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FISCAL DECENTRALISATION, PRIVATE SCHOOL FUNDING, AND STUDENTS' ACHIEVEMENTS. A TALE FROM TWO ROMAN CATHOLIC COUNTRIES [*]

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ABSTRACT: The objective of the paper is to study the disciplining role of both market forces and regional governments own resources in the provision of educational services. The historical evolution of school regulation in Italy and Spain (in particular regarding the funding of private schools run by Roman Catholic Church, and the role of regional governments financing education) created different institutions in terms of both dimensions, private funds and regional governments funds. We take advantage of these institutional diversities to estimate the disciplining role of different sources of funds in the context of educational production function using PISA data. Our results provide support to these accountability drivers. Moreover, we find evidence on the role played by a national standardised test in providing adequate incentives to improve schools' performance.

JEL Codes: H75, I22

Keywords: Public and private schools, accountability, fiscal federalism

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1. Introduction

Historical accounts of the evolution in school regulation all around the world suggest that this is a policy issue subject of bitter confrontations. Two questions emerge as important: on the one hand, what is the role that *private schools* should play in the provision of education. On the other hand, what is the role *regional governments* should play in the provision of education. In countries where the Roman Catholic Church is still an important actor in social life, the first question is basically centred on the role, if any, private schools run by Catholic Church should play in education, and whether these schools should be financed with public funds. The institutional answers are different on this point between two countries, like Italy and Spain, where the Roman Catholic Church is still considered a sort of "state religion". In Italy, starting from the Unification in the second half of the XIX century, there was a strong push towards a public free-for-all education centrally provided. In Spain, after the success of Franco's *coup d'etat* in 1939, the Catholic Church is still receiving a high share of public funds. As for the second question, Italy and Spain have also followed different paths with regard to decentralization patterns. In the last thirty years Spain has moved from being a unitary state to a much more decentralized one, with the regions (*Comunidades Autónomas*) having Parliaments and Governments that can decide on a broad range of public services, among which educational services represent a large share of regional public expenditures. On the other hand, Italian regional governments (*Regioni*) play, in general, a minor role in deciding over public expenditures; with regard to school funding, this is consistent with the process of centralization and secularization of education undertaken in Italy.

Given these combinations of private funds (coming from households paying a price for educational services) and public funds (both from regional and central governments), it is not clear how the "accountability effects" suggested by the literature on private markets and fiscal federalism impact on the production of education. The goal of the paper is to explore this issue. In particular, we study the

disciplining role of both market forces and regional governments' own resources in the provision of educational services. We exploit two different sources of variation: on the one hand, the difference between private and public schools suggests that – in the presence of standardised national tests to assess the level of students' achievements – private schools should be more productive than public schools in providing better attainments, given that households pay a price to access the service. This first "market-accountability" effect should be stronger the higher the share of funding coming directly from markets. On the other hand, the difference between schools funded with regional governments resources and schools centrally funded suggests that – according to second generation fiscal federalism theories – the former should be more productive than the latter, given the "fiscal-accountability" role played by own resources for regional governments. The historical evolution of school regulation in Italy and Spain, in particular regarding the funding of private schools run by Roman Catholic Church and the role of regional governments, created different institutions in terms of both dimensions, private funds and regional governments funds. We take advantage of these institutional diversities to estimate the disciplining role of different sources of funds in the context of educational production function using PISA data.

We build on two papers. First, Barankay and Lockwood (2007) provide empirical evidence on the claim that fiscal decentralisation promotes - amongst other benefits - the productive efficiency in the delivery of government services. The evidence is based on a data-set of Swiss cantons. The authors first offer careful evidence that expenditure decentralisation is a powerful proxy for factual regional/local autonomy. Further panel regressions on Swiss cantons supply then robust evidence that more decentralisation is associated with higher educational attainment. They also show that these gains lead to no adverse effects across education types, but that male students benefited more from educational decentralisation closing, for the Swiss case, the gender education gap. Finally, they present evidence of the importance of competence in government and how it can reinforce the gains from

decentralisation. Here we add to this paper by considering *tax* decentralisation and not *expenditure* decentralisation in the analysis of efficiency in educational spending, noting that the former should be the real source of accountability for regional governments according to recent literature on fiscal federalism (e.g., Oates, 2005; Weingast, 2009). Our aim is to study whether regions with more tax autonomy are more productive in terms of education attainment.

Second, West and Woessmann (2010) argue that nineteenth-century Catholic doctrine strongly opposed state schooling. The authors show that countries with larger shares of Catholics in 1900 (but without a Catholic state religion like Italy or Spain) tend to have larger shares of privately operated schools even today. They use this historical pattern as a natural experiment to estimate the causal effect of contemporary private competition on student achievements in cross-country student-level analyses. Results show that larger shares of privately operated schools lead to better student achievements in mathematics, science and reading, and to lower total education spending, even after controlling for current Catholic shares. We add to West and Woessmann (2010) by showing that *within countries with Catholic state religion*, there are strong differences in public and private schools depending *both on historical reasons and the degree of fiscal decentralisation*. Indeed, in Italy, private schools are only partially financed by the state and play a minor role in the provision of education. The opposite occurs in Spain, where schools run by the Roman Catholic Church represent a relevant share of total educational supply (about 30% of children attend private schools, the great majority of which are operated by the Roman Catholic Church) and are still now highly financed by the state. Our aim is to study - besides regional funding - the role of public/private funding in increasing school accountability.

Results obtained by estimating an education production function using PISA data for 2003 on the sample of Italian and Spanish regions provide support to both the "market-accountability" and the "fiscal-accountability" effects. In particular, we find that a larger share of private funding and a a larger share of local public funding

are consistently associated with better outcomes. Moreover, we find evidence on the role played by a national standardised test in providing adequate incentives to improve schools' performance.

The remainder of the paper is structured as follows. Section 2 provides a brief introduction on schooling systems in Italy and Spain, along both an historical and an institutional perspective. Section 3 discusses our empirical strategy, and presents the PISA data and our estimates, adding robustness tests and a brief policy discussion. Section 4 collects the final remarks.

2. Italy and Spain: historical and institutional differences

2.1 Educational systems

While sharing a number of cultural traits characterising the Mediterranean countries, Italy and Spain show large institutional differences rooted in the historical evolution of the two countries. Limiting the analysis to schooling, one can show two important sources of variation: on the one hand, the role of private schools; on the other hand, the role of fiscal decentralisation and regional funding for schools. The present day situation is the result of different historical patterns.

The Italian school system has been heavily influenced after the unification of the country in 1861 by the Coppino Law promulgated in 1877. This law has been introduced by a left-wing government headed by Agostino Depretis, establishing two basic principles: first, free-of-charge elementary schooling for all the citizens, with municipalities responsible of maintaining and funding schools; second, compulsory education for all, with sanctions and fines for all the citizens not attending schools. The implicit aim of this model was to create a national identity in a country with substantial differences across regions. Catholics strongly criticised this law with a secular taste that excluded religion from curricula in public schools, and sent their children to private institutions run by the Catholic Church. The

compulsory free-for-all public schooling system designed at the end of the XIX century was further emphasised by the Republican Constitution in 1948. Despite the contribution of different layers of governments, decisions and funding were almost totally centralised. The Constitution also stated that it is possible to establish and run private schools, but without any financial burden for the state. This is a formula that was (and still is) subject to bitter debates in the following years, with supporters of the public schools strongly opposing to any transfers of public funds to private schools, especially the religious ones. The Italian schooling system was subjected to a number of different reforms since then, but none of them changed the two fundamental principles of a compulsory and free-of-charge public school centrally managed and financed. Only in the proposed constitutional reform of 2005, schooling has been thought as an exclusive responsibility of Regional government like health care (that in Italy is the most important task devolved to Regions). However, a national referendum rejected this project, confirming the favour towards a highly centralised public schooling.

The Spanish schooling system followed a different route, with the Catholic Church playing a more or less prominent role according to the specific historical period. The 1812 Constitution established that schooling was the basic responsibility of the state. However, throughout the XIX century, liberals and conservatives engaged in bitter battles over educational issues and the role of the Catholic Church. In particular, the Revolution of 1868 and the subsequent advent of the First Republic pointed to the importance of academic freedom, and the separation of the Church and the State in education matters. While in the period of the Bourbon Restoration (1874 - 1931), the conservatives sought to re-establish the Catholic Church control in education, supported by a series of *Concordats* with the Vatican that went in the direction of solidifying the relationship between the State and the Catholic Church. The new Constitution, promulgated with the advent of the Second Republic in 1931, revoked the 1851 Concordat with the Vatican – which established Catholicism as the official state religion in Spain – and brought new important educational reforms, including

the call for free compulsory primary education and non-religious instruction. All these changes came to an end with the failure of the Republic and the success of the fascist forces of General Franco at the end of the Spanish Civil War in 1939. During subsequent years, education in Spain was converted into the transmission of Franco's views of Spanish Nationalism and Catholic ideology, and the power of the Catholic Church was restored with the approval of the 1952 Concordat. This agreement had important implications for education: Catholic religious instruction was to be mandatory in all schools, even in the public ones; moreover, the Catholic Church was given the right to establish their own universities. With the democratic regime following Franco's death (1975), some laws were issued aiming at reducing the role of state subsidies for education. In particular, in 1990, there was a profound reform of the educational system (*Law on the General Organization of the Educational System* – LOGSE) that tried to take into account the new reality of Spain, which was no longer a centralized but an increasingly decentralized state, with some regions having competencies to legislate on education from the early eighties. However, the issues surrounding government subsidies to Catholic Church education had not been resolved and, at the end of the XX century, the government continued (and still continue) to subsidize private church-affiliated schools.

2.2 Decentralization patterns

As for fiscal decentralisation, Italy and Spain have also followed different patterns. Nowadays, considering taxes and revenues defined by regional governments, Italy can be considered a "centralized" country compared to Spain. IMF data from Government Finances Statistics show that sub-central governments in Italy (including regions, provinces and municipalities) account in 2007 for around 28% of total revenue and 27% of total spending. On the contrary, in Spain, the 1978 democratic Constitution created the *Comunidades Autónomas* (CA) as an intermediate level of government aimed at recognizing the internal heterogeneity of

the country. This level of government soon took responsibility over matters related to the Welfare State, such as education and health, that were before in the hands of the central government. In 2005, IMF figures show that 55.3% of total spending in Spain is decided by the central government, while the remaining 44.7 refers to sub-central governments (31.6% to regional governments, and 13.1% to local governments).

With respect to decentralization in education, the share of funding coming from regional governments is very different between Italy and Spain. In Italy, only schools belonging to the two Autonomous Provinces of Trento and Bolzano (*de facto*, two regional governments) are financed by own regional funds, while schools in the other regions are almost totally financed by the Central government. For instance, the Provincial Law n. 5/2006 disciplines the educational system in the province of Trento, by assigning full autonomy (including financial autonomy) to each school. It also introduces additional tools for evaluating at the provincial level the productivity of schools. Notice that fiscal decentralisation results in a higher share of income devoted to public education: the spending-to-GDP ratio for schooling was 6.2% in the Autonomous Province of Trento in 2002, while 4.7% in Italy. At the national level, available statistics for 2003 shows that more than 82.7% of total spending in education is allocated at the central level, 2.3% is decided by regional governments and 15% by local governments (see, e.g., MIUR, 2007). In Spain, regions such as Andalusia, Basque Country, Canary Islands, Catalonia, Galicia and Comunidad Valenciana received responsibility over education between 1980 and 1983 for primary and secondary schools, and between 1985 and 1987 for higher education. Navarra received responsibility for all schools' grades in 1990. The remaining regions joined between 1995 and 2000. In 2005, IMF figures show that in Spain 4.5% of total spending devoted to education is decided by the central government; 89.5% by regional governments, and 6% by local governments.

In the remainder of the paper, we exploit these institutional differences in terms of the role played by public funds in financing private schools and of fiscal

decentralisation in order to identify the "accountability effects" played by both market forces and (regional) tax autonomy.

3. The empirical analysis

3.1. The strategy

According to the institutional differences described in the previous Section, we basically have two important sources of variation to identify the impact of the two accountability mechanisms:

a. The first one is the degree of fiscal decentralisation, which is different *within* Italy, between ordinary statute regions and the Autonomous Provinces of Trento and Bolzano; and *between* Italy and Spain. The degree of fiscal decentralisation is important because, as suggested, for instance, by Oates (2005) and Weingast (2009), the higher the share of funding provided by regional governments to finance services to citizens, the lower the Vertical Fiscal Imbalance, the higher their accountability, hence the efficiency of public spending. In terms of schooling, we should expect that an higher degree of fiscal decentralisation will lead to improved outcomes.

b. The second source of variation is the public/private dimension, which is different between Spain and Italy both for the role assigned to private providers of education and, more importantly, to public funding of these private schools. In particular, private schools in Spain (especially *escuelas concertadas*) are an important actor in the national education system and are consistently financed with public funds (e.g., Calero and Escardíbul, 2007), whereas private schools in Italy (both secular and religious schools) play a minor and residual role, and receive a relatively little financial support from

the government. Besides public funding, the private nature of schools is important in itself, especially in the presence of a nationally administered test. As suggested by Woessmann *et al.* (2009), external exams increase schools' accountability along several dimensions, including the enhanced monitoring of teachers and schools. This effect should be stronger the higher the share of educational costs paid by citizens. However, while in Spain, at the end of secondary (non compulsory) education, there is a unique (global) exam for students aiming at enrolling in a university course (*selectividad*), similar evaluation exercises have not been systematically introduced so far in Italy.

Starting from these premises, the disciplining effects stemming from both fiscal decentralisation and market incentives provide a ranking of different types of schools in terms of accountability:

i. At one extreme, Italian private schools are those financed mostly with fees paid by households (i.e., they are "private-independent" schools; e.g., Dronkers and Avram, 2009; Dronkers and Robert, 2008). In principle, then, market forces should strongly discipline them. However, this argument can be displaced by the fact that – in the absence of a national standardised test on attainment in Italy – these schools do not need to be as productive in terms of education as they should be in the presence of an external exam, just providing students with a "certificate" to enter the labour market. That private schools will provide lower quality education than public schools is not only theoretically feasible, but also somewhat consistent with available evidence (e.g., Bertola *et al.*, 2007, and Brunello and Rocco, 2008).

ii. At the other extreme, Italian public schools in ordinary statute regions are financed (almost) completely and staffed completely by the Central government. They are not subject to any evaluation program, and enjoy a very modest degree of autonomy over their budget. According to the theory, they should be the less accountable type of school.

iii. In between, we have Spanish public and private schools and Italian public schools in the Autonomous Provinces of Bolzano and Trento. Their degree of accountability should increase with the share of funding coming from the market (in the presence of nationally administered external exams) and from regional governments. Notice that Spanish private schools are mostly "private government dependent" schools (Dronkers and Avram, 2009; Dronkers and Robert, 2008), but they receive an important share of regional funding.

Having created a ranking of different types of schools according to their accountability, our strategy is to define a set of variables which basically identify each school type on the basis of the "degree of accountability", measured by the share of funding by regional governments, the share of public funding, and their nature (public or private). In particular, we define the dummy *DECENTR* to identify the schools located in Regions where this level of government plays an important role in education, and the variable *PUB_FUND*, which measures the percentage of total funding in a typical school year coming from public funding (including local, regional and central governments). The interaction *DECENTR*×*PUB_FUND* allows us to differentiate schools according to the degree of regional funding, hence test for the "fiscal-accountability" effect. The variable *PUB_FUND* allows us also to somewhat differentiate private-dependent schools from private-independent ones, and test the accountability role played by market incentives. Finally, the dummy *PUBLIC* identifies the public *nature* of schools.

Notice that, in most of the literature on schooling, accountability is defined according to the role of standardised external exams and other devices, but the role of fiscal decentralisation is hardly mentioned. In our exercise, we build a link with the fiscal federalism literature, and explicitly control also for the role of fiscal decentralization in order to provide a more clear evidence on the accountability role played by the different sources of public and private funding.

As for the econometric specification, we take a very simple route following West and Woessmann (2010) and Barankay and Lockwood (2007). Both papers consider an education production function where the dependent variable is the test score (*SCORE*), and the covariates can be grouped in regional controls, school controls, and (eventually) student controls. The general model to be estimated can be written as follows:

$$SCORE_i = \alpha + \beta_1 DECENTR_i + \beta_2 PUB\_FUND_i + \beta_3 DECENTR \times PUB\_FUND_i + \\ + \beta_4 PUBLIC_i + \sum \beta_k PUBLIC \times X_{ki} + \sum \beta_h X_{hi} + \varepsilon_i \qquad [1]$$

where i identifies the different schools, the $\boldsymbol{X_h}$'s are a set of controls deemed to be important determinants of school outcomes (including, for instance, the total number of students, the share of female students, and the pupils per teacher ratio), while $\boldsymbol{X_k}$ are variables to be interacted with *PUBLIC* in order to identify the different institutions providing education in Spain and Italy. According to our "accountability" story, we are particularly interested in the coefficients on *DECENTR*, *PUB_FUND*, *PUBLIC*, and their interactions.

3.2. The data

We consider the 2003 data from the OECD Programme for International Student Assessment (PISA), a widely used survey which takes place every three years to collect information on the educational competencies of 15-years-old students in

different countries (OECD, 2005a and 2005b). The 2003 wave is particularly interesting for our purposes, since it allows us to identify a number of different regions within each country. To be more precise, while usually conducted at the country level, the 2003 wave makes publicly available for Italy and Spain information on some participating regions. In particular, we are able to identify Lombardia, Piemonte, Toscana and Veneto as ordinary statute regions, and the two Autonomous Provinces of Bolzano and Trento in Italy; the Basque Country, Catalonia and Castilla y León in Spain. In both countries, we also have a residual category of "Other Regions". According to institutional details discussed above, we set the dummy *DECENTR* equal to one for all the Spanish regions and for the two Autonomous Provinces in Italy. Regional funding of schools represents an important share of total funding in all these regions, even though there are institutional differences across regions. To catch this variation, we consider in particular the interaction $DECENTR \times PUB\_FUND$.

Educational attainments. PISA surveys report students' performance through *plausible values*. These need to be thought as random draws from posterior distributions of students' test scores. In other words, instead of obtaining a point estimate of student ability, once collecting the raw score for each student on the number of correct answers, the distribution of student proficiency is computed, and the survey report random values from this (estimated) posterior distribution. Needless to say, this requires appropriate tools for the empirical analysis, even for descriptive statistics. We will take into account the particular nature of the data by considering the PV Stata module discussed in Lauzon (2004) and MacDonald (2008) for all our estimates.

Students' knowledge and ability (our dependent variable *SCORE* in Equation [1]) is assessed along four main domains: problem solving (PV_PROB), mathematical literacy (PV_MATH), reading literacy (PV_READ), and scientific literacy (PV_SCIE). Descriptive statistics for these variables for all the schools in the

sample are in Table 1-4, distinguishing also schools along the public/private dimension. Several interesting preliminary insights emerge from these tables. First, Spanish schools perform better than Italian schools along all the four domains. Second, the variance characterising Spanish schools' performance is lower than the variance characterising scores for Italian schools. Third, private schools in Spain perform consistently better than public schools, while in Italy the difference in scores between public and private schools is sizeable only for scientific literacy.

Table 1. Public and private schools performance: problem solving

Schools	Nr. obs.	Mean	SE	t-stat
All sample	789	442.56	31.89	13.87
Spain	383	479.29	3.61	132.73
Spain - public	199	462.62	8.24	56.14
Spain - private	175	498.50	11.69	42.63
Italy	406	413.35	61.41	6.73
Italy – public	380	412.46	67.02	6.15
Italy - private	25	417.74	26.83	15.57

Table 2. Public and private schools performance: mathematical literacy

Schools	Nr. obs.	Mean	SE	t-stat
All sample	789	446.29	26.24	17.01
Spain	383	482.11	3.31	145.44
Spain - public	199	467.33	7.61	61.38
Spain - private	175	499.35	10.91	45.78
Italy	406	417.81	51.70	8.08
Italy – public	380	417.81	55.90	7.47
Italy - private	25	417.37	16.90	24.70

Table 3. Public and private schools performance: reading literacy

Schools	Nr. obs.	Mean	SE	t-stat
All sample	789	448.11	30.79	14.55
Spain	383	475.78	5.64	84.43
Spain - public	199	459.92	10.41	44.19
Spain - private	175	493.84	13.81	35.77
Italy	406	426.09	55.40	7.69
Italy – public	380	424.98	60.20	7.06
Italy - private	25	431.79	27.24	15.85

Table 4. Public and private schools performance: scientific literacy

Schools	Nr. obs.	Mean	SE	t-stat
All sample	789	449.85	38.25	11.76
Spain	383	482.09	6.46	74.66
Spain - public	199	466.71	11.80	39.55
Spain - private	175	499.43	13.53	36.91
Italy	406	424.21	68.39	6.20
Italy – public	380	421.08	76.68	5.49
Italy - private	25	440.65	24.73	17.82

We also preliminary investigate the decentralisation issue, by analysing the means of test scores in the four domains along the centralization/decentralisation dimension (Table 5). Schools in regions where their funding is largely decentralised perform better along the four domains than schools in regions where funding is centralised. This is not merely the reflection of results for Spain and Italy, as we include in the decentralised regions also the two Autonomous Provinces of Trento and Bolzano. Hence, it can be considered as preliminary evidence to support the "fiscal-accountability" effect story.

Table 5. Performance of schools in regions where schools' funding is decentralised

Schools	Nr. obs.	Mean	SE	t-stat
	Decentralised			
PV_PROB	459	479.98	3.92	122.47
PV_MATH	459	482.71	3.69	130.69
PV_READ	459	476.63	5.98	79.65
PV_SCIE	459	482.91	6.85	70.47
	Non-decentralised			
PV_PROB	330	411.72	62.38	6.60
PV_MATH	330	416.28	52.49	7.93
PV_READ	330	424.59	56.29	7.54
PV_SCIE	330	422.60	69.46	6.08

In addition, in Table 6, we explore the "market-accountability" effect, by considering how scores change according to the share of public funding (irrespective of whether this funding comes from Regional governments or it is centrally allocated). There is a clear evidence in raw data that the higher the share of public funding (the lower the share of private funds), the lower the achievements. Again, also the "market-accountability" effect seems at work in Spanish and Italian schools.

Table 6. Performance of schools depending on their funding

Schools	Nr. obs.	Mean	SE	t-stat
	PUB_FUND < 25%			
PV_PROB	40	481.15	18.75	25.65
PV_MATH	40	472.99	22.99	20.56
PV_READ	40	481.53	19.88	24.21
PV_SCIE	40	497.32	21.39	23.23

	PUB_FUND > 25% & < 50%			
PV_PROB	45	489.99	17.30	20.30
PV_MATH	45	486.50	15.74	30.89
PV_READ	45	485.87	21.45	22.64
PV_SCIE	45	496.86	20.38	24.36
	PUB_FUND > 50% & < 75%			
PV_PROB	152	470.05	40.08	11.7
PV_MATH	152	472.25	33.52	14.08
PV_READ	152	474.91	39.88	11.90
PV_SCIE	152	479.16	48.10	9.96
	PUB_FUND > 75%			
PV_PROB	552	429.17	34.25	12.52
PV_MATH	552	435.22	27.18	16.00
PV_READ	552	436.19	31.54	13.82
PV_SCIE	552	435.03	40.81	10.65

The other determinants of educational achievements. Besides our main variables, *DECENTR*, *PUB_FUND*, and *PUBLIC*, the set of our covariates include a number of variables at the school level that previous literature deems to be important: *PUP_TEACH_RATIO* is defined as the number of students per (full time equivalent) teachers (part-time teachers has been considered equivalent to ½ full time ones); *TOT_ENROLL* measures the total number of students enrolled in each institution; *SHARE_FEM* captures the share of female students out of the total number of students. We also consider potential difficulties stemming from differences in language among students. In particular, foreigners may find more difficult than natives to understand the questions in the test. The dummy *LANGUAGE* is equal to one if at least 10% of all students enrolled in the school have a first language that is not the test language. (As this variable is missing for Catalan schools and Catalonia is an important region in Spain, we will run additional

estimate omitting this variable). As for teachers, we also take into account the potential shortage that can hinder the capacity of schools to provide appropriate instruction. In particular, *SHORTAGE_SCIENCE*, *SHORTAGE_MATH*, and *SHORTAGE_READ* are dummy variables equal to one when schools declare that capacity to provide education is hampered 'to some extent' or 'a lot' by scarcity of qualified teachers, respectively for science, mathematics and test language. Controls for schools' location are provided by three dummy variables: *SMALL* is equal to one when the school is located in a village or a small town with less than 15,000 inhabitants; *MEDIUM* is for location in towns from 15,000 up to 100,000 inhabitants; finally, *LARGE* is for cities with more than 100,000 inhabitants. Descriptive statistics for all the variables included in the empirical analysis are collected in Appendix Table A.1.

3.3. The results

We begin our analysis by estimating a very simple model, in which the production of education is a function of 'structural characteristics' of schools only. We consider in particular *PUP_TEACH_RATIO, TOT_ENROLL, SHARE_FEM, LANGUAGE,* the dummy for the shortage of qualified teachers, and the dummies for schools location. As considering the variable *LANGUAGE* automatically exclude schools in Catalonia, we then drop this variable and estimate an additional model with 'structural' variables only. Table 6 reports our estimates using *PV_PROB* as our dependent variable *SCORE*; results obtained using alternative definitions of *SCORE* are included in the Appendix, but largely mirror those described here. Results are pretty much consistent across the two models. Coefficient for *TOT_ENROLL* is positive and statistically significant at the usual confidence levels: an increase of one student at the school raises the test score by about 0.04 points. Coefficient for *PUP_TEACH_RATIO* is also positive, but statistically (marginally) insignificant: one more pupil per teachers raises the test score by about 4 points. Also the share of

female students exerts a positive effect on the score, but coefficient is not statistically significant. Much stronger impacts emerge when considering school location and the shortage of qualified teachers in the subject - for instance, coefficient on *SHORTAGE_MATH* decreases average school performance by about 80 points - but again coefficients are not statistically significant. Finally, coefficient for *LANGUAGE* is not statistically significant. When including in these models also regional and country fixed effects, results are largely confirmed, in terms of both signs and magnitudes. Now the coefficient for *PUP_TEACH_RATIO* is statistically significant, while the one for *TOT_ENROLL* turns insignificant. Coefficient for *LANGUAGE* still remains insignificant, and we decide to drop this variable from the following analysis.

We now augment the 'structural' specification of our education production function by taking into account (first alternatively, and then together) variables aimed at capturing the main dimensions of accountability: the public funding of the schools in order to consider accountability generated by private markets, and the role of regional funding to catch the accountability mechanism driven by fiscal decentralisation. We also consider the public/private nature of schools. We use again *PV_PROB* as an example; however, notice that results are largely consistent when using alternative definitions of *SCORE* (see Appendix Tables). Table 7 shows our estimates of the education production function when considering the 'accountability' variables one at a time. First, coefficients for both *PUB_FUND* and *DECENTR* are statistically significant, and provide support to the two 'accountability' stories. In particular, the negative coefficient for *PUB_FUND* shows that the higher the share of public funding, the lower the incentives to perform well from private markets, the lower the score. The positive coefficient for *DECENTR* implies that where regional governments enjoy a higher autonomy in funding schools, performances are better. Notice that these results hold controlling also for regional and country fixed effects. Coefficient for *DECENTR*×*PUB_FUND* and the coefficients for the dummy *PUBLIC* and its interactions are however not

significant. Second, among the structural variables, only coefficient for *PUP_TEACH_RATIO* appears consistently significant: the positive correlation with schools' performance and the magnitude – that remains close to about 4 points – are confirmed.

As a final step, we consider a complete version of our model, pooling together all the accountability drivers. Estimates are in Table 8. All the models – which include regional and country fixed effects - tell fairly the same story. First, the share of public funding is negatively correlated with performance, and the correlation is statistically significant: *ceteris paribus*, a one percent increase in *PUB_FUND* reduces the *PV_PROB* score by about one point, from -0.830 to -1.213, depending on model specification. Similar magnitudes emerge also for other definitions of *SCORE*; only for PV_MATH the impact is smaller, with estimated coefficient ranging from -0.603 to -0.856. Second, coefficient for *DECENTR* is positive and statistically significant: where regional governments are more autonomous in funding schools, performances are better. The magnitude, however, range from about 140 points to 70: the coefficient halves when adding to the model the interaction term *DECENTR×PUB_FUND*, and the interaction of *PUBLIC* with the two country dummies. Third, the coefficient for *DECENTR×PUB_FUND* is positive and statistically significant at the usual levels only when considering in the model the interaction of *PUBLIC* with the two country dummies. In this case, a one percent increase in the share of public funding where these funds come from Regional governments, increases school's performance by 0.8 points. The magnitude and significance is similar also for alternative definitions of *SCORE*. There are two ways to read this result: considering the negative coefficient for *PUB_FUND*, it means that incentives from private markets are *less* strong where regional governments can finance schools. Summing up coefficients, the negative impact of *PUB_FUND* on performance reduces from -1.213 to -0.371 in regions where governments enjoy some degree of autonomy in funding schools. Considering the positive coefficient for *DECENTR*, the positive coefficient for the interaction with

PUB_FUND provides support to the "fiscal-accountability" role played by own resources for regional governments. A one percent increase in regional public funds improve average schools performance by 0.842, summing to the average performance (+71.32 points) in all fiscally decentralized regions. Fourth, the coefficient for *PUBLIC* is positive and significant, but when interacted with country dummies, it turns out that only the coefficient for *PUBLIC×D_ITA* remains positive and significant. *Ceteris paribus*, students at Italian public schools score 76.78 points more than students at private institutions, whereas no difference between public and private schools can be spotted in Spain. We interpret this result as evidence in favour of a disciplining role played by a standardised national test, which is currently lacking in Italy, while being compulsory in Spain. If we consider jointly *PUB_FUND* and *PUBLIC×D_ITA*, Italian public schools (almost completely financed by the State in almost all regions, but in the two Autonomous Provinces) do not have any market incentives to perform well, whereas private schools (almost completely financed with private fees) do have these incentives, but the absence of a standardised national test let them live a "quiet-life". On the contrary, Spanish public and private schools receive public funds, so that the "market-accountability" effect is lacking also here, but the performance of Spanish schools is influenced both by the standardised national test, and by the "fiscal-accountability" mechanism generated by the regional government funds. Finally, among structural variables, only the coefficient for *PUP_TEACH_RATIO* appears consistently significant: the positive correlation with schools' performance and the magnitude – that remains close to about 4 points – are again confirmed.

3.4. Discussion and policy implications

Our results discussed in previous Section provide support to both the accountability drivers, the market incentives on the one hand, and the regional funding incentives on the other hand. There are two possible comments to the robustness of these

results. First, we do not take into account different dimensions of schools' autonomy that can be the true drivers of an improved accountability (e.g., Woessmann *et al.*, 2009). Second, previous literature on PISA data confirms the importance of the family background on students' scores (e.g., Oppedisano and Turati, 2011). Hence, our accountability explanation can hide a better family background in more fiscally decentralised regions. We explore each of these alternative explanations in turn.

In order to capture school autonomy, we control for two variables (*AUTCURR* and *AUTRES*) that are thought to increase (indirectly) accountability (Woessmann *et al.*, 2009). In particular, we consider an index of autonomy computed by the OECD to measure school autonomy in defining assessment policies, textbooks, and course contents (*AUTCURR*); and a second index of autonomy, also computed by the OECD, to measure school autonomy in managing resources like, for instance, hiring and firing teachers, deciding budget allocations within the school, determining teachers' career (*AUTRES*). Results for models augmented also with these variables are in Table 9. Coefficients for both *AUTCURR* and *AUTRES* are never statistically significant. More importantly, all previous findings are confirmed. One main explanation is that regulation is defined at country and/or regional level for public as well as for private schools. As we already control for country and regional fixed effects, these variables do not add much to the explanatory power of our model.

Finally, in order to capture the impact of the parental background, we define from the student questionnaire two dummy variables, *FATHER_HIGH* and *MOTHER_HIGH*, to identify the students whose parents have a degree or a PhD. At the school level, these variables will identify the percentage of students with highly educated parents. As the two variables are highly collinear, we use just the one for mother education in the empirical models below. We also define an alternative variable *BACKGROUND*, which is the sum of the two variables *FATHER_HIGH* and *MOTHER_HIGH*; as results are coincident, we just include in Table 10 those with *MOTHER_HIGH*. As before, the estimates are quite close to

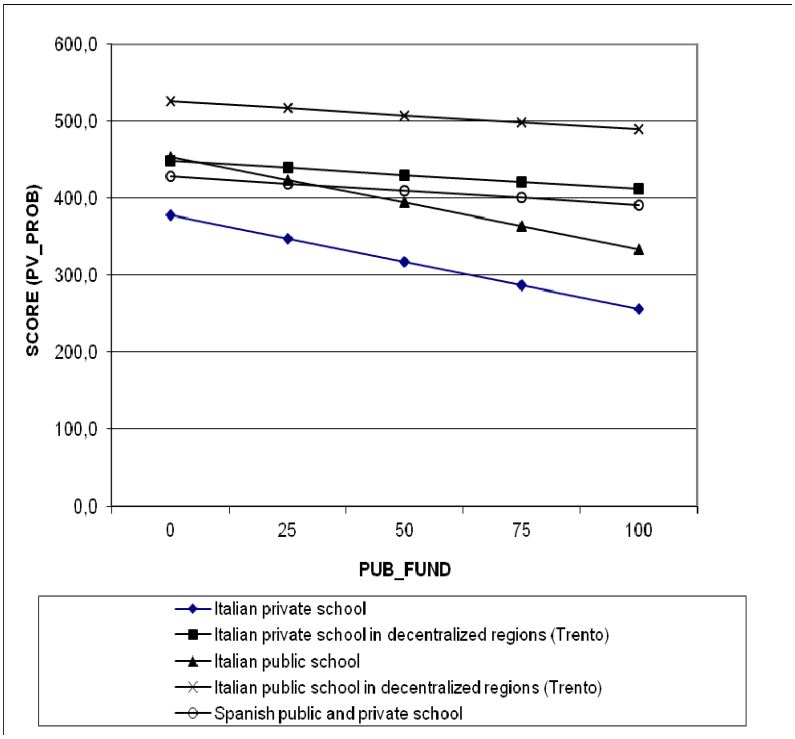
those obtained with the full model: coefficient for *MOTHER_HIGH* is positive, but never statistically significant at the usual confidence levels in all the four equation. Interestingly, for both *PV_PROB* (see Table 10) and *PV_MATH* (see Appendix Tables), the inclusion of a variable measuring parental background considerably reduces the magnitude of the coefficient for *PUB_FUND*, as well as its statistical significance. The coefficient for *PUP_TEACH_RATIO* also turns to be insignificant when measuring *SCORE* using these two variables. Most probably, these interactions among variables signal a non random selection of students in different types of institutions, that are only partially controlled for by regions and school dummies.

Overall, our results – which appear robust to different model perturbations – suggest a number of thoughts on important issues in educational policy. First, decentralised schools' funding is consistently associated with a better performance with respect to centralised funding. This is emphasised by coefficients for *DECENTR* and the interaction *DECENTR*×*PUB_FUND*. To the best of our knowledge, this is a novel result in the literature. If - starting from our estimates - we compute predicted scores for different types of schools, those operating in regions where funding is decentralised perform better (see Figure 1). The clear ranking is independent of *PUB_FUND*: public schools in the fiscally decentralised Autonomous Province of Trento (and Bolzano, not reported in the figure) perform better than private schools in the same context. In turn, these score better than public and private schools in Spain (that are statistically indistinguishable, given that coefficient on *PUBLIC*×*D_ESP* is not statistically significant). At the bottom of the ranking we find public and private schools in Regions that do not enjoy any autonomy in school funding. This finding confirms results by Barankay and Lockwood (2007) and supports theoretical predictions of second generation theories of fiscal federalism (e.g., Oates, 2005, and Weingast, 2009): the higher the share of funding provided by regional governments to finance services to citizens, the higher their accountability, hence the efficiency of public spending (here measured by higher students'

attainments). Even though our results cannot be interpreted as causal, still - in terms of policy – one should take into account that students' performance is higher where financing of schools is decentralised, and looking for causal explanations is a research task that deserve attention.

Second, the negative sign on the coefficient for *PUB_FUND* supports the "market-accountability" mechanism. *Ceteris paribus*, private schools completely financed with tuition fees paid by households (the private-independent schools) perform better than (public and private-dependent) schools largely (or even completely) financed with public funds (see Figure 1). Again, while we cannot give a causal interpretation to this result, still public funding of *private* schools should be accompanied with a nationally administered standardised test, especially for this type of schools, if not for all schools as in Spain.

Figure 1. Predicted scores for different types of schools



Note: predicted scores computed using results in Table 8 Model (4)

Finally, the importance of regional and country dummies, together with the controls for the public nature of the schools (*PUBLIC*) suggest that institutional differences are important drivers of performance: public schools in Italy are different institutions from public schools in Spain, because they are not subject to any assessment exercise conducted at the national level, and they are financed and staffed by the national government, with limited autonomy for regional governments to effectively manage schools. At the same time, private schools in Italy are different institutions from private schools in Spain, both when considering private-dependent schools (almost absent in Italy) and when considering private-independent schools (almost absent in Spain). As such, any generalization on the role of public and private institutions in schooling should be subject to careful scrutiny before any policy recommendations is implemented.

4. Concluding remarks

In this paper we study the disciplining role of both market forces and regional governments own resources in the provision of educational services. We exploit two different sources of variation: on the one hand, the difference between private and public schools, suggests that – in the presence of standardised national tests – private schools should be more productive than public schools, given that households pay a price to access the service. On the other hand, the difference between schools funded with regional governments own resources and schools funded by the Central government, suggests that the former should be more productive than the latter, given the accountability role played by own resources from regional governments. The historical evolution of school regulation in Italy and Spain, in particular regarding the funding of private schools run by the Roman Catholic Church and the role of regional governments, created different institutions in terms of both dimensions, private funds and regional governments funds.

We take advantage of these institutional diversities to estimate the disciplining role of different sources of funds in the context of educational production function using PISA data. We provide three main results. First, decentralised schools' funding is consistently associated with a better performance with respect to centralised funding. Second, the higher the share of public funding, the lower the "market-accountability" effect, the lower the performance. *Ceteris paribus*, private schools completely financed with tuition fees paid by households perform better than public (and private) schools completely (or largely) financed with government funds. Third, the public/private nature of schools matters, but only in Italy, where public schools outperform private ones. Hence, the presence of a standardised test at the national level (available in Spain, but not in Italy) is an important mechanism to improve schools' performances. Overall, our findings highlight that institutional differences are important drivers of performance: public and private schools in Spain and Italy are different schools. This should be taken into account when designing educational policies aimed at improving students' performance.

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Table 6. Structural variables only (*PV_PROB*)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.193	4.541	3.919**	4.471*
	[2.784]	[3.288]	[1.924]	[2.519]
TOT_ENROLL	0.0410***	0.0366**	0.0333	0.0319
	[0.0152]	[0.0182]	[0.0228]	[0.0215]
SHARE_FEM	0.438	0.530	0.426	0.404
	[0.379]	[0.514]	[0.283]	[0.305]
SHORTAGE_MATH	-79.87	-88.05	-59.49	-68.39
	[63.60]	[65.78]	[39.81]	[43.20]
D_SMALL	3.903	-2.724	-13.11	-18.41
	[17.19]	[19.06]	[25.83]	[27.11]
D_LARGE	0.439	-4.300	-6.739	-10.23
	[16.51]	[20.58]	[25.88]	[28.12]
D_LANGUAGE		4.199		-5.128
		[31.38]		[20.43]
Constant	368.2***	364.5***		
	[56.71]	[70.80]		
Regional fixed effects	no	no	yes	yes
Country fixed effects	no	no	yes	yes
Observations	638	581	638	581
R^2	0.2480	0.2577	0.9557	0.9738

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 7. "Market accountability" and "fiscal accountability" (*PV_PROB*)

VARIABLES	(1)	(2)	(3)	(4)	(5)
PUP_TEACH_RATIO	3.469**	3.919**	4.210*	4.291**	4.373*
	[1.641]	[1.924]	[2.172]	[2.114]	[2.629]
TOT_ENROLL	0.0325*	0.0333	0.0273	0.0286	0.0302
	[0.0180]	[0.0228]	[0.0255]	[0.0254]	[0.0189]
SHARE_FEM	0.336	0.426	0.400	0.427	0.420
	[0.229]	[0.283]	[0.317]	[0.307]	[0.282]
SHORTAGE_MATH	-46.69	-59.49	-48.96	-61.22	-61.34
	[34.59]	[39.81]	[34.95]	[41.12]	[41.41]
D_SMALL	-0.770	-13.11	-4.547	-14.24	-13.66
	[18.82]	[25.83]	[21.97]	[26.36]	[24.10]
D_LARGE	-7.249	-6.739	-9.002	-5.212	-5.531
	[24.39]	[25.88]	[27.96]	[25.07]	[26.55]
PUB_FUND	-0.538***				
	[0.184]				
DECENTR		138.9***			
		[31.61]			
PUB_FUND×DECENTR			0.0201		
			[0.195]		
PUBLIC				11.69	
				[13.22]	
PUBLIC×D_ESP					15.22
					[26.18]
PUBLIC×D_ITA					7.606
					[41.76]
Regional fixed effects	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes
Observations	620	638	620	638	638
R^2	0.9780	0.9757	0.9768	0.9758	0.9758

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 8. The complete model (*PV_PROB*)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.423**	4.113*	4.449**	3.887**
	[2.047]	[2.175]	[2.030]	[1.934]
TOT_ENROLL	0.0203	0.0133	0.0239	0.0149
	[0.0256]	[0.0271]	[0.0218]	[0.0240]
SHARE_FEM	0.305	0.325	0.286	0.301
	[0.258]	[0.261]	[0.236]	[0.228]
SHORTAGE_MATH	-50.83	-49.74	-51.54	-50.34
	[38.29]	[38.10]	[39.22]	[39.09]
D_SMALL	-2.081	-3.976	-0.577	-2.316
	[18.53]	[18.33]	[17.38]	[16.88]
D_LARGE	-1.115	0.893	-1.465	1.938
	[18.49]	[16.89]	[18.68]	[15.01]
PUB_FUND	-0.830***	-0.919***	-0.925**	-1.213**
	[0.294]	[0.313]	[0.378]	[0.491]
DECENTR	136.2***	137.7***	108.4***	71.32**
	[28.31]	[29.14]	[28.54]	[27.80]
PUB_FUND×DECENTR			0.374	0.842*
			[0.405]	[0.434]
PUBLIC	40.83**		38.56**	
	[18.51]		[18.17]	
PUBLIC×D_ESP		30.20		15.36
		[22.67]		[22.17]
PUBLIC×D_ITA		62.30**		76.78***
		[30.00]		[25.83]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	620	620	620	620
R^2	0.9787	0.9789	0.9788	0.9793

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 9. The role of school autonomy (*PV_PROB*)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.442**	4.133*	4.464**	3.926**
	[2.075]	[2.176]	[2.065]	[1.965]
TOT_ENROLL	0.0207	0.0129	0.0241	0.0143
	[0.0253]	[0.0276]	[0.0217]	[0.0247]
SHARE_FEM	0.303	0.323	0.285	0.297
	[0.257]	[0.261]	[0.236]	[0.226]
SHORTAGE_MATH	-50.81	-49.50	-51.50	-50.05
	[38.30]	[38.14]	[39.17]	[39.06]
D_SMALL	-2.020	-4.119	-0.593	-2.485
	[18.50]	[18.57]	[17.40]	[17.11]
D_LARGE	-1.451	0.729	-1.769	1.798
	[18.44]	[16.66]	[18.61]	[14.86]
AUTCURR	-1.855	-4.383	-1.243	-5.046
	[7.501]	[7.383]	[7.134]	[8.158]
AUTRES	0.184	-0.0747	0.0485	-0.613
	[6.350]	[6.246]	[6.184]	[5.560]
PUB_FUND	-0.828***	-0.930***	-0.921**	-1.236**
	[0.280]	[0.313]	[0.367]	[0.522]
DECENTR	135.8***	137.1***	107.0***	69.70**
	[27.74]	[28.40]	[27.68]	[27.35]
PUB_FUND×DECENTR			0.360	0.855*
			[0.397]	[0.471]
PUBLIC	40.31		38.11	
	[26.92]		[25.91]	
PUBLIC×D_ESP		26.95		10.55
		[28.71]		[24.67]
PUBLIC×D_ITA		63.46**		77.61***
		[32.34]		[29.70]
Regional fixed effects	yes	yes	Yes	yes
Country fixed effects	yes	yes	Yes	yes
Observations	618	618	618	618
R^2	0.9789	0.9788	0.9793	0.9797

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

Table 10. The role of parental background (*PV_PROB*)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.069	3.777	4.094*	3.547
	[2.480]	[2.689]	[2.454]	[2.458]
TOT_ENROLL	0.0204	0.0138	0.0242	0.0154
	[0.0216]	[0.0224]	[0.0182]	[0.0195]
SHARE_FEM	0.284	0.304	0.264	0.279
	[0.257]	[0.254]	[0.235]	[0.221]
SHORTAGE_MATH	-50.13	-49.09	-50.88	-49.70
	[39.00]	[38.92]	[40.00]	[40.00]
D_SMALL	1.645	-0.185	3.252	1.514
	[15.88]	[15.56]	[14.88]	[14.32]
D_LARGE	-4.686	-2.756	-5.074	-1.718
	[14.11]	[12.69]	[14.18]	[11.07]
MOTHER_HIGH	74.06	73.53	74.47	73.92
	[94.90]	[96.44]	[94.96]	[98.48]
PUB_FUND	-0.627	-0.713*	-0.726	-1.010*
	[0.388]	[0.396]	[0.466]	[0.543]
DECENTR	131.9***	133.4***	100.2***	66.10**
	[27.47]	[28.26]	[21.70]	[28.70]
PUB_FUND×DECENTR			0.394	0.853***
			[0.351]	[0.329]
PUBLIC	37.88***		35.47**	
	[14.61]		[14.64]	
PUBLIC×D_ESP		27.80		12.77
		[21.55]		[23.27]
PUBLIC×D_ITA		58.28**		72.91***
		[27.99]		[23.07]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	619	619	619	619
R^2	0.9797	0.9799	0.9798	0.9803

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table A.1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
PUP_TEACH_RATIO	648	11.01765	5.685349	1.38	70
TOT_ENROLLMENT	745	643.9638	404.5179	26	2,819
SHARE_FEM	745	50.1802	20.48196	0	100
SHORTAGE_MATH	767	.1694915	.3754303	0	1
SHORTAGE_SCIENCE	766	.1449086	.3522387	0	1
SHORTAGE_READ	766	.1436031	.350916	0	1
D_SMALL	779	.2439024	.4297105	0	1
D_LARGE	779	.322208	.4676224	0	1
AUTCURR	773	3.483829	.7524122	1	4
AUTRES	773	2.165589	1.491255	0	6
MOTHER_HIGH	788	.286683	.1757495	0	1
D_ITA	789	.5145754	.5001045	0	1
D_ESP	789	.4854246	.5001045	0	1
D_VENETO	789	.0659062	.2482755	0	1
D_TOSCANA	789	.0659062	.2482755	0	1
D_PIEMONTE	789	.0722433	.2590546	0	1
D_LOMBARDIA	789	.0659062	.2482755	0	1
D_BOLZANO	789	.0544994	.2271444	0	1
D_TRENTO	789	.0418251	.2003163	0	1
D_CASTILLA	789	.0646388	.2460434	0	1
D_CATALUNYA	789	.0633714	.2437842	0	1
D_BASQUE	789	.1787072	.38335	0	1
PUB_FUND	750	78.71044	23.859	0	100
DECENTR	789	.581749	.4935847	0	1
PUB_FUND×DECENTR	750	48.9528	44.4882	0	100
PUBLIC	779	.7432606	.437115	0	1
D_ESP_PUB	779	.2554557	.4363973	0	1
D_ITA_PUB	779	.4878049	.5001724	0	1

Appendix Tables. Results considering alternative definitions of *SCORE*[*]

Table A.6. Structural variables only (PV_MATH)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	3.738*	3.995	3.404**	3.832**
	[2.107]	[2.508]	[1.378]	[1.807]
TOT_ENROLL	0.0428***	0.0371**	0.0340**	0.0307*
	[0.0137]	[0.0151]	[0.0151]	[0.0164]
SHARE_FEM	0.0672	0.227	0.0569	0.115
	[0.307]	[0.491]	[0.217]	[0.301]
SHORTAGE_MATH	-64.99	-72.07	-44.19	-51.94*
	[48.44]	[50.27]	[28.00]	[30.75]
D_SMALL	8.016	0.686	-9.528	-15.74
	[15.25]	[16.83]	[21.38]	[23.11]
D_LARGE	5.089	0.330	-2.689	-6.400
	[11.66]	[14.07]	[17.71]	[19.64]
D_LANGUAGE		2.471		-7.708
		[24.98]		[15.95]
Constant	389.9***	385.5***		
	[49.21]	[62.79]		
Regional fixed effects	no	no	yes	yes
Country fixed effects	no	no	yes	yes
Observations	638	581	638	581
R^2	0.2421	0.2442	0.9819	0.9808

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

[*] The numbers of these Tables follow closely the numbers of those in the main text, to facilitate comparison of results.

Table A.7. "Market accountability" and "fiscal accountability" (PV_MATH)

VARIABLES	(1)	(2)	(3)	(4)	(5)
PUP_TEACH_RATIO	3.226**	3.404**	3.659**	3.791**	3.818*
	[1.313]	[1.378]	[1.598]	[1.539]	[1.958]
TOT_ENROLL	0.0317**	0.0340**	0.0273	0.0292*	0.0297**
	[0.0135]	[0.0151]	[0.0182]	[0.0171]	[0.0127]
SHARE_FEM	-0.00133	0.0569	0.0438	0.0577	0.0552
	[0.200]	[0.217]	[0.240]	[0.235]	[0.219]
SHORTAGE_MATH	-33.99	-44.19	-34.89	-45.98	-46.02
	[24.46]	[28.00]	[24.04]	[29.09]	[29.29]
D_SMALL	-0.538	-9.528	-4.038	-10.70	-10.50
	[16.67]	[21.38]	[18.88]	[21.79]	[20.06]
D_LARGE	-3.913	-2.689	-5.242	-1.107	-1.216
	[17.18]	[17.71]	[19.38]	[16.92]	[17.89]
PUB_FUND	-0.369**				
	[0.177]				
DECENTR		140.0***			
		[25.37]			
PUB_FUND×DECENTR			-0.137		
			[0.175]		
PUBLIC				12.11	
				[9.551]	
PUBLIC×D_ESP					13.31
					[20.61]
PUBLIC×D_ITA					10.72
					[32.70]
Regional fixed effects	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes
Observations	620	638	620	638	638
R^2	0.9834	0.9819	0.9830	0.9820	0.9820

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.8. The complete model (PV_MATH)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	3.991***	3.741**	4.004***	3.602**
	[1.541]	[1.682]	[1.533]	[1.563]
TOT_ENROLL	0.0220	0.0163	0.0237	0.0173
	[0.0171]	[0.0170]	[0.0158]	[0.0154]
SHARE_FEM	-0.0263	-0.00956	-0.0357	-0.0245
	[0.219]	[0.216]	[0.210]	[0.199]
SHORTAGE_MATH	-37.32	-36.43	-37.66	-36.80
	[26.63]	[26.74]	[26.99]	[27.25]
D_SMALL	-1.590	-3.120	-0.855	-2.099
	[16.26]	[15.81]	[15.78]	[15.03]
D_LARGE	1.007	2.629	0.837	3.271
	[12.99]	[11.84]	[13.07]	[10.84]
PUB_FUND	-0.603***	-0.675***	-0.649***	-0.856***
	[0.192]	[0.192]	[0.238]	[0.280]
DECENTR	137.5***	138.7***	122.8***	97.93***
	[21.64]	[21.99]	[24.47]	[34.53]
PUB_FUND×DECENTR			0.182	0.518
			[0.291]	[0.334]
PUBLIC	32.75***		31.64***	
	[11.98]		[11.91]	
PUBLIC×D_ESP		24.16		15.05
		[16.07]		[18.78]
PUBLIC×D_ITA		50.08*		58.98**
		[26.63]		[25.49]
Regional fixed effects	yes	yes	Yes	yes
Country fixed effects	yes	yes	Yes	yes
Observations	620	620	620	620
R^2	0.9839	0.9840	0.9839	0.9841

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.9. The role of school autonomy (PV_MATH)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.103**	3.829**	4.113**	3.697**
	[1.674]	[1.772]	[1.671]	[1.661]
TOT_ENROLL	0.0223	0.0153	0.0238	0.0162
	[0.0168]	[0.0180]	[0.0158]	[0.0164]
SHARE_FEM	-0.0347	-0.0167	-0.0428	-0.0334
	[0.214]	[0.212]	[0.206]	[0.193]
SHORTAGE_MATH	-37.22	-36.06	-37.53	-36.41
	[26.72]	[26.76]	[27.02]	[27.26]
D_SMALL	-1.553	-3.419	-0.917	-2.381
	[16.37]	[16.26]	[15.94]	[15.41]
D_LARGE	0.426	2.364	0.284	3.043
	[13.29]	[11.85]	[13.36]	[10.87]
AUTCURR	-3.654	-5.902	-3.382	-6.323
	[7.318]	[7.324]	[7.156]	[7.802]
AUTRES	-1.563	-1.793	-1.623	-2.135
	[4.759]	[4.557]	[4.729]	[4.260]
PUB_FUND	-0.619***	-0.710***	-0.661***	-0.905***
	[0.194]	[0.206]	[0.241]	[0.316]
DECENTR	137.2***	138.3***	124.3***	95.50***
	[21.44]	[21.84]	[40.34]	[31.39]
PUB_FUND×DECENTR			0.160	0.543
			[0.290]	[0.342]
PUBLIC	28.76*		27.78*	
	[16.90]		[16.38]	
PUBLIC×D_ESP		16.89		6.464
		[18.94]		[18.92]
PUBLIC×D_ITA		49.35**		58.34**
		[25.02]		[23.47]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	618	618	618	618
R^2	0.9839	0.9841	0.9839	0.942

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

Table A.10. The role of parental background (PV_MATH)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	3.624*	3.392	3.637**	3.249*
	[1.867]	[2.077]	[1.850]	[1.966]
TOT_ENROLL	0.0221	0.0168	0.0241*	0.0178
	[0.0141]	[0.0134]	[0.0132]	[0.0122]
SHARE_FEM	-0.0478	-0.0320	-0.0583	-0.0474
	[0.216]	[0.208]	[0.207]	[0.190]
SHORTAGE_MATH	-36.57	-35.75	-36.96	-36.12
	[26.37]	[26.58]	[26.80]	[27.18]
D_SMALL	2.240	0.784	3.070	1.837
	[13.55]	[13.08]	[13.20]	[12.51]
D_LARGE	-2.715	-1.178	-2.915	-0.534
	[10.02]	[9.158]	[10.00]	[8.476]
MOTHER_HIGH	76.86	76.45	77.08	76.69
	[69.37]	[70.91]	[69.50]	[72.62]
PUB_FUND	-0.393*	-0.461**	-0.443*	-0.645**
	[0.215]	[0.213]	[0.259]	[0.285]
DECENTR	133.1***	134.2***	116.7***	92.51**
	[19.87]	[20.20]	[31.44]	[38.07]
PUB_FUND×DECENTR			0.203	0.529
			[0.261]	[0.332]
PUBLIC	29.64***		28.40***	
	[9.526]		[9.667]	
PUBLIC×D_ESP		21.61		12.29
		[14.38]		[19.01]
PUBLIC×D_ITA		45.88		54.96*
		[31.14]		[32.09]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	619	619	619	619
R^2	0.9850	0.9849	0.9851	0.9835

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

Table A.6. Structural variables only (PV_READ)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	3.788	4.052	3.696**	4.055*
	[2.345]	[2.719]	[1.622]	[2.071]
TOT_ENROLL	0.0458***	0.0430**	0.0402***	0.0387**
	[0.0163]	[0.0182]	[0.0137]	[0.0162]
SHARE_FEM	0.899**	1.006**	0.884***	0.906***
	[0.367]	[0.501]	[0.300]	[0.347]
SHORTAGE_READ	-67.43	-69.37	-55.34	-56.95
	[49.71]	[50.02]	[36.64]	[38.08]
D_SMALL	-0.551	-5.449	-12.01	-16.93
	[15.17]	[17.98]	[23.74]	[25.90]
D_LARGE	-1.003	-4.590	-5.482	-8.995
	[18.66]	[23.87]	[27.72]	[31.84]
D_LANGUAGE		-2.122		-10.21
		[29.15]		[19.41]
Constant	352.0***	348.3***		
	[55.27]	[69.07]		
Regional fixed effects	no	no	yes	yes
Country fixed effects	no	no	yes	yes
Observations	638	581	638	581
R^2	0.2937	0.2910	0.9812	0.9794

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.7. "Market accountability" and "fiscal accountability" (PV_READ)

VARIABLES	(1)	(2)	(3)	(4)	(5)
PUP_TEACH_RATIO	3.214**	3.696**	3.880**	3.884**	4.011*
	[1.310]	[1.622]	[1.767]	[1.692]	[2.174]
TOT_ENROLL	0.0405***	0.0402***	0.0348**	0.0378***	0.0403**
	[0.0146]	[0.0137]	[0.0139]	[0.0131]	[0.0158]
SHARE_FEM	0.782***	0.884***	0.849**	0.885***	0.873***
	[0.244]	[0.300]	[0.331]	[0.316]	[0.292]
SHORTAGE_READ	-42.39	-55.34	-42.73	-56.11	-56.36
	[32.33]	[36.64]	[30.29]	[37.03]	[37.56]
D_SMALL	-0.467	-12.01	-4.437	-12.65	-11.74
	[17.29]	[23.74]	[20.75]	[23.96]	[21.43]
D_LARGE	-6.226	-5.482	-7.872	-4.723	-5.230
	[25.38]	[27.72]	[28.98]	[27.56]	[29.22]
PUB_FUND	-0.524***				
	[0.168]				
DECENTR		114.8***			
		[19.12]			
PUB_FUND×DECENTR			-0.0660		
			[0.198]		
PUBLIC				5.919	
				[11.43]	
PUBLIC×D_ESP					11.45
					[22.79]
PUBLIC×D_ITA					-0.461
					[39.17]
Regional fixed effects	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes
Observations	620	638	638	638	638
R^2	0.9830	0.9812	0.9820	0.9812	0.9812

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.8. The complete model (PV_READ)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	3.966***	3.749**	3.986***	3.582**
	[1.539]	[1.733]	[1.531]	[1.580]
TOT_ENROLL	0.0309**	0.0259**	0.0338**	0.0273**
	[0.0121]	[0.0121]	[0.0138]	[0.0131]
SHARE_FEM	0.758***	0.773***	0.743***	0.753***
	[0.274]	[0.269]	[0.257]	[0.245]
SHORTAGE_READ	-45.83	-45.04	-46.69	-46.13
	[35.53]	[35.61]	[36.86]	[37.45]
D_SMALL	-1.694	-2.990	-0.535	-1.739
	[17.00]	[16.21]	[16.00]	[15.14]
D_LARGE	-1.375	0.0547	-1.654	0.835
	[20.93]	[20.08]	[21.05]	[18.29]
PUB_FUND	-0.758***	-0.820***	-0.832***	-1.040***
	[0.226]	[0.217]	[0.290]	[0.317]
DECENTR	111.8***	112.8***	88.29***	62.89**
	[15.52]	[15.73]	[25.05]	[26.64]
PUB_FUND×DECENTR			0.292	0.630**
			[0.357]	[0.318]
PUBLIC	32.44***		30.70**	
	[12.16]		[12.01]	
PUBLIC×D_ESP		24.96		13.96
		[18.00]		[19.95]
PUBLIC×D_ITA		47.55		58.39**
		[31.28]		[26.67]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	620	620	620	620
R^2	0.9835	0.9836	0.9836	0.9838

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.9. The role of school autonomy (PV_READ)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.084**	3.869**	4.103**	3.715**
	[1.683]	[1.855]	[1.680]	[1.717]
TOT_ENROLL	0.0310***	0.0254**	0.0338**	0.0266**
	[0.0120]	[0.0119]	[0.0134]	[0.0125]
SHARE_FEM	0.749***	0.763***	0.734***	0.743***
	[0.267]	[0.264]	[0.250]	[0.237]
SHORTAGE_READ	-46.13	-45.19	-47.01	-46.29
	[35.42]	[35.36]	[36.78]	[37.25]
D_SMALL	-1.805	-3.231	-0.671	-1.980
	[16.94]	[16.38]	[15.94]	[15.28]
D_LARGE	-2.105	-0.556	-2.369	0.249
	[20.82]	[19.83]	[20.94]	[18.10]
AUTCURR	0.325	-1.458	0.828	-1.940
	[6.791]	[6.291]	[6.462]	[6.762]
AUTRES	-3.006	-3.165	-3.129	-3.586
	[4.980]	[4.946]	[4.865]	[4.451]
PUB_FUND	-0.792***	-0.863***	-0.868***	-1.096***
	[0.233]	[0.235]	[0.305]	[0.367]
DECENTR	112.5***	113.4***	89.27***	62.06**
	[16.36]	[16.64]	[23.00]	[26.24]
PUB_FUND×DECENTR			0.290	0.649*
			[0.356]	[0.343]
PUBLIC	27.36		25.60	
	[18.65]		[18.02]	
PUBLIC×D_ESP		18.04		5.689
		[22.98]		[21.91]
PUBLIC×D_ITA		43.62		54.33**
		[30.29]		[26.08]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	618	618	618	618
R^2	0.9836	0.9836	0.9838	0.9845

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

Table A.10. The role of parental background (PV_READ)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	3.619*	3.423	3.639*	3.252
	[1.882]	[2.149]	[1.863]	[2.000]
TOT_ENROLL	0.0314***	0.0268**	0.0345**	0.0282**
	[0.0119]	[0.0126]	[0.0143]	[0.0144]
SHARE_FEM	0.735***	0.749***	0.719***	0.729***
	[0.277]	[0.268]	[0.259]	[0.243]
SHORTAGE_READ	-46.70	-45.97	-47.63	-47.09
	[32.42]	[32.62]	[33.82]	[34.46]
D_SMALL	2.176	0.968	3.454	2.262
	[14.23]	[13.39]	[13.35]	[12.50]
D_LARGE	-4.920	-3.595	-5.242	-2.818
	[16.05]	[15.32]	[16.03]	[13.42]
MOTHER_HIGH	73.86	73.43	74.27	73.79
	[81.84]	[82.77]	[81.92]	[84.57]
PUB_FUND	-0.557*	-0.615**	-0.637*	-0.839**
	[0.287]	[0.267]	[0.348]	[0.345]
DECENTR	107.6***	108.5***	82.04***	57.55**
	[14.66]	[14.91]	[24.79]	[27.68]
PUB_FUND×DECENTR			0.316	0.643**
			[0.311]	[0.278]
PUBLIC	29.73***		27.82***	
	[9.438]		[9.553]	
PUBLIC×D_ESP		22.91		11.66
		[16.68]		[20.71]
PUBLIC×D_ITA		43.53		54.57*
		[33.52]		[30.85]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	619	619	619	619
R^2	0.9846	0.9846	0.9848	0.9806

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

Table A.6. Structural variables only (PV_SCIE)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	3.943	4.215	4.038*	4.462*
	[3.064]	[3.508]	[2.214]	[2.701]
TOT_ENROLL	0.0353	0.0318	0.0304	0.0288
	[0.0232]	[0.0264]	[0.0285]	[0.0274]
SHARE_FEM	0.444	0.591	0.400	0.425
	[0.328]	[0.477]	[0.249]	[0.279]
SHORTAGE_SCIE	-101.4	-109.8	-82.46	-89.53
	[77.58]	[84.21]	[50.68]	[57.67]
D_SMALL	-5.247	-12.98	-17.30	-24.63
	[19.17]	[23.18]	[30.15]	[33.24]
D_LARGE	2.190	-2.892	-2.773	-7.274
	[16.95]	[22.93]	[26.93]	[31.51]
D_LANGUAGE	3.943	4.215	4.038*	4.462*
	[3.064]	[3.508]	[2.214]	[2.701]
Constant	386.5***	385.2***		
	[48.51]	[59.26]		
Regional fixed effects	no	no	yes	yes
Country fixed effects	no	no	yes	yes
Observations	637	580	637	580
R^2	0.2973	0.3168	0.9972	0.9757

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.7. "Market accountability" and "fiscal accountability" (PV_SCIE)

VARIABLES	(1)	(2)	(3)	(4)	(5)
PUP_TEACH_RATIO	3.640*	4.038*	4.433*	4.453*	4.687
	[1.924]	[2.214]	[2.472]	[2.405]	[2.953]
TOT_ENROLL	0.0315	0.0304	0.0261	0.0251	0.0297
	[0.0220]	[0.0285]	[0.0307]	[0.0319]	[0.0227]
SHARE_FEM	0.278	0.400	0.345	0.402	0.381
	[0.211]	[0.249]	[0.279]	[0.270]	[0.256]
SHORTAGE_SCIE	-69.28	-82.46	-73.24	-84.64	-84.34
	[48.01]	[50.68]	[50.39]	[52.77]	[51.97]
D_SMALL	-4.426	-17.30	-8.452	-18.67	-17.06
	[23.26]	[30.15]	[26.80]	[30.83]	[27.84]
D_LARGE	-4.025	-2.773	-5.917	-1.118	-2.085
	[24.94]	[26.93]	[28.88]	[25.91]	[28.01]
PUB_FUND	-0.563***				
	[0.180]				
DECENTR		143.0***			
		[28.01]			
PUB_FUND×DECENTR			0.0423		
			[0.227]		
PUBLIC				13.01	
				[12.70]	
PUBLIC×D_ESP					23.27
					[27.97]
PUBLIC×D_ITA					0.984
					[38.33]
Regional fixed effects	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes
Observations	619	637	619	637	637
R^2	0.9796	0.9772	0.9783	0.9773	0.9774

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.8. The complete model (PV_SCIE)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.715**	4.556*	4.740**	4.361*
	[2.314]	[2.559]	[2.289]	[2.354]
TOT_ENROLL	0.0176	0.0139	0.0213	0.0153
	[0.0315]	[0.0298]	[0.0270]	[0.0271]
SHARE_FEM	0.246	0.256	0.226	0.235
	[0.232]	[0.231]	[0.213]	[0.209]
SHORTAGE_SCIE	-74.43	-74.38	-74.79	-74.94
	[53.21]	[53.02]	[53.67]	[53.47]
D_SMALL	-6.302	-7.240	-4.760	-5.872
	[23.07]	[22.02]	[21.61]	[20.56]
D_LARGE	2.706	3.780	2.298	4.661
	[18.33]	[18.00]	[18.54]	[16.17]
PUB_FUND	-0.889***	-0.936***	-0.991***	-1.190***
	[0.271]	[0.266]	[0.356]	[0.419]
DECENTR	143.9***	144.7***	99.38***	87.35***
	[26.90]	[27.11]	[36.79]	[31.72]
PUB_FUND×DECENTR			0.403	0.727*
			[0.407]	[0.418]
PUBLIC	45.87***		43.38**	
	[17.69]		[17.45]	
PUBLIC×D_ESP		40.35*		27.55
		[24.30]		[24.77]
PUBLIC×D_ITA		57.20*		69.73**
		[31.59]		[29.80]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	619	619	619	619
R^2	0.9805	0.9806	0.9807	0.9809

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table A.9. The role of school autonomy (PV_SCIE)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.827**	4.631*	4.847**	4.448*
	[2.455]	[2.639]	[2.440]	[2.456]
TOT_ENROLL	0.0180	0.0130	0.0214	0.0142
	[0.0311]	[0.0310]	[0.0270]	[0.0284]
SHARE_FEM	0.237	0.249	0.219	0.226
	[0.227]	[0.229]	[0.210]	[0.205]
SHORTAGE_SCIE	-74.31	-74.13	-74.67	-74.64
	[53.02]	[52.79]	[53.45]	[53.16]
D_SMALL	-6.308	-7.588	-4.888	-6.217
	[23.16]	[22.52]	[21.77]	[21.01]
D_LARGE	2.210	3.649	1.848	4.566
	[18.55]	[17.77]	[18.74]	[15.99]
AUTCURR	-4.916	-6.551	-4.274	-7.134
	[9.502]	[8.918]	[9.047]	[9.665]
AUTRES	-1.128	-1.294	-1.270	-1.765
	[5.660]	[5.678]	[5.500]	[5.118]
PUB_FUND	-0.900***	-0.967***	-0.998***	-1.236***
	[0.271]	[0.281]	[0.358]	[0.465]
DECENTR	143.3***	144.1***	101.8***	84.78***
	[26.29]	[26.75]	[34.96]	[29.54]
PUB_FUND×DECENTR			0.377	0.752*
			[0.398]	[0.448]
PUBLIC	42.33*		39.99*	
	[24.33]		[23.36]	
PUBLIC×D_ESP		33.76		19.33
		[28.43]		[25.08]
PUBLIC×D_ITA		57.39*		69.89**
		[31.81]		[30.70]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	617	617	617	617
R^2	0.9806	0.9807	0.9807	0.9810

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

Table A.10. The role of parental background (PV_SCIE)

VARIABLES	(1)	(2)	(3)	(4)
PUP_TEACH_RATIO	4.356	4.216	4.381	4.015
	[2.762]	[3.083]	[2.728]	[2.891]
TOT_ENROLL	0.0179	0.0147	0.0220	0.0161
	[0.0273]	[0.0248]	[0.0229]	[0.0221]
SHARE_FEM	0.217	0.226	0.196	0.205
	[0.227]	[0.222]	[0.208]	[0.200]
SHORTAGE_SCIE	-78.92	-78.85	-79.34	-79.46
	[59.07]	[58.87]	[59.58]	[59.27]
D_SMALL	-2.021	-2.869	-0.346	-1.448
	[19.68]	[18.46]	[18.30]	[17.14]
D_LARGE	-1.201	-0.237	-1.663	0.641
	[14.48]	[14.27]	[14.57]	[12.41]
MOTHER_HIGH	82.99	82.70	83.55	83.17
	[78.49]	[79.46]	[78.39]	[81.09]
PUB_FUND	-0.662**	-0.704**	-0.769*	-0.962**
	[0.327]	[0.300]	[0.407]	[0.425]
DECENTR	138.2***	139.0***	103.5***	80.21**
	[23.82]	[23.93]	[34.60]	[33.24]
PUB_FUND×DECENTR			0.431	0.744**
			[0.363]	[0.365]
PUBLIC	43.22***		40.53***	
	[15.24]		[15.36]	
PUBLIC×D_ESP		38.33		25.22
		[23.92]		[26.49]
PUBLIC×D_ITA		53.26		66.06**
		[33.13]		[32.35]
Regional fixed effects	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes
Observations	617	617	617	617
R^2	0.9810	0.9817	0.9818	0.9818

Note: Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1.

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