2010 ($CDMI^{PrivPub}_{2009/2010} > 1$), but that in 2013/2014 public universities outperformed private universities ($CDMI^{PrivPub}_{2013/2014} < 1$), our $PPMI^{PrivPub}_{2010,2014}$ is lower than one, indicating that the status of private universities has worsened drastically – the gap between the two sectors has been reduced by 25.4% between the two periods. This closing of the relative performance gap is a consequence of the frontier of public universities catching up with private universities ($TGC^{PrivPub}_{2010,2014} < 1$; 21.6% reduction of the frontier gap change is explained by technological changes), and the increasing spread of the technical efficiency of private universities ($EGC^{PrivPub}_{2010,2014} > 1$) that is reducing the efficiency gap between the two sectors.

In 2009/2010, private universities performed better than public universities (although their efficiency performance was more heterogeneous) because they achieved higher productivity. Private universities are less constrained by regulations than public universities, and it seems that their greater flexibility led to a better adjustment of labour inputs to teaching and research outputs. However, in 2010, the public expenditure on universities dropped along with turnovers and, in 2012, the tuition fees of public universities strongly increased. Consequently, as Table 1 shows, from 2009/2010 to 2013/2014, the number of students enrolled in the public sector hardly increased (bachelor enrolment even decreased), and the private sector has taken advantage of the narrower difference in public and private tuition levels: in 2009/2010, 120,340 students enrolled in private universities while, in 2013/2014, the enrolment of the private sector was 147,056 students – a 22.2% increase. The academic staff FTE of private universities increased from 6734.26 to 7569.52 (a 12.4% increase) while, in public universities, this input decreased from 83,457.75 to 69,644.81 (a 16.6% reduction).

However, time is still needed for public teaching and research output levels to reflect the input cuts because of the lag between inputs and outputs in the higher education production process – the graduated cohort of bachelor students enrolled in 2012/2013 (when tuition fees were raised) had not graduated in 2013/2014, and most of the research activity underway in 2010 was still producing results in 2013/2014. Additionally, the big research-intensive universities are compensating the lack of public national resources for research with international resources (particularly, the EU Framework Programme for Research and Innovation – see Perez-Esparrells, Casani, & Puente, 2015).

Conclusions

New public management and global rankings are setting trends encouraging a more entrepreneurial management approach for many higher education institutions: public or private, research or teaching intensive, smaller or larger, comprehensive or specialised. This scenario has led to a rapid expansion of the higher education private sectors in Europe. Consequently, the scientific community is increasingly comparing the two sectors in terms of governance, managerial skills and initiatives, accountability and transparency. Concurrently, efficiency has arisen as a key indicator for performance due to the growing necessity of *doing more with less*. However, the ongoing debate on higher education efficiency measurements is typically focused on the public sector, not only because it is the sector that usually dominates European higher education systems, but because of the lack of data on private higher education institutions. Additionally, in the

case of Spain, the strategic and managerial approaches of Spanish public universities are quite recent and, in some cases, still limited.

In this work, we stressed the need for new performance analyses in higher education comparing the private and public sectors. Accordingly, we assessed the relative efficiency and productivity of public and private universities for the Spanish case for 2009/2010 and 2013/2014 through the extensions of the Malmquist index proposed by Camanho and Dyson (2006) and Aparicio et al. (2016). Results show that, in 2009/2010, the greater flexibility of private universities, given their particular disciplinary and employment focus, led to a better adjustment between inputs and outputs for the private sector, which performed better than the public universities in this year. However, public universities caught up with private universities over time. Because of the economic crisis, the inputs considered in this analysis have been reduced for public universities, but this reduction has still not achieved its full impact on their outputs.

Policy makers should be cautious when considering these results: the technical efficiency and productivity measures employed in this study do not consider quality indicators, a dimension that has most likely also been affected by public funding restrictions. Furthermore, the amount of academic results may be also affected in the medium/long term. Therefore, before translating our results into policy recipes and funding trends for higher education, the dimensions of university performance not considered in this analysis should be taken into account, that is to say funding constraints may not have had positive outcomes in terms of higher education performance despite our (partial) results.

Private universities are less constrained by public authorities in both their financial support and their regulation, and they are more market oriented (*value for money*). Consequently, they have more flexibility to take advantage of efficiency analyses in benchmarking initiatives and efficiency gain objectives. On the other hand, public universities are more dependent on higher education policies and public expenditure because their strong regulation makes them less resilient. In the medium term, we should use empirical evidence in policy-making when introducing incentive systems for hiring policies, compulsory institutional efficiency assessments, performance-based funding systems and competitive funding allocations.

Our empirical study has also demonstrated that, despite the improved data availability, it is still difficult to compare performance levels for public and private universities in Spain, given the more restricted data for the latter. We initially intended to calculate more accurately the production function of universities by including proxies for their knowledge transfer activity (output) and their capital factor (inputs related to expenditure levels). However, it was impossible to carry out this task because of the lack of transparency of private universities and the scarcity of data on them – in Spain the accountability and transparency of the private higher education sector are lower than those of the public sector. Transparency (accountability) must be extended to the private sector. When more recent data is available, it will be necessary to analyse whether the reduction of resources for public universities has had a positive impact on productivity and efficiency in the long run.

Furthermore, the increasing competition that private universities are supposed to introduce (in Europe and Spain) seems to be limited to particularly profitable activities, degrees and programmes (social sciences, business and law and postgraduate teaching) and restrained by the limited size of this sector. Alternative mechanisms to encourage competition in the higher education sector should be implemented.

Finally, our analysis raises further questions that are to be addressed in future research. In the first place, it would be interesting to empirically determine the factors

that account for the relative performance differences between Spanish public and private universities, so as to monitor and correct this gap in the near future. Secondly, meta-frontier methods may be useful to accurately proxy the technology of private universities, since very few of them develop research activities intensively and reach the frontier. Lastly, our analysis assesses technical efficiency and productivity, but future comprehensive analyses on the relative performance of public and private higher education institutions should also consider quality divergences between these sectors.

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