Economies of Scale in Private and Charter Spanish Schools Under an Ownership and Management Perspective[1]

Úspory z rozsahu v soukromých a charterových španělských školách na pozadí vlastnictví a managementu

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Abstract

This paper investigates economies of scale in primary and secondary Spanish schools, distinguishing between ownership (private/charter school) and management (non-religious/religious). We have used the *Survey of Private Education Funding* and considered both the number of students per school unit (class) and the total number of students enrolled at the school. The overall results show that unit cost per student in smaller centres is around 45% higher than the average and nearly 20% lower than the average in schools with between 1,000 and 1,400 students enrolled. These larger schools had the lowest overall cost per student. As far as ownership is concerned, private schools show an average cost per pupil around 20% higher than charter schools, due to their higher average cost per teacher and lower student unit/teacher ratio. In both private and charter schools, size also influences a school's economic performance, private schools being more greatly affected. The possible influence of school size and class size on Spanish student performance in PISA 2009 is also studied.

Keywords

economies of scale, cost, efficiency, school organisation

JEL Codes

H7; I2; M21

Abstrakt

Článek zkoumá úspory z rozsahu ve španělských školách prvního a druhého stupně s rozlišením vlastnictví (soukromé/charterové školy) a managementu (necírkevní/církevní). Využíváme "Přehledu financování soukromého vzdělávání" a bereme v potaz jak počet studentů na školní jednotku (třída), tak také celkový počet studentů zapsaných na škole. Celkové výsledky ukazují, že jednotkové náklady na studenta v malých sídlech jsou okolo 45 % vyšší než průměr a téměř o 20 % nižší než průměr ve školách, v nichž je zapsáno 1 000 – 1 400 studentů. Tyto větší školy měly nejnižší celkové náklady na studenta. Pokud jde o vlastnictví, soukromé školy vykazují průměrné náklady na žáka asi o 20 % vyšší, než

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charterové školy, a to v důsledku jejich vyšších průměrných nákladů na učitele a nižšího počtu studentů na učitele. V obou školách, soukromých i charterových, má velikost také vliv na jejich ekonomickou výkonnost, přitom jsou tímto více ovlivněny soukromé školy. Předmětem analýzy je také možný vliv velikosti školy a třídy na výkonnost španělských studentů vykazovanou v PISA 2009.

Klíčová slova
úspory z rozsahu, náklady, efektivnost, školní organizace

Introduction

The optimisation of resources and the pursuit of economic efficiency have become indispensable in the current economic climate. In this context, economies of scale, which are characterised by generating a cost reduction per unit of input while output increases (Mankiw 2001), are the most decisive factor. It should be pointed out that some events that are not under the control of the company may generate economies of scale. It is thus clear that productive factors are those that decrease the average cost per unit while production increases, being directly related to increasing production capacity and the savings they provide in terms of costs.

Economies of scale are usually considered in reference to industrial firms, but can also be applied to service companies such as hospitals (Ramirez 1992; Riha et al. 2013) or schools. In the educational field, economies of scale have been of special interest in the cases of for-profit and charter schools (Rosenfeld 1977; Butler & Monk 1985; Roomkin & Weisbrod 1999; Andrews et al. 2002). Nevertheless, the topic of economies of scale has not been treated in depth in the field of economy of education (Tholkes & Sederberg 1990; Leithwood & Jantzi 2009).

Most existing studies have looked at ways in which private schools can minimise costs, focusing primarily on the existing investigation in the US. Although education is a basic service of our welfare system, these profit schools are private companies that seek to minimise costs, and it may be useful for them to achieve economies of scale. Other studies have analysed the effects on government-financed private schools (charter schools) and public schools (Butler & Monk 1985; Andrews et al. 2002; Ketchum & Slate 2012).

The total number of students enrolled is one of the most frequently studied variables when investigating economies of scale in the educational sector (Rosenfeld 1977; McGuffey & Brown 1978; Butler & Monk 1985; Andrews et al. 2002; Riha 2013). This criterion should not be analysed in isolation, because other aspects of a school's organisation can also have a decisive influence (Morris 1964; Faber 1966; McGuffey & Brown 1978; Lubienski 2001; McEwan 2001; Lubienski 2005).

What is more, the differences between religious and non-religious schools have not been considered when talking about ways schools can minimise costs (Lubienski 2005). This paper will analyse the characteristics of primary and secondary private schools when trying to minimise costs, distinguishing between private and charter schools, and also considering whether the school is run by a religious entity or a corporation. For this

purpose, microdata reflecting the financial situation of the Spanish private school sector will be analysed.

1 School characteristics and their contribution to economies of scale

The number of students enrolled is one of the most frequently studied aspects of economies of scale in this field. There is, however, little agreement about the most suitable number in terms of increasing profits. Butler and Monk (1985) conducted one of the first analyses of economies of scale and efficiency of public schools in New York State. They made a distinction between small districts, with fewer than 2,500 students, and large districts, with over 2,500. The results showed that significant economies of scale were achieved when the number of students increased. Nevertheless, this only occurred in small districts, and within them, specifically in smaller schools. Previously, Turner and Thrasher (1970), in a study that included schools with up to 3,000 students, also noted that the cost per student was at its lowest after reaching 1,000 students enrolled. According to these data, Fox (1981) maintained that the ideal size of a school was between 1,000 and 2,000 students, due to the fact that schools with fewer than 1,000 students had a higher cost per pupil.

Nevertheless, Monk (1987) concluded that after reaching 400 registrations, schools did not benefit from economies of scale. Similarly, Andrews et al. (2002) observed that economies of scale were achieved in districts with between 2,000 and 4,000 students, but never in those with more than 6,000. At this level of enrolment, the opposite effect, diseconomies of scale, was observed. Chakraborty et al. (2000) concluded, after studying public schools in Utah districts, that economies of scale existed in larger districts and schools and that cost reduction may be achieved when the number of students enrolled increases.

As far as the relation between rural schools and economies of scale is concerned, several analyses have been made. Tholkes and Sederberg (1990) reviewed studies looking at economies of scale and rural schools, taking into account different aspects that tend to affect rural communities. Hickey (1969) presented consolidation of schools as the best way to achieve more efficient administration. Rosenfeld (1977) concluded that larger unified schools were found to have a larger percentage of costs defined as administrative costs than smaller unified schools.

In order to explain the schools' cost reduction factors, Morris (1964) hypothesised that larger schools offer broader educational programmes which, according to him, could be behind the cost reduction per student. Like previous authors, he found that schools with fewer than 500 students had a higher cost per student than larger ones. However, this figure reached a low point when the total number of students enrolled reached 1,000. Bowles and Bosworth (2002), after analysing 17 schools in a district of Wyoming, concluded that an increase of 10% in school size leads to a decrease of 2% in total cost.

Most studies focus on the relationship between total cost and school size (Andrews et al. 2002; Newman et al. 2006) without considering other school factors. Related to this issue,

it is important to point out that these analyses of economies of scale can be subjected to various types of bias. Other researchers have taken a different view of economies of scale, focusing on other factors that may influence them, such as the organisation of the school (Huang and Howley 1993; Ketchum & Slate 2012).

Lubienski (2001) discovered that smaller schools had disadvantages in the field of innovation in comparison to the largest ones. According to his study, charter schools have the ability to encourage innovation in education. After a review of practices in these schools, he concluded that large schools use innovation in organisational terms: however, the strategies used in the classroom did not reflect this. The conclusion emphasised that when having to choose between innovation opportunities in education or pedagogical and curricular strategies, the latter prevail. Later, Lubienski (2005) suggested that for-profit schools spent part of their organisational resources on marketing strategies instead of redirecting them to students or faculty. Due to the private nature of these organisations and the competitive pressures they are subjected to, these for-profit schools develop marketing strategies rather than structural and organisational reforms.

Another aspect that could influence economies of scale is directly linked to the size of the facilities (Lubienski 2005). McGuffey and Brown (1978) analysed the relationship between school size and the cost of use of the facilities. They found that large schools made better use of their space and incurred lower operational costs than small schools.

As for-profit schools and charter schools seek financial profit, it is important to analyse whether this has any impact on student academic performance. This issue has been studied by several authors (Monk 1987; Huang & Howley 1993; Greenwald et al. 1996; Chakraborty et al. 2000).

Ramirez conducted a review of the available literature on this topic in 1992 and found that the differences between academic progress made by students in small and large schools were not significant. Nevertheless, there have been dissenting conclusions in both directions. Cotton (1996) reviewed 31 studies which identified the relationship between school size and academic achievement. He concluded that the best size for primary schools was between 300 and 400 students and between 400 and 800 for secondary schools. Greenwald et al. (1996), after reviewing 60 studies, concluded that academic performance was inversely related to the size of the school. Once again, academic performance was better in smaller schools. Ketchum and Slate (2012) analysed the relationship between the size of secondary schools and the academic achievement of students with financial problems in the state of Texas between 2005-06 and 2010-11. They concluded that these students had better marks in smaller schools, considering the ideal size to be between 600 and 900 students.

Nevertheless, it would seem that no clear conclusion has been reached. Some authors have come to the opposite conclusion, maintaining that students have better academic achievement in large schools (Morris 1964; Rosenfeld 1977; Huang & Howley 1993; Greeney & Slate 2012). Slate and Jones (2007) examined the relationship between school size (small, fewer than 400 students, medium, between 800 and 1,199, and large, 1,200 students or more) and the performance of Hispanic students in Texas. Analysing the

results of tests in different subjects, students enrolled in large schools had better marks in algebra and history, but students from small schools did better in English and Biology. Riha et al. (2013) repeated the study relating the size of the school (small between 100-499 students, 500-999 medium and large from 1,000 students) to the academic performance of the Texas Hispanic students from 8th grade between 2005-06 and 2009-10. The results corroborated previous study data, showing that the academic performance of students in larger schools was better. Similar conclusions were obtained by Huang and Howley (1993). After applying a multivariable regression analysis, in which they included not only school size variables but also others such as school resources, school environment and academic background, they concluded that students' academic achievement in small schools was worse than in large schools. Iatarola et al. (2008) studied the effect of small schools on student achievement in New York City, reaching similar conclusions.

Greeney and Slate (2012) analysed the relationship between school size and other variables (class attendance, dropout rates and rate of completion of studies) in Texas Hispanic students between 2003-04 and 2008-09. They concluded that there were no significant differences in the cases of school size, class attendance and dropout rate. Nevertheless, completion rate was higher if these students were enrolled in small schools.

2 Objectives and methodology

The main purpose of this study is to determine the existence of economies of scale and the effects of size in primary and secondary for-profit and charter schools in Spain. Private schools are those owned by a legal person or a company, while charter schools are private corporations supported with public funds under regulation in Spanish law (L.O.D.E. 1985).

According to the sample, the following aspects were analysed:

- Estimate of the minimum efficient school size.
- Analysis of what kind of entity (corporation or religious entity) manages schools better in terms of cost.
- Study of regional disparities in Spain in relation to average school size and costs per student.

That is why the main objective is to analyse the relationship between the number of students enrolled in the centre and its cost function, distinguishing between for-profit and charter schools, as well as by the school management (corporation or religious entity) and the characteristics of the region in which the school is located. The optimal number of students enrolled (threshold) will be also studied.

The analysis will be based on microdata from the *Statistics of Financing and Expenditure of Non-university Private Education in 2009-2010,* prepared by the National Statistics Institute (INE), a sample which contains information for 7,559 Spanish private and charter schools.

In Spain, the different stages taught by schools are kindergarten, primary education, secondary education and high school (*bachillerato*). The earliest, preprimary stage of education (kindergarten) is usually provided by specialised centres, such as nursery schools, as this stage is not offered by many schools.

The sample has been divided between preprimary centres and the rest, which include primary, secondary and high school education. This second sample of the mean is the one chosen for the present study.

Several linear regressions were applied in the analysis. The independent variable chosen was the number of students at the school and the dependent ones were the total costs of the centre, spending on transportation, fungible material costs, educational personnel costs, non-teaching staff costs, canteen expenses, living expenses and cleaning services. The applied equation was:

$$A_i = C + \beta_{1ALUMNO} + \beta_{2ALUMNO*ALUMNO} + u_i \quad (1)$$

where A_i is the dependent variable, $\beta_{1ALUMNO}$ the number of students at the school and $\beta_{2ALUMNO*ALUMNO}$ the squared number of students.

At the same time, and although it is not the main objective of this research, the relationship between the results obtained by students in PISA 2009 and school size was also analysed using the Hanushek production function (1979). A multilevel regression was applied (Choi et al. 2013; Agasisti 2013), estimating the results using the techniques recommended in the *Data Analysis PISA OECD Manual* (2009), which involves making estimates from five plausible values and eighty replicates of each student.

PISA 2009, whose sample includes 25,887 fifteen-year-old Spanish students, incorporates different variables that can affect student achievement. The assessed competencies are mathematics, science and reading. PISA 2009 is characterised by large international participation (74 countries compared to 32 in 2000) and a greater consolidation of the regional analysis, allowing a broad comparison within the country. Thus, in PISA 2000, Spain participated as a single state sample, while in 2009 all except three regions took part.

3 Average size of Spanish schools

As there are no specific statistics which would make an international comparison of average school size possible, we used the information contained in PISA 2009. From the values of each country according to this source, we identified five groups of countries according to the size of their schools. The function of k-means clusters from the IBM SPSS statistical software version 19 was used, as shown in Table 1.

Spain is situated within the largest group formed by 29 countries including Japan, Germany and Belgium, and with an average value of 657 students per school. Groups of countries with smaller schools, 473 students on average, include most of the Nordic

countries (Denmark, Sweden and Finland), while at the opposite pole are the three regions of China, Thailand and UAE, with an average value of about 2,500 students per school. Other Asian economies such as India, Malaysia and Singapore, together with the US, are in the group of countries with an average school size of around 1,400 students.

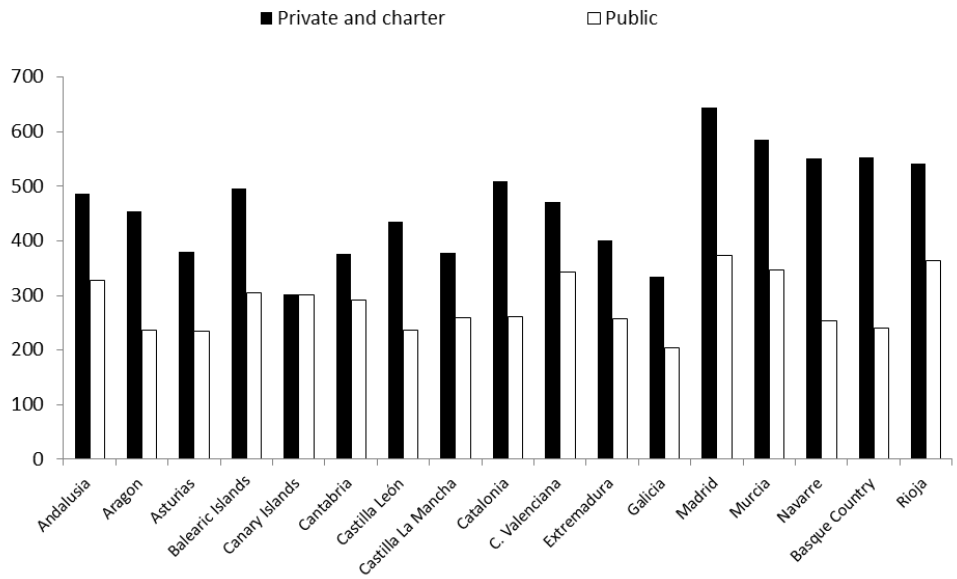
Table 1: Average school size by country: PISA 2009

	N	*Min.*	*Max.*	*Mean*	*Std. deviation*
Denmark. Moldova. Latvia. Slovenia. Czech Republic. Finland. Sweden. Iceland. Norway. Poland. Liechtenstein. Greece	*12*	*275.7*	*473.4*	*403.6*	*68.0*
Israel. Kazakhstan. Kyrgyzstan. Serbia. Japan. Azerbaijan. Miranda - Venezuela. Italy. Peru. Germany. Belgium. Spain. Jordan. Trinidad and Tobago. Switzerland. Malta. Croatia. Lithuania. Hungary. Bulgaria. Georgia. Ireland. Indonesia. Albania. Argentina. Austria. Estonia. Russian Federation. Slovak Republic	*29*	*512.5*	*796.6*	*656.9*	*87.4*
New Zealand. Korea. Chile. UK. Brazil. Panama. Canada. Hong Kong-China. Netherlands. Australia. Uruguay. Portugal. Turkey. Romania. Tunisia. Mexico. Montenegro. Costa Rica. Mauritius	*19*	*805.8*	*1188.1*	*993.3*	*102.4*
Qatar. Colombia. Singapore. United States. Luxembourg. India. Malaysia	*7*	*1273.3*	*1485.9*	*1375.5*	*64.7*
Chinese Taipei. Macao-China. Thailand. UAE. Shanghai China	*5*	*1697.1*	*2534.5*	*1944.2*	*335.5*

Source: own calculations using PISA 2009 (OECD) data.

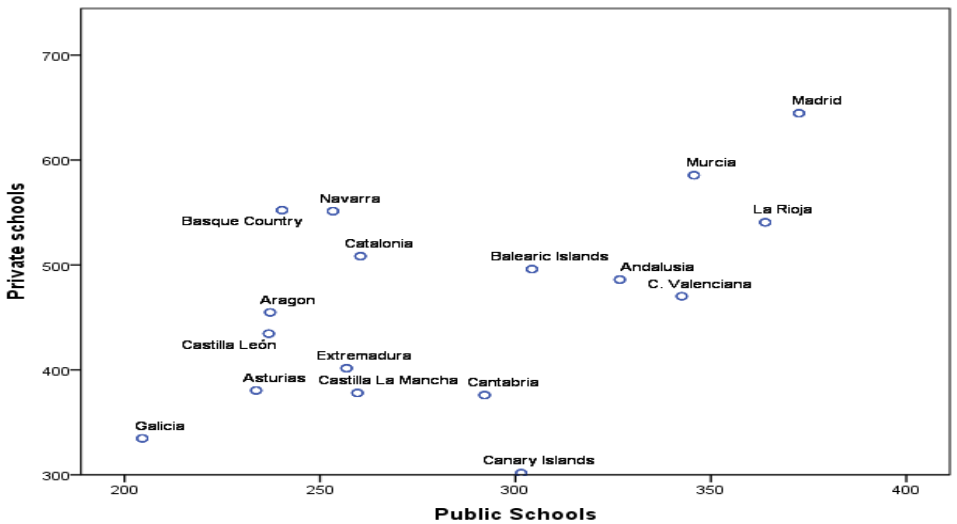
A second characteristic related to the size of Spanish schools is the major differences found among public schools, with a size around 30% smaller than private ones (Figure 1). The correlation between the size of private and public schools according to region is significant at a level of 95% (Figure 2). The average size of private schools related to regional incomes shows a positive and significant correlation at the 95% level, but it is independent of other variables that, a priori, could affect it, such as the total population of the region, population density, area, number of municipalities or average temperature (Table 2).

Figure 1: Comparative average size of Spain's public and private schools by region: Number of students



Source: own calculations based on statistics from the Spanish Ministry of Education, Culture and Sports for public and private centres INE. Data relating to 2011/12.

Figure 2: Comparison of Spain's public and private school size by region: Number of students



Source: own calculations based on statistics from the Spanish Ministry of Education, Culture and Sports for public centres and from the Spanish National Statistics Institutes for private ones. Significant at a level of 95%.

Table 2: Partial correlation between regional school size and regional indicators

		Average school size	*GDP p.c. 2012*	*Population*	*Area*	*Density*	*Number of municipalities*	*Temperature*
Average school size	*Pearson correlation*	*1,00*						
	p. value							
GDP p.c. 2012	*Pearson correlation*	*0,59**	*1,00*					
	p. value	*0,01*						
Population	*Pearson correlation*	*0,26*	*0,11*	*1,00*				
	p. value	*0,32*	*0,64*					
Area	*Pearson correlation*	*-0,24*	*-0,30*	*0,42*	*1,00*			
	p. value	*0,36*	*0,22*	*0,07*				
Density	*Pearson correlation*	*0,48*	*-0,27*	*-0,28*	*-0,35*	*1,00*		
	p. value	*0,05*	*0,27*	*0,25*	*0,14*			
Number of municipalities	*Pearson correlation*	*-0,11*	*-0,09*	*0,29*	*0,84***	*-0,29*	*1,00*	
	p. value	*0,68*	*0,72*	*0,26*	*0,00*	*0,26*		
Temperature	*Pearson correlation*	*0,14*	*-0,50**	*0,14*	*-0,25*	*0,48**	*-0,33*	*1,00*
	p. value	*0,58*	*0,03*	*0,58*	*0,31*	*0,04*	*0,20*	

*** Significance at 95%; * Significance at 90%*

Source: own elaboration from the Spanish National Statistics Institutes.

4 Results

4.1 Influence of school size on students: PISA results

The literature reviewing the efficiency of the education system has attempted to identify the variables which have an influence. One of the most common ways to study efficiency in education involves the production function of education defined by Hanushek (1979), where the output of the educational process of a student is measured in a particular school (Aij) based on a series of school inputs (Sikh), the socioeconomic characteristics of the student (Bij), the influence of peers (Pij) and the innate abilities of the student (Iij). The production function would be:

$$Aij=f(Sij, Bij, Pij, Iij) \quad (2)$$

Using this equation, the effect of school size on student performance in the PISA 2009 tests of mathematics, both in public and private schools will be shown, performing the following multilevel regression (Agasisti 2013):

$$Aij = \alpha j + \beta_{1\ ESCS} + \varepsilon\ ij$$

$$\alpha j = Y0 + \beta_{2\ SCSIZE} + \beta_{3\ PRIVATE} + \beta_{4\ LARGECITY} + \beta_{5\ CLASSSIZE} + \beta_{6\ MU\_ESCS} + \mu i, j \qquad (3)$$

where Aij is the result obtained in mathematics by student i at school j, conditioned by socioeconomic background (βESCS) and several fixed effects of the school (αj).

SCSIZE represents school size, measured by the number of students enrolled, MU_ESCS includes the average ESCS of the school or "peer effect"; CLASSSIZE measures the number of students in the classroom of student i; PRIVATE indicates school ownership; and LARGECITY shows whether the school is located in a city with a population of more than 100,000. These last two variables have been coded, taking the value 0 when the school is public, and 1 when it is private, and 0 if the city has a population below 100,000 and 1 when it is higher, respectively.

The analysis shows that all the variables, with the exception of PRIVATE, are good predictors of the dependent variable (significance of 95% or higher). School size has a slightly negative influence on student performance in these tests. In contrast, and paradoxically, the relationship between class size and results in mathematics is positive. Students in larger classrooms obtain better results. This could be explained by a quality or reputational effect of the school, with the more popular schools in Spain usually trying to fill their classes to the maximum level. Finally, schools located in large cities also obtained better results in the PISA 2012 test.

Table 3: Influence of school size on student achievement in maths: PISA 2009

Variable	B	Std. error	df	T	p value	Lower bound	Upper bound
Intercept	*469.51*	*3.72*	*1,450.77*	*126.22*	*0.000*	*462.21*	*476.80*
ESCS	*22.17*	*0.77*	*795.20*	*28.87*	*0.000*	*20.66*	*23.68*
MU_ESCS	*24.05*	*2.75*	*892.36*	*8.74*	*0.000*	*18.65*	*29.46*
SC Size	*-0.01*	*0.00*	*908.00*	*-3.19*	*0.002*	*-0.02*	*0.00*
Private School	*-2.17*	*2.90*	*859.84*	*-0.75*	*0.462*	*-7.86*	*3.53*
Large City	*6.78*	*2.75*	*816.85*	*2.46*	*0.014*	*1.38*	*12.18*
Class Size	*1.96*	*0.10*	*21,574.44*	*20.52*	*0.000*	*1.78*	*2.15*

Source: own elaboration from PISA 2009.

4.2 Influence of school size on average costs

First, a descriptive analysis of the main economic indicators of the school was performed. The indicators were distributed into ten groups or deciles of schools, according to the number of students enrolled. The sample shows the average values of the main indicators

and unit costs by groups of schools depending on size. There is a direct relationship between school and class size, as well as higher expenditure per student in smaller schools.

Table 4: Average cost of schools by size

Deciles	*Number of centres*	*Average students*	*Students per classroom*	*Total expense per student*	*Teachers total expense per student*	*Non-teachers total expense per student*	*Rest of expenses per student*
1	*440*	*27.3*	*10.1*	*11,708.3*	*5,298.3*	*3,544.7*	*2,865.3*
2	*439*	*86.7*	*15.9*	*7,937.7*	*4,103.9*	*2,159.8*	*1,673.9*
3	*441*	*193.7*	*21.3*	*4,162.6*	*2,662.0*	*552.2*	*948.3*
4	*440*	*279.8*	*22.1*	*3,919.6*	*2,666.3*	*438.3*	*815.1*
5	*436*	*337.5*	*24.7*	*3,581.1*	*2,603.3*	*359.9*	*617.8*
6	*440*	*408.0*	*23.5*	*3,977.8*	*2,620.2*	*438.2*	*919.5*
7	*439*	*591.3*	*23.3*	*3,871.3*	*2,627.7*	*390.5*	*853.0*
8	*440*	*708.1*	*24.8*	*3,746.2*	*2,534.5*	*381.5*	*830.1*
9	*439*	*902.5*	*25.0*	*3,793.8*	*2,503.9*	*394.0*	*895.9*
10	*440*	*1,405.1*	*25.9*	*3,873.5*	*2,436.3*	*420.4*	*1,016.8*
Total(a) /Average	*4,394 (a)*	*494.0*	*21.7*	*5,058.2*	*3,005.4*	*907.7*	*1,145.1*

Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

In order to analyse the differences in expenses per student in each school, average expenditure per student was broken down into two components, according to the following equation:

$$E / S = [E/ C] \times [C / S] \quad (4)$$

where E represents total expenditure, S the number of students in the school and C the number of classrooms.

To analyse the elasticity of the cost per student related to school size and the shape of the cost curve, these equations were estimated (least squares approach):

$$A_i = c + \beta_1 S + \beta_2 S^2 + u_i \quad (5)$$

where Ai represents the different components of the cost of each school (costs of teachers, non-teaching staff costs and other expenses), S represents the number of students, S2 the square of the number of students, and ui includes the error term.

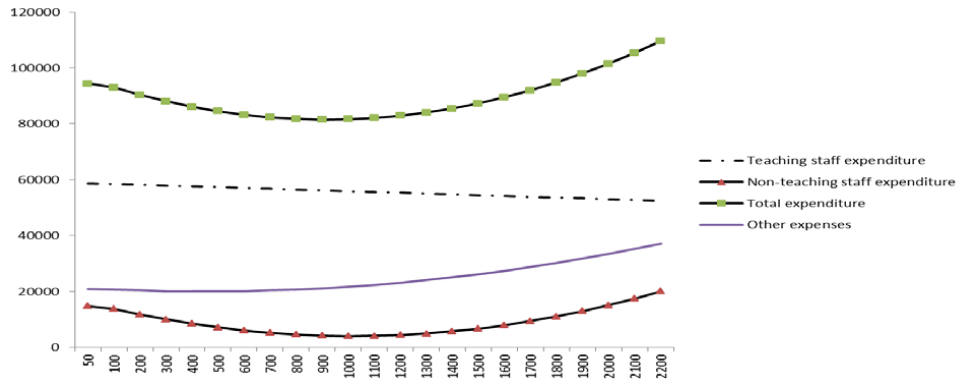
The cost values of each teaching unit (class) according to size (Figure 3) were also calculated. The following equation was estimated:

$$B = c + \beta_1 S + \beta_2 S^2 + u_i \quad (6)$$

where B is the number of students per school unit (class).

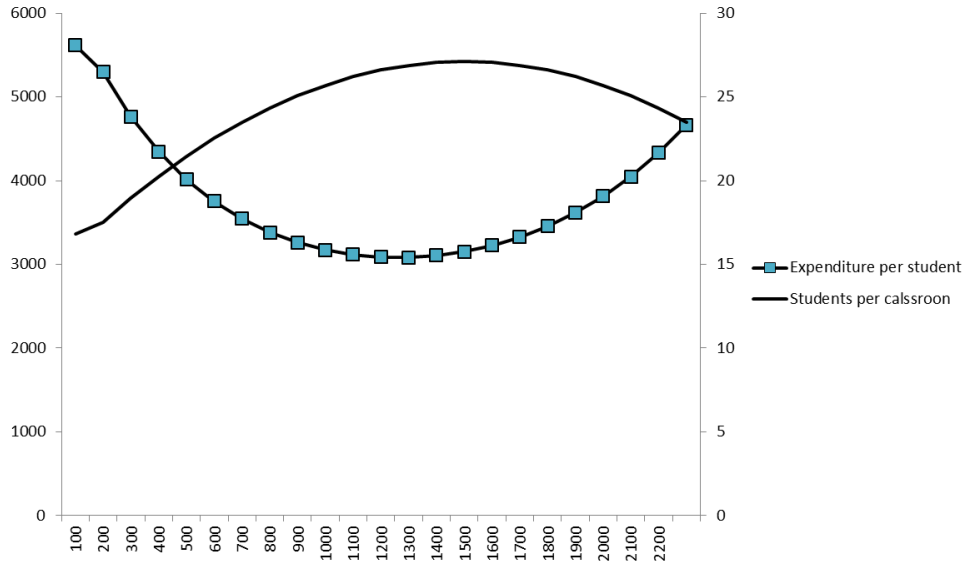
Total cost per student was also calculated (Figure 4). Finally, values for average cost per student, the relative levels of average expenditure for each class and the average number of students per class were expressed in index numbers, with the average of all schools = 100 (Figure 5).

Figure 3: Estimated average classroom costs per student by school size



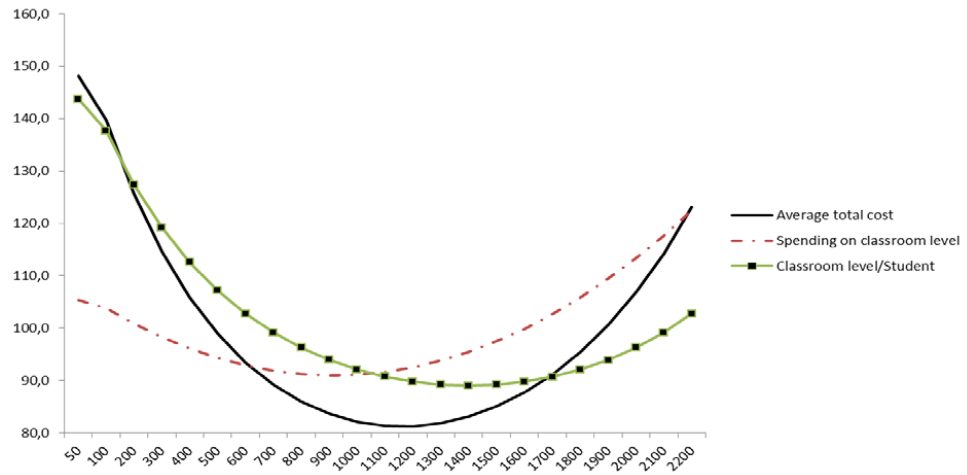
Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

Figure 4: Estimated number of students per classroom and average cost per student by school size



Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

Figure 5: Relative levels of average cost per student, average cost per classroom and average classroom size



Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

There are significant differences in school size depending on the religious or non-religious nature of the school and its ownership (charter or private) determining the average cost per student in each type of school (Table 5):

a) Costs per student about 10% below the average figure are obtained in religious private schools. This is explained by the lower average cost per school unit and larger number of students per school unit (Table 5).
b) Non-religious charter schools have a cost per student 9.8% above the average, due to the higher average cost per school unit (4.8%) and lower average number of students per school unit (95.4% from the mean = 100).
c) Non-religious private schools spend about 25% more per student than the average, due to the fact that they have about 12% fewer students per school unit and an expenditure of 10% more per school unit.
d) Finally, the expenditure per student of religious private schools is 15.3% above the average figure due to higher spending per school unit.

Table 5: Average costs, school management and ownership

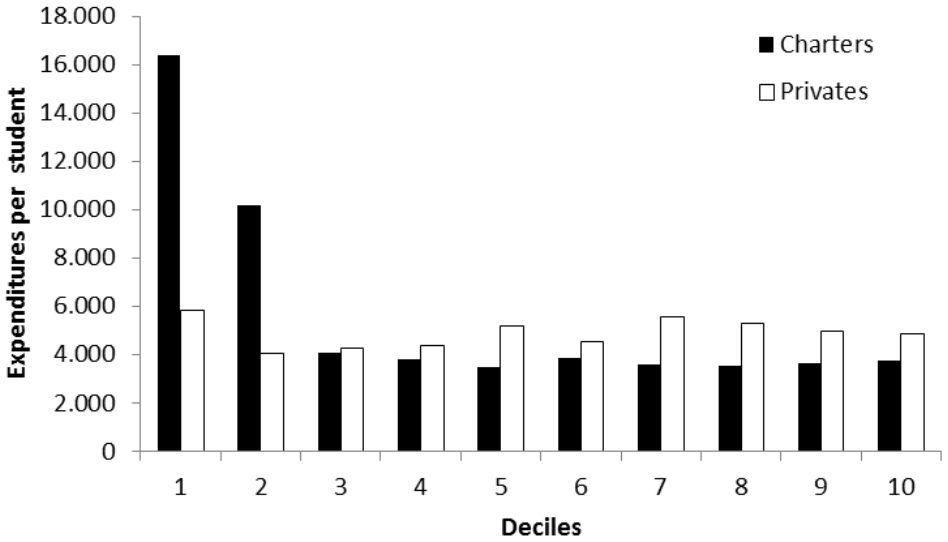
	Number of centres	Number of students	Expenses/ student (euros)	Expenses/ classroom (euros)	Students/ classroom (euros)
Charters (a)	**3,470**	**540.9**	**3,799**	**90,364**	**23.8**
Non-religious	1,350	414.3	4,332	96,495	22.3
Religious	2,120	621.5	3,573	87,502	24.5
Private	**923**	**318.5**	**4,880**	**101,732**	**20.8**
Non-religious	817	311.5	4,931	101,453	20.6
Religious	106	372.4	4,549	103,725	22.8
Total	**4,394**	**494.0**	**3,946**	**92,089**	**23.3**
Charters		**109.5**	**96.3**	**98.1**	**101.9**
Non-religious		83.9	109.8	104.8	95.4
Non-religious		125.8	90.6	95.0	104.9
Private		**64.5**	**123.7**	**110.5**	**89.3**
Non-religious		63.1	125.0	110.2	88.1
Religious		75.4	115.3	112.6	97.7

(a) Because of the possible mixed character (private-subsidised) of some Spanish centres, a school has been treated as a charter school when more than 50% of its classrooms are subsidised.

Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

Studying the differences in costs per student related to the type of school, it is clear that smaller charter schools have higher unit costs, which is not the case for private ones (Figure 6). This is due to the low number of students per school unit. Nevertheless, it could be possible to maintain this type of charter school because they are funded by the public money. In contrast, from a certain school size, charter schools have lower average costs per student than private schools.

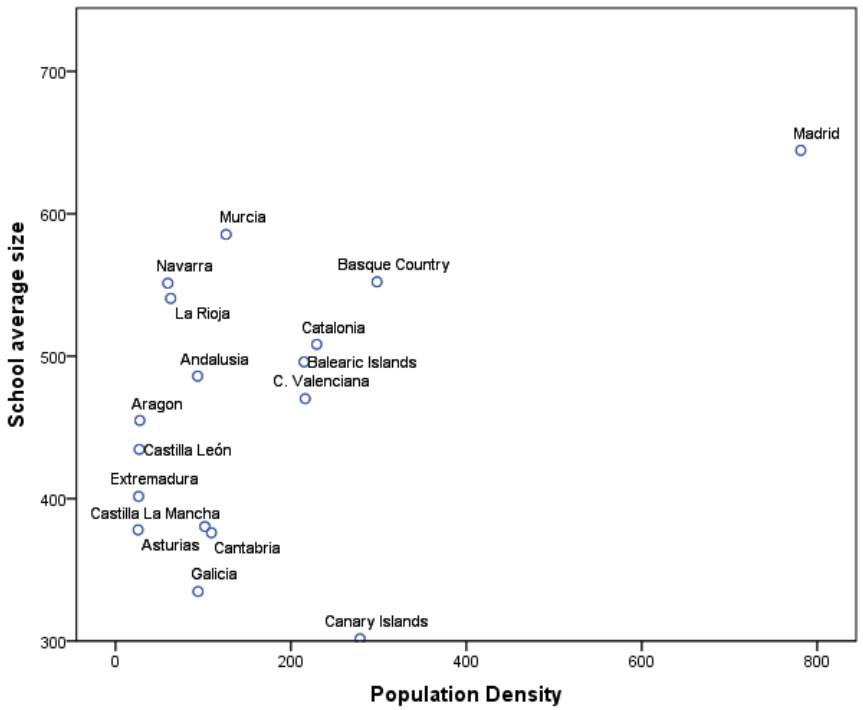
Figure 6: Variation in average cost per student according to size: charter and private schools

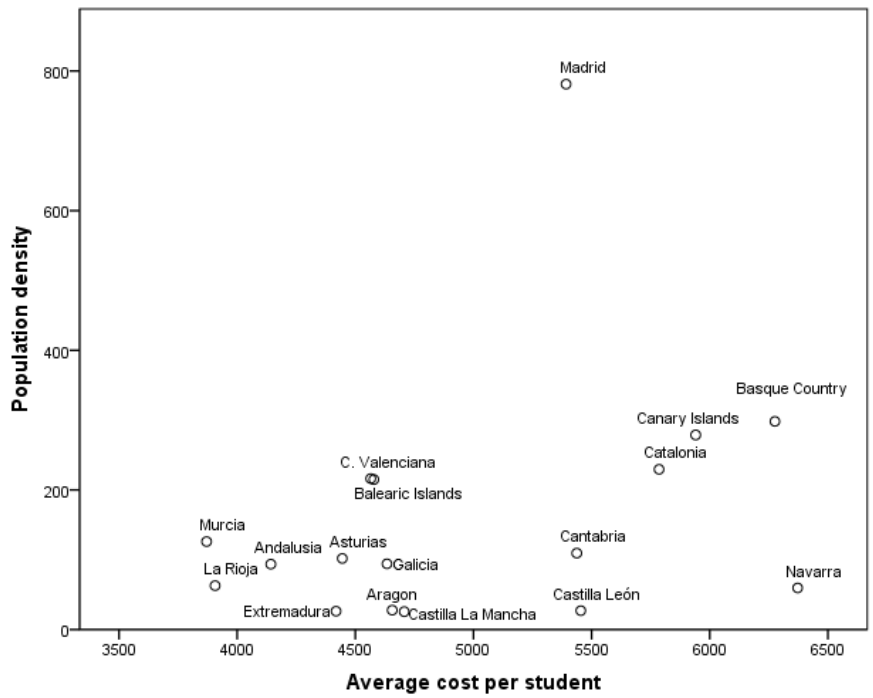


Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

When analysing the average size of schools in each region, significant differences were observed. These can, in part, be explained by the different density of population of each region (Figure 7). The estimation of the influence of population density on school size was studied using a linear regression. It concluded that this variable explains 17% of the differences in school size, with a significance level of 95%. However, regional population density and the average cost per student in private schools are independent variables, as shown on the right of Figure 7. Source: own elaboration from *Survey of Private Education Funding* (Spanish National Statistics Institute) and *Population Figures* (Spanish National Statistics Institute).

Figure 7: Relationship between average school size and population density: Spanish regions





5.3 Contribution margin per student by school size

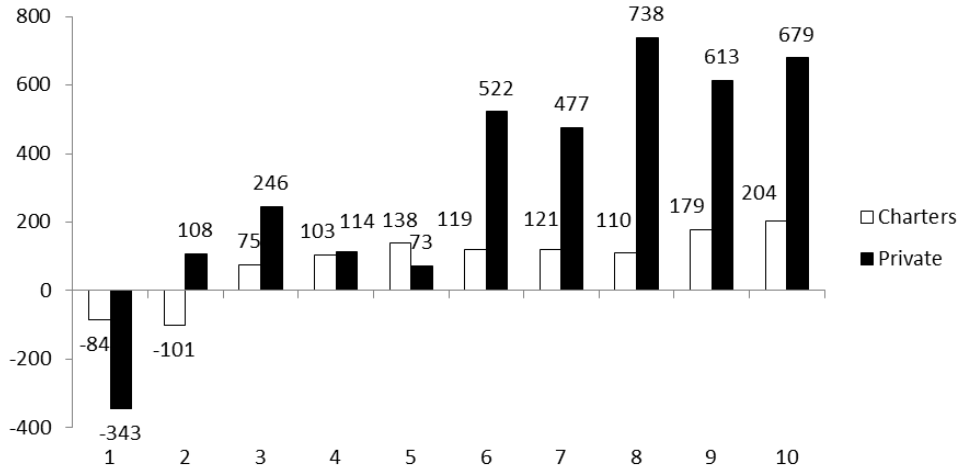
School size is an important determinant factor of profit margin. These data have been obtained from Spanish private and charter schools. In both cases, three categories of school size (small, medium and large) were distinguished. Charter schools in deciles 1 and 2 presented negative results per student of around 100 euros, and in private schools decile 1 also recorded a loss of 343 euros. However, the high value of the standard deviation indicates a significant dispersion of the results (Table 6 and Figure 8). In contrast, larger schools (deciles 8, 9 and 10 in the case of private schools and deciles 9 and 10 in charter schools) showed a positive result of 600/700 euros in private schools, and of 180/200 euros in charter schools. Finally, the medium-sized schools recorded a result per student of between 100-500 euros in private schools and between 75-125 euros in charter schools.

Table 6: Influence of size on current profit margin in charter and private schools: euros per student

	Private				Charter			
			Confidence interval at 95%				Confidence interval at 95%	
Decile	Mean	Standard deviation	Lower limit	Upper limit	Mean	Standard deviation	Lower limit	Upper limit
1	-343.3	2157.1	-619.3	-67.2	-83.8	2226.6	-391.2	223.6
2	108.1	2554.7	-243.7	459.9	-101.2	1407.8	-285.7	83.4
3	245.7	703.6	112.8	378.7	75.5	433.1	28.7	122.2
4	114.5	1198.1	-187.2	416.2	103.3	373.7	65.4	141.2
5	73.1	613.0	-179.9	326.1	137.8	400.9	98.9	176.8
6	522.2	733.8	349.7	694.6	118.9	479.0	69.8	168.0
7	476.6	677.7	296.7	656.4	120.9	378.8	82.8	159.0
8	737.6	864.7	491.9	983.3	110.5	282.4	82.2	138.8
9	612.7	524.2	465.2	760.1	179.1	424.3	136.8	221.3
10	679.4	537.2	528.3	830.4	203.7	389.7	164.7	242.7
Total	156.8	1753.3	43.4	270.2	104.5	751.8	79.4	129.5

Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

Figure 8: Current centre results per pupil (euros) according to deciles formed by school size



Source: own elaboration from Survey of Private Education Funding (Spanish National Statistics Institute).

Conclusions

Designing educational policies that promote efficiency in the educational system requires knowledge of the effects on performance and the associated costs of different schools and classes sizes. According to the Spanish results in PISA 2009, there is a slightly negative relationship between student performance in these tests and school size. In contrast, paradoxically, the relationship between class size and academic results is positive after controlling for variables such as the size of the city and the influence of the socioeconomic status of the school and the student.

Regarding the impact of school size on average costs, potential savings in costs per student in Spanish private and charter schools have been estimated, using for this purpose the *Statistics of Financing and Expenditure of Non-university Private Education in 2009-2010* microdata, prepared by the INE. The contribution of: a) the lower cost per school unit in larger centres and b) the higher number of students per school unit in such schools were differentiated in the calculation of this potential savings figure.

In terms of average costs per school unit, lower levels were achieved in schools with between 600 and 1,200 students enrolled. These costs were around 8% below the average, meanwhile in schools with fewer than 100 students enrolled, the cost per unit increased by about 5% on average.

The number of students per class is 10% higher when 600 students or more are enrolled, In schools with fewer than 200 students enrolled, this ratio decreases by about 40%. The combined effect of these two factors means that the cost per student is around 45% higher than the average in small schools, and almost 20% below the average in schools

with between 1,000 and 1,400 students enrolled. This kind of school presents, overall, a lower cost per student.

According to ownership, private schools register a cost per student around 20% higher than charter schools, due to the fact that charter schools have a higher cost per teacher and a lower student unit/teacher ratio. There is a higher proportion of small private schools compared to small charter schools. Nevertheless, private schools have lower unit costs, but only slightly above the average, meanwhile in charter schools the smaller class size means an unusually high average cost per student of around 13,000 euros, compared with the average of 3,946 euros.

School size influences the economic performance of charter and private schools. In charter schools, which generally obtain lower profits than private schools, the small ones make a loss of around 100 euros per student on average, compared with large charter schools which make an average profit of approximately 200 euros. The differences in profits in the case of private schools are higher. The small schools make losses of 300 euros, compared to profits of 600-700 euros in large schools.

Finally, the analysis leads to the conclusion that although different population densities of the Spanish regions have an influence on average school size, this influence is limited and independent of the average expenses per student of the region.

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