What matters in educational performance? Evidence from OECD and non-OECD countries

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Abstract

The aim of this paper is to investigate the determinants of school performance measured by the average value of students' test scores at the school level. PISA data (2000–2012) are used to explore this relationship. A multivariate regression and a quantile and multilevel regression are employed in order to perform the analysis considering both the total sample and grouping for OECD countries and non-OECD countries. The results show that, considering the entire sample and only the OECD countries, school performance is positively driven by student fees, the presence of girls, and computers; the mother's education also plays an important role, while the father's education is notable only at a high level and negative otherwise. The results are robust to a battery of robustness checks.

Keywords Test scores · School performance · PISA data · Multivariate regression · Quantile regression

JEL Classification C10 · I21 · I28

For many years, researchers have shown an interest in understanding the determinants of students' achievement because schooling is recognized as an important channel through which individuals accumulate human capital. The main idea of the theory of human capital is that education is an investment, which allows people to contribute to the society in a productive way. Of course, investment in human capital, like other forms of investment, requires initial costs in terms of direct spending and the opportunity costs of students' time, which are taken on in the expectation that the investment will generate future benefits in terms of higher productivity, higher wages, a lower risk of unemployment, and so on (Woessmann and Schuetz 2006). The evidence strongly indicates that the quality of human capital is very important for individual success and for nations as a whole. Until recently,

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however, it has been hard to study quality across nations in a consistent way (Hanushek and Luque 2003).

Considering programmes that might be used to promote higher-quality schools within countries, Hanushek and Luque (2003) highlight the particular emphasis on the power of resource policies such as improving teachers' education or reducing class sizes. Classifying the features of students' performance as well as understanding what contributes to the divergence in achievement scores among countries is crucial considering the importance of improving the efficiency and equity of educational systems. Education production function studies aim to investigate the relationship between specific measured teacher or school characteristics (i.e. teacher experience, teacher education, class size, per-pupil expenditures, etc.) and student performance. However, because parents choose areas in which to live (and their associated schools) according to their perceptions and incomes (Tiebout 1956), student and family backgrounds are confused with naturally occurring school resource characteristics.

There is some debate about the interpretation of the findings of research on education production functions: Coleman et al. (1966) reveal that a great percentage of the variance in student achievement is explained by student background features and that relatively little additional variation is explained by school characteristics,

Evidence for schools' effect on students' academic outcomes is presented by Goldstein (1997), Konstantopoulos and Hedges (2008), and Konstantopoulos and Borman (2011). Other studies recognize that this variation is due to factors such as human or financial resources (Card and Krueger 1996), which have links to social and economic outcomes (Hanushek 1986), or private/public school attendance influencing school performance (Thapa 2015).

Although explanations for differences in school quality vary, implicit in many recent educational reforms is the recognition that the school context matters (Carlson and Cowen 2015). School accountability organizations (Booher-Jennings 2005; Dee and Jacob 2011; Jennings and Sohn 2014), private school vouchers (Rouse 1998; Wolf et al. 2013), and charter schooling (Buddin and Zimmer 2005) are planned to improve student outcomes by changing the schooling experience.

Given this body of research, the novelty of this paper in the existing literature on this topic is twofold. First, we capture the main determinants of student performance for OECD and non-OECD countries, using PISA data from 2000 to 2012 (see also Bélanger et al. 2009; Agasisti and Longobardi 2017; Agasisti et al. 2017), which are based on standardized tests taken by a representative sample of 15 years of students, through the application of different econometric methods (multivariate regression-estimated as a fixed effect model-and a quantile and multilevel regression). Second, in a comparative perspective, we deeply explore the role played by specific determinants (government resources, student fees, and the presence of girls and computers; the mother's and father's education) in explaining students' performance measured by the average value of students' test scores (maths, reading, and science).

The most important results make in evidence that in OECD countries, school performance is positively driven by government resources, student fees, and the presence of girls and computers; the mother's education also plays an important role, while the father's education is notable only at a high level and otherwise negative. When non-OECD countries are considered instead, the improvement of the student achievement is driven by the presence of girls and by the parents' education level. As for the student-teacher ratio, it negatively affects the outcomes in most of the estimations performed.

1 Students' achievement determinants: a brief overview of the literature

The literature based on analyses of the determinants of test scores is very rich and explores the different channels that affect student achievement. Many works are related to the estimation of the education production function, and the student background, school inputs, and institutional structures of the education system affect achievement in any case. For example, Fuchs and Woessmann (2007) perform an analysis at the level of the individual student using PISA data. The results show that student characteristics, family background, home inputs, resources, teachers, and institutions affect pupils' maths, science, and reading achievement.

Considering the above input as determinants of test scores (student characteristics, family background, students' citizenship, home inputs, resources, and teachers) separately, the following evidence is noted. A strong association between students' socio-economic background and their educational achievement is confirmed in several studies, estimated both between and within countries, at the country level (Lee and Barro 2001) and the student level (Woessmann 2003). As for the analysis between countries, these studies make use of the cross-country structure of the data to compare the size of the association of the specific background measure with students' achievement across countries. Their results show that educational achievement varies substantially by student and family background within the countries but also that there is significant variation in the influence of families across countries.

Ciccone and Garcia-Fontes (2009) conclude that, in Spain, there is a sizable increase in PISA scores relative to the rest of Europe when accounting for parental schooling. However, Spain's performance is relatively poor to start with and only rises to somewhat above average when considering parental education levels. In Catalonia, controlling for parental education leads to small increases in the PISA test score compared with other Spanish regions and Flanders, Lombardy, and Denmark. In a later study, Martins and Veiga (2010), using PISA 2003 data, investigate the effects of socio-economic-related inequalities in students' maths achievement in 15 EU countries and find that there is inequality in mathematics achievement, favouring the higher socio-economic groups in each country, and that there are important differences among countries.

Bonacini et al. (2021) point to catch the main determinants of the reading and maths performances of students in the European Union using data from the OECD's 2018 PISA survey. They consider the following countries: Austria, Croatia, Germany, Hungary, Italy, Portugal, Slovakia, and Slovenia, given that these begin school tracking when students are 15 years old or earlier. The results underline that, the most important drivers of student performance in all analysed countries, are the number of books at home and a proxy combining the type and location of the school are, while other school characteristics are infrequently relevant. The empirical analysis (based on OLS) makes in evidence that students attending vocational schools perform notably worse than those in general schools (except in Portugal) and that those attending a vocational school in a big city tend to perform worse than those in a small city. In addition, the decomposition analysis shows that the variables relating to the gap between types of schools are overall similar across countries: they find that family socioeconomic characteristics are the main reason for the differences between general and vocational schools, while the quality of the school represents the main reason for differences between big and small cities.

Socio-economic background also plays an important role in determining learning outcomes and explaining territorial differences in the study by Quintano et al. (2009), which uses data from PISA 2006. PISA data were also used in Checchi (2004) that considering family background and school-level peer effects find that there are significant regional differences in students' performance even after controlling for the type of school attended. Vyverman and Vettenburg (2009) also investigate whether the socio-economic background of the parents has an impact on school well-being (of young people aged 14–18) but obtain different results. To answer this research question, a survey is conducted among 1265 young people in Flanders. The study finds no evidence that young people with a lower socio-economic background have lower school well-being. Moreover, a small relationship appears between the educational qualification and the school well-being of girls when investigating boys and girls separately.

Faria and Portea (2016), using Portuguese data from PISA-2009, focus on the measurement of student achievement in mathematics and on its determinants both at the student and at the school levels. More specifically, they were interested in understanding whether the impact of students' variables were similar for students with different levels of achievement. They, given the hierarchical structure of data, use a multilevel quantile regression model to analyse the determinants of students' achievement, where the potential determinants are represented by student and school variables. The study offers suggestion that for gender, repetition, or socio-economic background a stable relation with achievement is expected while other variables show varying impacts depending on the students' location on the rank of achievement in maths (immigrant status of students, or some study strategies like control strategies). In spite of schools having a significant impact on students' performance, they found that most school-level variables (except location) were not significant in explaining the school effect.

Karakolidis et al. (2016) and Pholphirul (2016) show as to socioeconomic status, immigration status, and age/grade are strongly associated to student performance.

As underlined by Gamazo et al. (2018), gender is a particular case, because its influence can favour male or female students depending on the competence under study (generally, boys outperform girls in maths and science while the opposite is verified for reading), and with different degrees of intensity.

Differences in achievement scores in mathematics and the Serbian language depend on differences between the students. Gender, student motivation, parental education, and participation in student work and homework are some of the determinants of student achievement (Teodorović 2012). Meanwhile, considering both the geographical location and the average socio-economic status of students among the main determinants of student achievement (as measured by the Invalsi test) in mathematics in the academic year 2008/09 in Italian schools, Agasisti and Vittadini (2012) show that students attending schools in northern Italy outperform their counterparts in the south.

Glick et al. (2011) find that, in Madagascar, distance negatively affects the results and the mother's education level has a greater impact than the father's education level. In a later work, Gianbona and Porcu (2015) also analyse the 2009 OECD-PISA survey and find that some family background predictors (parental education, computer availability at home, and availability of a desk for homework at home), as well as the residential region and school programme attended, play important but differing roles for low- and high-performing readers. For example, the parental education level shows a positive effect on students' reading; general academic programmes perform better than vocational or technical ones; and northern regions exhibit a better performance than central and southern ones, with differentiated effects along the distribution of students' reading scores. In some cases,

students' digital skills are also analysed. Digital skills are defined differently by researchers in different disciplines, including media and communication, economics, sociology, education, and information technology. So, to refer to digital abilities different terms, such as skills, competence, literacy, knowledge, and fluency are used (Litt 2013). In more detail, Pagani et al. (2016) aim to evaluate the effects of digital literacy on education. They used data from the Italian National Assessment in secondary schools¹ matched with an original data set² on performance tests of internet skills. The findings indicate that, overall, internet skills positively affect academic achievement. This effect is stronger for students with a low family background or academic performance. It is also persistent for students in technical or vocational schools.

The more recent literature argument about the ICT (Information and Communication Technology) that is not clear: for instance Banerjee et al. (2007) presents the results of two randomized experiments managed in schools in urban India, and in particular a computer-assisted learning program aiming on math increased math scores by 0.47 standard deviation. One year after the programs were over, initial improvements remained significant for targeted children, but they disappeared to about 0.10 standard deviation.

In addition, some articles assert that there is difference between having ICT access at home or at school (Escueta et al. 2020; Murat and Bonacini 2020).

More specify Murat and Bonacini 2020, using PISA 2018 data from France, Germany, Italy, Spain and the United Kingdom and employing an empirical analysis based on probit and bivariate probit, observe that students unable to study remotely, given the lack of ICT resources or of a peaceful place to study, register significant cognitive losses of 70 percent of a school year in the UK to 50 percent in Italy. The results are more or less the same considering days of absence from school. In the long period, especially in Spain, Germany and Italy, students who cannot learn remotely are more likely to end their education early and repeat grades.

When moving from family to school determinants of educational achievement, the topics that are most intensively researched are the inputs available in schools (Hanushek 2006). Among the school inputs we find the spending per student, class size, accessibility of instructional material, and teacher characteristics. Studies reveal that, in general, the cross-country association of students' achievement with resources is much weaker than that with their socio-economic background. Considering spending inequality, Card and Payne (2002) provide evidence that the equalization of spending across districts leads to a decrease in test score results across family background groups.

The literature also shows evidence on the effects of financial reforms on student outcomes, for which there is no consensus. Negative conclusions may result from confounding factors, such as family income, that might be correlated with both district expenditures and student performance (Hanushek 1986). Even when students' academic potential and socio-economic status are taken into account, certain types of expenditures play an important role in explaining the differences in students' achievement between schools.

A positive link is also evidenced. Eide and Showalter (1998) use a quantile regression to suggest that the marginal dollars allocated to per-pupil district expenditures raises test

¹ The second source of information consists of administrative data collected by the Italian National Institute for the Evaluation of the School System (INVALSI).

² A survey conducted by the authors on a sample of randomly selected students from all second-year upper-secondary school classes in Lombardy. The survey, carried out in April 2012, covers 2025 students from 100 classrooms in 51 different schools.

score gains at the bottom of the conditional distribution. The ways in which the additional per-pupil expenditure is spent and the additional time in school is used will obviously determine the effectiveness of these policies in improving test score performance at the relevant points of the conditional distribution. The claim that “throwing more money at public schools will do little or nothing to improve them” is also rejected by Mackenzie (2006), who concludes that there is a positive relationship between funding and student performance.

Chaudhary (2009) analyses the effects of a Michigan school finance reform on educational inputs and outputs. First, he explores the impact of Proposal A on educational inputs; second, he uses the foundation allowance as an instrument to measure the causal effect of increased spending on fourth- and seventh-grade maths scores. The results indicate that, following Proposal A, Michigan school districts increased their operating expenditures by 5.8%. The increase in spending was used to increase teacher salaries and reduce class sizes. The instrumental variable results focus on Michigan school districts and show positive effects of increased spending on fourth-grade maths scores but no statistically significant effects on seventh-grade scores.

As indicated above, the literature that examines the determinants of test scores is very rich, and some studies also investigate the role of the class size and the student–teacher ratio. Angrist and Levy (1999) show that reducing the class size in Israel induces significant and substantial increases in the test scores for fourth and fifth graders, although not for third graders. Similarly, Hoxby (2000) finds no evidence of a class size effect. Some other studies assess the impact of class size on student performance. Bandiera et al. (2010) find a significant not positive but highly non-linear effect of class size on student test results: changes in class size have an impact on student performance but only at the top and bottom of the class size distribution. Furthermore, they show that the students at the top of the grade distribution are the most negatively affected by class size, mostly in large class sections.

Other studies (Bingley et al. 2005; Browning and Heinesen 2007) make in evidence that there is a small positive impact of reduced class size on long-term outcomes such as overall educational attainment.

Differently, Denny and Oppedisano (2013) using PISA data for the UK and USA, suggest that bigger classes lead to better results.

Similarity Coupe et al. (2016), assessing the effect of class size and school size on the performance of secondary schools in Ukraine’s External Independent Test, show that larger schools exhibit better test scores and test participation.

Many other works attempt to evaluate the relationship between student–teacher ratio, class size, and test score (Hanushek 1986, 2002; Brunello and Checchi 2005). Brunello and Checchi (2005) show that higher student attainment positively depends on a lower pupil–teacher ratio; moreover, the overall improvement of parental education has an even stronger impact on attainment. Their results also suggest that the positive effects on school attainment and on returns to education are particularly significant for native people in regions and environments with a poorer family background.

Teachers’ quality, which is related to their academic background, preparation programme, and teaching experience, affects their students’ achievement (Akiba et al. 2007), showing a positive and significant coefficient in the study by Glick et al. (2011). Moreover, the findings of both a qualitative and a quantitative analysis in the study by Darlin-Hammond (2000) indicate that policy investments in the quality of teachers may be related to improvements in student performance. A study of mathematics teachers in New York City discovered that students who were skilled by fully certified teachers with strong academic

backgrounds and two or more years of teaching experience benefited the most. When taught by teachers with little to no experience who held temporary or alternative licensure, students' achievement was decreased (Boyd et al. 2009).

Beese and Liang (2010) use PISA 2006 data to investigate how school resource indicators and student-level variables (such as socio-economic status and family resources) affect science literacy in the United States, Canada, and Finland. The results indicate that school funding practices, teacher quality, school type, and family socio-economic status affect students' science achievement and that there is an effect on international school rankings.

2 Data

The data are collected from the PISA database³ because it has a large time extension and contains rich information about schools', students', and parents' status. In this paper, we focus our attention on five waves over the 2000–2012 period,⁴ a wave being produced every 3 years, that is, in 2000, 2003, 2006, 2009, and 2012. Given that our analysis is basically focused on the school level, we add other information about students' and parents' status, taking into account the relevant questionnaire.⁵

The sample of schools is based on the European context, in particular OECD countries (34) and non-OECD countries (46). Tables 1 and 2 describe the sample used in the analysis by geographical location, emphasizing the importance of countries based on different school regimes and the variables used. The details are reported in "Appendix 1".

Looking at Table 1 we can notice that OECD countries with a representativeness, in terms of number of schools, greater than 5% are: CAN (8.11%), CHE (5%), ESP (7.19%), GBR (5.48%), ITA (8.08%) and MEX (8.87%), while the other countries have a representativeness a less than 5%. Instead, as regards the NON-OECD countries, only BRA (10.69%), IDN (5.08%), RUS (5.87%) and THA (5.35%) have a representativeness greater than 5%, while the rest are below 5%, with some countries reaching 1%. Therefore, in general, we

³ The Program for International Student Assessment (PISA) is a triennial survey of which the objective is to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. Since 2000, the OECD has carried out the PISA. It is administered every 3 years to provide comparisons of students' achievements among the participating countries. PISA collects information on mathematics, reading, and science in terms of test scores and, every 3 years, focuses on one of the three competencies. In particular, this data set allows researchers to investigate both the determinants of school performance and the role played by the geographic differences. See Collins and Odders-White (2015) for an interesting framework about the importance of articulating the intended mechanisms and effects of education programmes.

⁴ We are aware that the old data is a limitation of the analysis. For this reason, for future research, it will be our aim to extend (if possible) the sample, even if the extension of the dataset has all the information useful for the analysis. According to the abundance of our sample, we relied on the sampling techniques used in order to construct the PISA dataset.

⁵ The data set consists of a repeated cross-section. We do not follow the same students over the years; on the contrary, every year, a new cohort of first-year students enters the data set. On the other hand, we can talk of a panel if our unit of analysis is the school since we follow every year. More precisely, we have data for the academic years 1997/2000 (year 2000), 2001/2003 (year 2003), 2004/2006 (year 2006), 2007/2009 (year 2009), and 2009/2012 (year 2012). The data set gathers information about the students' basic demographics (gender and age), educational background and pre-enrolment characteristics (type of high school attended and score gained in the high school final exams), household financial conditions (family's self-declared income), and general information about university careers and performances (exams passed and credits acquired).

can assert that many countries in our sample have a very low percentage in terms of the number of schools.

3 Empirical design and variables

To determine how different channels or determinants influence school performance, with respect to the European context, we specify the following equation model or multivariate regression:

$$\begin{aligned} PERFORMANCE_{i,j,t} = & a_i FUNDS_{i,j,t} + b_1 COMPUTER_{i,j,t} \\ & + c_i EDUCATION_{i,j,t} + d_1 SIZE_{i,j,t} \\ & + e_1 GENDER_{i,j,t} + f_i COMMUNITY_{i,j,t} \\ & + g_1 OWNERSHIP_{i,j,t} + COUNTRY_j + TIME_t + \varepsilon_{i,j,t} \end{aligned} \quad (1)$$

where PERFORMANCE is the school performance, that is, the student test scores averaged by school ($I=[\text{maths, science, and reading}]$). This variable is used as a proxy to measure the school achievement; in other words, this variable serves to determine whether the manager has been able to allocate resources to achieve the optimal final output. FUNDS is the financial funding obtained by each school taken as a percentage ($I=[\text{government, student fees, charitable, other}]$) (other is used as a benchmark); this variable is an important driver allowing us to identify the types of funds that have a greater influence on school performance. It is linked to the ability of the manager to allocate resources optimally to contribute to the success of the school in terms of performance; we expect to find a positive relationship between funds and school performance—in other words, more funds allow schools to sustain more costs and therefore to have more resources available to students (in terms of tools) to increase the probability of a high test performance. COMPUTER indicates the computers connected to the Internet. This variable controls for the technology available in the school; we expect to find that this variable can have a positive influence on school performance as a high level of technology allows students to have more information to practise for the test. EDUCATION is the set of dummies relating the parents' (both the father's and the mother's) educational level ($1=\text{ISCED level 1 only or no school}$; $2=\text{ISCED level 2 only}$; $3=\text{ISCED level 3B or 3C}$; $4=\text{ISCED level 3A}$; $5=\text{ISCED level 5B}$; and $6=\text{ISCED 5A, 6}$)⁶ (group 1 is used as a benchmark). We expect to find a positive relationship between education and school performance because more educated parents, in most cases, help students to give their best and therefore increase the likelihood of them achieving the best test results. SIZE is the school dimension proxied by the student–teacher ratio. We expect to find a negative relationship between school size and achievement; as suggested in the literature, the larger the class size, the lower the concentration on the student, having an adverse effect on his or her performance (Hanushek 1986, 2002; Brunello and Checchi 2005). GENDER are the girls enrolled in the school. The literature suggests that girls have a greater probability of achieving high test scores than boys; for this reason, we expect to find a positive association between the number of girls and the school performance. COMMUNITY is the set of dummies describing the community in which the school is located ($1=\text{village } (>3000 \text{ people})$; $2=\text{small town } (3000 < \text{people} < 15,000)$;

⁶ ISCED: International Standard Classification of Education.

3 = town (15,000 < people < 100,000); 4 = city (100,000 < people < 1,000,000); 5 = large city (< 1,000,000 people)) (group 1 is used as a benchmark). We expect to find that a small community could have a positive impact on school performance because managers can manage resources better. *OWNERSHIP* is the set of dummies denoting the typology of schools (0 = public; 1 = private) (private is used as the benchmark group); we expect to find that public schools perform less well than private ones.

We also control for two dimensions: the country in which the school operates and the timing of our sample. In particular, *COUNTRY* is the set of dummies for the country in which the school operates to control for different policy implications and regime applications; and *TIME* is the set of time dummies included in the model to capture any possible unobservable shocks. Finally, ϵ constitutes the disturbance terms. Subscripts i , j , and t refer to the unit of analysis (school), the area where the school is located, and the time period (years), respectively. As a benchmark, we use the multivariate regression to estimate Eq. (1). Unlike other techniques, multivariate regression allows us to take into account simultaneously a high number of dependent variables (in our case, students' maths, science, and reading test scores averaged by school) with respect to other estimators. In fact, the aim of multivariate regression, a term first used by Pearson (1908), is to learn more about the nexus between some independent or predictor variables and a dependent or variable criterion. For this reason, we consider this estimator to be applicable for our analysis.

As robustness checks, we also use quantile and multilevel regression to estimate the relationship between schools' performance and its determinants. We run the regression by separating the channels described in Eq. (1) into the entire sample (ALL SAMPLE) and grouping only OECD countries (ONLY OECD) and only non-OECD countries (ONLY NON-OECD). This exercise helps us to understand how the different channels affect school performance in different contexts. In other words, we want to verify how the different technology influences the empirical findings given that the OECD countries are more developed in this sense. Table 3 describes the statistics for all the variables used in the analysis (see "Appendix 1"). As expected, OECD countries present higher scores (in terms of maths, reading, science) compared to NON-OECD countries. The OECD countries are characterized by greater public and student fees fundings, while NON-OECD countries as expected receive more funds from charities and other sources being less income and developing countries. Parental education is higher in OECD countries, while NON-OECD countries are characterized by a larger school size, as can be seen by the number of boys and girls compared to OECD countries. It is possible to notice that over the years the number of boys is almost always greater than the number of girls in the OECD countries, while the opposite occurs for the NON-OECD countries. Finally, the data reveal that OECD countries have a higher percentage of computers connected to the internet with respect to NON-OECD countries, while for both groups of countries seems emerge that schools are more present in town (15,000 < people < 100,000).

4 Empirical evidence

This part is devoted to the presentation of the results from the multivariate regression model⁷ (Tables 4, 5, 6, "Appendix 2"), considering a "panel model at all" which takes into account the effects of "unobserved individual effects". The most important conclusions are that, considering both the full sample and only the OECD countries, good school performance is positively driven by student fees, the presence of girls, and the number of computers connected to the Internet; the mother's education also plays an important role, while the father's is notable only at a high level and otherwise is negative. The student–teacher ratio negatively affects the outcomes, but these results are not robust to the inclusion of all the variables. On the contrary, the development of student achievement in non-OECD countries depends on benefaction, the presence of girls, and the parents' education level. The student–teacher ratio and being a public school affect the test performance negatively and significantly.

5 Multivariate regression: first results

The results for the effect of determinants on maths scores at the school level for the entire sample are presented in Table 4 (columns 1, 4, 7, 10, and 13), for OECD countries only (columns 2, 5, 8, 11, and 14), and for non-OECD countries only (columns 3, 6, 9, 12, and 15). According to the results related to the whole sample, that is, when all the countries in our sample are considered, government expenditure, student fees, the presence of girls, and the number of computers connected to the Internet significantly and positively affect the maths test score, while public schools' performance is worse than private schools' performance (column 1); these findings are robust to the inclusion of the father's and mother's education level (column 4). In particular, the mother's education significantly and positively affects the maths test score and the father's education is important only at a high education level. No effect of government expenditure is evidenced.

When adding the student–teacher ratio to the benchmark model (column 10), a negative relationship is noted. Finally, considering the last model, which includes all the variables together (column 13), the results are consistent with the previous estimation except for the student–teacher ratio and public schools, for which the signs are not statistically significant.

Table 5 (column 1) shows that student fees, the number of computers connected to the Internet, and the number of girls positively affect the science test score, and public schools

⁷ The multivariate regression employed has been estimated as a fixed effect model, i.e. including in our specification the country dummies. In this way, we control for possible heterogeneity and differences between countries. We do not include school dummies to avoid multicollinearity problems that could exist between these dummies and error terms. Unfortunately, the multivariate approach used does not allow to include an option for the inclusion of fixed effects, comparing fixed effects (FE) and random effects (RE) implementing the well-known Hausman test. In this regards, to understand whether the introduction of country dummies was important in our context, we perform the F-test (i.e. Wald statistics). We reject the null hypothesis, confirming that it's reasonable to include in the models the country dummies. Somehow this test also allows us to detect the presence of unobserved individual effects (as suggested by Wooldridge 2010) and then the use of fixed effects in the models (as suggested by Angrist and Newey 1991). Despite this limitation, however we estimated the models using the canonical "fixed effect models", comparing fixed effects (FE) and random effects (RE) specification. The Hausman test confirms that the FE model must be implemented, validating our baseline specification employed in the multivariate contest. For space purpose, the empirical evidence and Hausman test are available upon request.

achieve lower performance than private ones. This evidence, such as the significant and positive value of student fees and the number of girls, is robust to the inclusion of the father's and mother's education (column 4), presenting the same characteristics as before. Adding the student–teacher ratio (column 10), which is negatively correlated, to the benchmark model produces no changes in the results. Finally, including all the variables together (column 13), all the types of funds seem to be important drivers of school performance; the other independent variables show the same sign as in the previous regression, except the student–teacher ratio, which is now not significant.

As regards the effect on the reading test scores (Table 6, column 1), student fees, the number of computers connected to the Internet, and girls' presence are important determinants, while public schools' performance is worse than that of private schools; these signs are consistent with the inclusion of parents' education level (column 4), with the father's education level, as before, being relevant only at a high level and negative otherwise.

The empirical findings do not change when we add to the benchmark model the student–teacher ratio (column 10), which is negatively related to the outcomes. The overall results are robust to the inclusion of all the variables (column 13), except for computers connected to the Internet and the student–teacher ratio, for which the coefficients are not statistically significant.

Now, to capture how the different contexts in which schools operate affect the estimation, we separate the sample into only OECD countries and only non-OECD countries (for more details of the composition of the sample, see Tables 1 and 2). This exercise might be useful for policy makers and regulators, enabling them to understand how the different channels affect school performance in different environments based on different technology. In particular, they could decide to provide more resources to improve the educational levels in non-OECD countries. This should help to increase the number of teachers, reduce class sizes, and improve schools' performance.

Considering the same test scores in only OECD countries in regard to the maths score (Table 4, column 2), the positive results are subject to student fees, the number of computers connected to the Internet, and girls' presence; negative results are driven by public schools. When the mother's and father's education (column 5) are added to the analysis, the test score appears to be positive for the presence of girls and negative for public schools. The impact of parents' education has the same significance as before. Considering the student–teacher ratio (column 11), for which the impact is negative and significant, a similarity to the previous estimations is apparent.

Finally, when we take all the variables into account (column 14), student fees, girls, mother's education, and father's high level of education positively and significantly affect schools' performance, while the effect of the student–teacher ratio disappears. As for the science and reading test scores (columns 2, 5, 11, and 14 of Tables 5 and 6), student fees and the number of girls are positive determinants of test scores while the sign of public schools is again negative. The parents' education shows the evidence presented before. In contrast, no evidence is found for the student–teacher ratio.

Moreover, considering only non-OECD countries, for the maths score (Table 4, column 3), only the number of girls is an important factor, while public schools show negative and significant evidence. In contrast to the previous results, parents' education (column 6) is a remarkable issue in improving the test scores in all cases, and the value of charity (funds) positively drive the outcomes. Adding the student–teacher ratio (column 12), which is negatively correlated, the sign related to funds appears to be positive. Considering the last model (column 15), the percentage of funding does not affect the outcome in any of the cases or with the other variables presented previously.

Regarding the science test score (Table 5, column 3), the charity funds and the number of girls are key factors. Adding separately the parental education (column 6), positively related, and the student–teacher ratio (column 12), negatively related, the results present the same signs as before; moreover, nothing changes when considering all the variables (column 15). It is important to note that, in all the cases considering the non-OECD countries, the number of computers connected to the Internet does not significantly improve the test scores.

Concerning the reading test scores (Table 6, column 3), charity funds are not a significant determinant; the other variables have the above characteristics, and only in the model in which we add the student–teacher ratio to the benchmark (column 12) do student fees significantly improve the reading test score. Finally, all the outcomes decrease for public schools (i.e. public schools achieve lower performance than private ones) and increase with the number of girls.

To provide a strong perspective, we sum up our findings below. First, we focus on the full sample and separate the channels as follows:

- Fees for students are the main fund component that most affects school performance; the logic is that a school redistributes these resources, providing more services to improve its performance (e.g. it provides more tools that allow students to pass the tests and to ensure better school performance).
- The presence of computers connected to the Internet improves school performance by allowing students to practise to pass the tests.
- Regarding gender, the presence of girls contributes more to raising school performance, perhaps because girls commit more and attain higher scores, enabling the school to increase its performance.
- Public schools achieve lower performance than private ones.
- There is an exponential (monotonic) relationship between urbanization and performance. In other words, it seems that to be in highly populated areas contributes more to school performance, maybe because the schools have more money (e.g. student fees) to improve their performance (more exercises used to pass the tests).
- There is an exponential (monotonic) relationship between the mother's education and the school performance. This means that the higher the level of the mother's education, the more likely it is that a student will pass the test and therefore the better the performance of the school.
- There is a U-shaped relationship between the father's education and the school performance. In other words, low levels of education reduce the probability of high student test performance, reducing the school performance. Nevertheless, this trend changes with high levels of education, contributing positively to school performance.
- In line with the literature according to which the class size has a negative effect on students' test performance, there is an inverse relationship between the student–teacher ratio and the performance; this means that an increase in the class size reduces the performance; in fact, the teacher gives little time to each individual student.

The results are confirmed when all the channels are considered together, except for the student–teacher ratio, which loses significance, and the level of urbanization, which no longer appears to have an exponential relationship with the performance. In other words, it seems that only the least populated areas contribute positively to school performance; this occurs because the school can allocate resources optimally among

the few units in such a way as to improve the performance. The results are similar when we consider the maths, reading, and science test scores separately.

Focusing on OECD countries only, it seems that student fees have a weaker effect. The same applies to the presence of computers connected to the Internet, while the other two forms of funding do not contribute in any way to school performance, and the same is true for the student–teacher ratio. Furthermore, when we consider all the channels, it appears that the most populated areas have a negative effect on school performance; there is always a U-shaped relationship between the father’s education and the school performance. In these countries (so-called developed countries), only people with higher levels of education seem to contribute positively to school performance.

In terms of policy implications, to guarantee higher school performance, policy makers and regulators in OECD countries should:

- increase the fees for students and public funds;
- in line with Angrist and Levy (1999), Bingley et al. (2005); Browning and Heinesen (2007) and differently Denny and Oppedisano (2013) reduce class sizes;
- increase the number of computers connected to the Internet, which gives greater importance to technology;
- increase, especially seeing the long run period, the levels of education of next generation, given that the average levels, in particular for father, contribute negatively to the performance;

This might be a surprising result, but in line, even if in Non-OECD countries, with we can read in Banerjee and Duflo (2019), where girls’ education was higher than the boys one’s in Haryana, a village close to Delhi.

Finally, we focus on non-OECD countries. The part of funds that contributes the most to performance, albeit weakly, is that of charity. In fact, schools in these countries (i.e. so-called developing countries) base their spending expectations on charitable offerings. The presence of computers connected to the Internet does not contribute to their performance. Because there is a lack of technology (comparing the percentage between OECD and non-OECD countries), an interesting result is that when considering these countries, there is no longer a U-shaped relationship between the father’s education and the school performance but an exponential relationship, as in the case of the mother’s education. This is because, unlike the richer and more developed OECD countries, in the non-OECD countries, the percentage of those who have a high level of education is very low, so even a small elevation in the father’s education can facilitate an improvement in children’s test scores. There is also an exponential relationship between the size of an area in population and the performance, even when we consider all the channels together. Finally, the student–teacher ratio is negative and significant considering all the channels. This is because, in general, the classes are very large, making it difficult for teachers to help their students. In terms of policy implications, to guarantee higher school performance, policy makers and regulators in non-OECD countries should: (i) increase the funds from charitable offerings but at same time to make able, with these funds, these countries to increase the self-improvement efforts in order to have better performance due to internal resources and not only to external ones; (ii) continue to increase the level of education; and finally (iii) reduce class sizes, being a negative factor for school performance.

6 Robustness check

To check whether the findings presented above change when different estimators are used, we repeat our models using quantile (based on conditional median) and multilevel regression.⁸ This allows us to give robustness to our analysis, supporting the results of the multi-regression estimation with the quantile regression (Tables 7, 8, 9, 10). In most of the cases, the results are consistent with the previous conclusions.

7 Results of quantile regression

As to the least squares result, that approach the conditional *mean* of the response variable given certain values of the predictor variables, quantile regression aims to estimate either the conditional median or another quantile of the response variable. In this way, the method is not affected by the presence of outliers or extreme values, which could distort the estimation, but, unlike multivariate analysis, it does not allow for controlling the simultaneity problem.

Quantile regression is appropriate if conditional quantile functions are of interest. Considering the quantile regression, one advantage, compared to the OLS, is that quantile regression estimates are more robust to outliers in the response measurements. However, the main attraction of quantile regression extends beyond that. Different measures of central tendency and statistical dispersion can be useful in obtaining a more comprehensive analysis of the relationship between variables.

Quantile regression is proposed and used, in ecology, as a method to recognise more useful predictive associations between variables in cases in which there is no relationship or only a weak relationship between the means of the variables and the need for and success of quantile regression is attributed to the complexity of interactions between different factors, leading to data with unequal variation of one variable for diverse arrays of another variable.

Another application (of quantile regression) is related to the growth chart where percentile curves are commonly used to screen for abnormal growth.

Considering the student maths test scores, averaged by school, both in the full sample and in the OECD countries, the performance increases with government expenditures, student fees, and girls' presence; public schools achieve lower performance than private ones; the sign of the mother's and father's education has the same characteristics as before; and no evidence is found for the student–teacher ratio. As for the non-OECD countries, in this case, as with the multi-regression, charity funds play an important role, and in some cases student fees and government expenditures are significant. The other determinants have more or less the same signs as before; in particular, the effect of the student–teacher ratio is negative in all the models considered.

Regarding students' science scores, averaged by school, student fees, government expenditures, and computers connected to the Internet are significant. The effect of the student–teacher ratio is significantly negative both in the full sample and in non-OECD

⁸ For the sake of brevity and space, we only show the quantile regression. Multi-level models are available on request.

countries, but it disappears when we consider only OECD countries. The other variables have approximately the same outcomes as seen previously.

For students' reading test scores, averaged by school, in the full sample, the significance of variables does not change, and the effect of the student–teacher ratio is negative in all cases. Moreover, when we select only the OECD countries, student fees, computers connected to the Internet, and the student–teacher ratio do not appear to be significant determinants of increasing scores. In the case of non-OECD countries, charity funds appear to be less important than before, while the student–teacher ratio is negative and significant.

Focusing on the average value of the test scores, for the full sample, the results are similar to the previous results. When only the OECD countries are considered, the effect of government expenditures disappears, while the student–teacher ratio is not robust to the inclusion of all the variables. Surprisingly, considering only the non-OECD countries, government expenditures have a positive and significant coefficient; however, very little changes with respect to the other components considered. The scores decrease when the student–teacher ratio increases.

8 Conclusions and policy implications

In this paper, we analysed the determinants of school performance measured by the average value of student test scores (maths, reading, and science) at the school level. We used PISA data from 2000 to 2012 to explore this relationship. A multivariate regression, estimated as a fixed effect model, and a quantile and multilevel regression were used to assess the different channels (funds, computers connected to the Internet, parental education, student–teacher ratio, number of girls, and ownership). The analysis was performed on the total sample and separately for OECD countries and non-OECD countries.

The most important results show that, considering the full sample and only the OECD countries, school performance is positively driven by student fees, the presence of girls (Gamazo et al. 2018), and the digital literacy (Litt 2013 and Pagani et al. 2016). As to the family background effects (see also Quintano et al. 2009; Checchi 2004; Bonacini et al. 2021; Vyverman and Vettenburg 2009 for a discussion) and in line with Ciccone and Garcia-Fontes (2009) and Gianbona and Porcu (2015), the mother's education plays an important role, while the father's is notable only at a high level and negative otherwise.

Improvements in student achievement in non-OECD countries result from charity funds, the presence of girls (Gamazo et al. 2018), and the parents' education level. The student–teacher ratio, also analysed by Hanushek (1986, 2002) and Brunello and Checchi (2005), negatively affects the outcomes in most of the estimations performed, this means that, in terms of class size, our results are in line with Angrist and Levy (1999), Bingley et al. 2005; Browning and Heinesen 2007 and different by Denny and Oppedisano (2013).

Finally, it is reasonable to conclude that, as in the study by Darlin-Hammond (2000), more funds allow schools to invest more in the quality of teaching, increasing the probability of better student test performance in maths, science, and reading.

This exercise might be useful for policy makers and regulators to understand how the different channels affect school performance in different contexts, based on different amounts of technical progress.

In terms of policy implications, to guarantee higher school performance, policy makers and regulators in OECD countries should: increase the fees for students and public funds; reduce class sizes; increase the next generation levels of education, increase the number

of computers connected to the Internet, which gives greater importance to technology and ICT.

Differently from that, in non-OECD countries the presence of computers connected to the Internet does not contribute to their performance, because there is a lack of technology. As to concern the part of funds that contributes the most to performance, albeit weakly, is that of charity: in fact, schools in these countries base their spending expectations on charitable offerings.

As above underlined an interesting result is that, when considering these countries (non-OECD), there is no longer a U-shaped relationship between the father's education and the school performance but an exponential relationship, as in the case of the mother's education.

An exponential relationship is also found between the size of an area in population and the performance, even when we consider all the channels together.

Finally, the student–teacher ratio is negative and significant considering all the channels. This is because, in general, the classes are very large, making it difficult for teachers to help their students.

In terms of policy implications, to guarantee higher school performance, policy makers and regulators in non-OECD countries should: (i) increase the funds from charitable offerings aimed to use their resources; (i) continue to increase the level of education; and finally (iii) reduce class sizes.

9 Future steps of research and limitation

We are aware that the old data is a limitation of the analysis. For this reason, for future research, it will be our aim to extend (if possible) the sample, even if the extension of the dataset has all the information useful for the analysis.

In addition, future step of research could be to consider some selected countries and derive the differences. (see Bonacini 2021 for a discussion).

Finally, an additional point might be to repeat a similar exercise using other data (annual). This will make the researcher able to perform others econometric techniques and give robustness to this analysis.

Appendix 1: Tables on sample and statistics

See Tables 1, 2, 3

Table 1 The sample

Countries (OECD)	Number of schools (2000–2012)	Frequency	Countries (NON-OECD)	Number of schools (2000–2012)	Frequency
AUS	777	2.79	ALB	249	1.72
AUT	590	2.12	ARE	483	3.34
BEL	934	3.36	ARG	438	3.03
CAN	2,258	8.11	AZE	230	1.59
CHE	1,391	5.00	BGR	376	2.60
CHL	389	1.40	BRA	1,547	10.69
CZE	896	3.22	CHL	112	0.77
DEU	782	2.81	COL	510	3.52
DNK	828	2.97	CRI	240	1.66
ESP	2,001	7.19	EST	130	0.90
EST	271	0.97	GEO	148	1.02
FIN	749	2.69	HKG	324	2.24
FRA	269	0.97	HRV	365	2.52
GBR	1,525	5.48	IDN	735	5.08
GRC	624	2.24	ISR	101	0.70
HUN	724	2.60	JOR	421	2.91
IRL	525	1.89	KAZ	321	2.22
ISL	356	1.28	KGZ	231	1.60
ISR	257	0.92	LIE	45	0.31
ITA	2,248	8.08	LTU	420	2.90
JPN	648	2.33	LVA	654	4.52
KOR	520	1.87	MAC	110	0.76
LUX	136	0.49	MDA	138	0.95
MEX	2,469	8.87	MLT	31	0.21
NLD	540	1.94	MNE	119	0.82
NOR	642	2.31	MUS	116	0.80
NZL	593	2.13	MYS	235	1.62
POL	651	2.34	PAN	90	0.62
PRT	671	2.41	PER	325	2.25
SVK	602	2.16	QAT	206	1.42
SVN	468	1.68	QCN	239	1.65
SWE	603	2.17	QHP	48	0.33
TUR	458	1.65	QRS	44	0.30
USA	439	1.58	QTN	96	0.66
			QVE	55	0.38
			ROU	385	2.66
			RUS	850	5.87
			SGP	257	1.78
			SRB	346	2.39
			SVN	295	2.04
			TAP	396	2.74
			THA	775	5.35
			TTO	107	0.74
			TUN	338	2.34
			URY	658	4.55
			VNM	136	0.94
Total	27,834	100		14,475	100

Table 1 (continued)

Authors' elaboration;

Table 2 Variables description

Variables	Description
Math score	School performance, i.e. test score of student averaged by school in Math
Reading score	School performance, i.e. test score of student averaged by school in Reading
Science score	School performance, i.e. test score of student averaged by school in Science
Funds (Government)	Funding obtained by each school by the Government (%)
Funds (Student fees)	Funding obtained by each school by Student fees (%)
Funds (Benefits)	Funding obtained by each school by Benefits (%)
Funds (Other Source)	Funding obtained by each school by Other Source (%)
Computers	Number of computers connected to the internet
Boys	Number of boys enrolled in the school
Girls	Number of girls enrolled in the school
Ownership	Set of dummies (0=public; 1=private) denoting the typology of school; private is used as benchmark group
Father (Education)	Set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 5B; 6=ISCED 5A) describing the fathers' education; 1 used as benchmark group
Mother (Education)	Set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 5B; 6=ISCED 5A) describing the fathers' education; 1 used as benchmark group
Community	Set of dummies ((1=village (> 3,000 people); 2=small town (3,000 < people < 15,000); 3=town (15,000 < people < 100,000); 4=city (100,000 < people < 1,000,000); 5=large city (< 1,000,000 people)) describing the community in which school is located; 1 used as benchmark group
Size	Student–teacher ratio

Authors' elaboration; see section "Data" for more details about the description of the variables;

Table 3 Descriptives statistics of the variables

Year	Maths score	Reading score	Science score	Funds (Government)	Funds (Student fees)	Funds (Benefits)	Funds (Other source)	Computers
<i>ALL</i>								
2000	467,5879	466,6846	469,9534	83,7766	10,2632	3,1986	2,8394	31,8552
2003	490,4581	485,1399	490,7343	80,8260	12,7196	3,6176	3,0477	72,6774
2006	467,6538	459,4026	471,5916	80,7259	13,5680	2,7857	3,0327	86,2898
2009	455,8260	453,7206	460,2562	78,5641	15,7989	3,0080	2,8536	60,2980
2012	466,2665	467,8486	473,3987	79,7656	14,7271	2,7005	2,9251	75,3660
Mean	466,7849	464,1309	471,1488	80,2092	14,0421	2,9668	2,9349	68,6121
<i>OECD</i>								
2000	491,1413	489,8561	490,6585	85,4904	9,6294	2,2825	2,6945	35,7852
2003	500,7565	493,5412	498,2563	80,6473	12,8396	3,6078	3,1313	72,8323
2006	491,3231	484,5141	494,0437	79,8452	14,3548	2,7452	3,1861	88,7500
2009	484,1492	481,1808	487,6442	77,5397	16,8176	2,9195	2,9700	62,2081
2012	482,0154	483,9148	489,4032	78,6654	15,6739	2,8008	2,9884	76,2106
Mean	488,4711	485,5849	491,4867	79,7343	14,5349	2,8863	3,0135	70,2680
<i>NON-OECD</i>								
2000	413,9701	413,6613	421,7093	78,8596	12,2159	5,7184	3,2168	21,2562
2003	426,3546	432,8457	443,9133	81,9387	11,9729	3,6784	2,5391	71,7133
2006	428,1662	417,5088	434,1345	82,1951	12,2553	2,8532	2,7801	82,1854
2009	416,5654	415,6565	422,2920	79,9841	14,3869	3,1308	2,6939	57,6502
2012	437,5177	438,5206	444,1832	81,7740	12,9986	2,5175	2,8104	73,8243
Mean	425,7513	423,4866	432,5601	81,0389	13,1692	3,1289	2,7872	65,8870
<i>PUBLIC</i>								
2000	463,9374	462,2860	466,5826	87,5519	6,9942	2,8402	2,7125	31,6251
2003	485,6733	480,9175	486,8156	80,9408	12,6399	3,6138	3,0247	73,5484

Table 3 (continued)

Year	Maths score	Reading score	Science score	Funds (Government)	Funds (Student fees)	Funds (Benefitis)	Funds (Other source)	Computers
2006	462,5873	454,0231	466,8605	81,1483	13,0298	2,9055	3,0300	86,1718
2009	451,0296	448,3474	455,3927	79,0070	15,4269	2,9752	2,8109	60,1628
2012	459,5865	460,7587	467,0415	80,0298	14,3392	2,7947	2,9608	75,1652
Mean	461,6243	458,5702	466,2367	80,9251	13,3410	2,9746	2,9168	68,5865
<i>PRIVATE</i>								
2000	484,9350	487,5665	485,9268	65,8538	25,7825	4,9000	3,4373	32,9475
2003	517,5405	509,0396	512,9150	80,1767	13,1710	3,6387	3,1749	67,7474
2006	493,1819	486,5074	495,4299	78,5976	16,2799	2,1821	3,0460	86,8842
2009	478,4928	479,1134	483,2403	76,4711	17,5569	3,1632	3,0558	60,9365
2012	494,0811	497,3694	499,8687	78,6655	16,3421	2,3086	2,7776	76,2021
Mean	491,1098	490,3390	494,2959	76,8348	17,3465	2,9303	3,0199	68,7326
Year	Boys	Girls	Ownership	Father (Education)	Mother (Education)	Community	Size	
<i>ALL</i>								
2000	348,7170	355,1692	0,8260	4,1986	4,1238	2,9596	14,9163	
2003	343,7851	333,7189	0,8499	3,7626	3,7394	2,9478	14,1037	
2006	370,7683	367,5658	0,8344	3,6563	3,6155	2,9512	15,3873	
2009	384,0478	385,6732	0,8254	3,7506	3,7155	2,9986	15,8827	
2012	376,7137	378,2486	0,8063	3,8003	3,8279	3,0571	14,9983	
Mean	370,4101	370,0907	0,8250	3,7930	3,7717	2,9949	15,2065	
<i>OECD</i>								
2000	331,4044	333,0129	0,8028	4,2750	4,2181	2,9605	13,8699	
2003	335,2557	318,4461	0,8409	3,8109	3,7786	2,9396	13,2719	
2006	338,7301	329,8128	0,8251	3,7413	3,6962	2,9910	14,2586	
2009	342,5724	337,3881	0,8374	3,8125	3,8138	3,0018	15,1946	

Table 3 (continued)

Year	Boys	Girls	Ownership	Father (Education)	Mother (Education)	Community	Size
2012	338,7083	330,4625	0,8064	3,8786	3,9539	3,0419	14,1602
Mean	338,2655	330,3868	0,8228	3,8673	3,8679	2,9965	14,2560
<i>NON-OECD</i>							
2000	375,1959	394,3612	0,8604	3,9663	3,8603	2,9493	17,4239
2003	396,8771	428,7853	0,9054	3,4640	3,4973	2,9986	19,2813
2006	424,2178	430,5495	0,8499	3,5145	3,4810	2,8845	17,2704
2009	442,1255	452,6039	0,8087	3,6647	3,5793	2,9942	16,8365
2012	446,7621	465,4799	0,8062	3,6577	3,5981	3,0847	16,5282
Mean	431,2868	445,0508	0,8269	3,6423	3,5810	2,9915	17,0186
<i>PUBLIC</i>							
2000	356,2172	357,5911	//	4,1750	4,1095	2,9230	14,8856
2003	338,8682	327,6404	//	3,6924	3,6832	2,9330	14,1545
2006	363,3956	364,6553	//	3,5750	3,5480	2,9375	15,3517
2009	374,6139	376,1396	//	3,6646	3,6416	2,9896	15,8339
2012	366,1529	370,2013	//	3,6800	3,7165	3,0510	15,0749
Mean	363,3686	363,9550	//	3,7068	3,6967	2,9814	15,2074
<i>PRIVATE</i>							
2000	312,2272	343,6712	//	4,3133	4,1935	3,1322	15,0624
2003	371,6159	368,1237	//	4,1602	4,0586	3,0322	13,8165
2006	407,9162	382,2310	//	4,0663	3,9562	3,0207	15,5664
2009	428,5627	430,7273	//	4,1575	4,0653	3,0412	16,1134
2012	420,6471	411,7558	//	4,3012	4,2917	3,0821	14,6793
Mean	403,6665	399,0087	0,8250	4,2003	4,1266	3,0587	15,2025

Authors' elaboration;

Appendix 2: Tables on multivariate regression

See Tables 4, 5, 6

Table 4 Multivariate regression

	A1 (1) All sample	B1 (2) Only OECD	C1 (3) Only non-OECD	D1 (4) All sample	E1 (5) Only OECD	F1 (6) Only non-OECD	G1 (7) All sample	H1 (8) Only OECD	I1 (9) ONLY NON-OECD	L1 (10) ALL SAMPLE
	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score
Funds (Govern- ment)	0.0531* [0.0270]	0.0401 [0.0331]	0.0788 [0.0465]	0.0445 [0.0233]	0.0423 [0.0287]	0.0518 [0.0393]	0.0446 [0.0269]	0.0354 [0.0331]	0.0755 [0.0455]	0.0640* [0.0284]
Funds (Student fees)	0.0813** [0.0286]	0.0831* [0.0350]	0.0860 [0.0494]	0.0504* [0.0247]	0.0541 [0.0304]	0.0524 [0.0417]	0.0671* [0.0285]	0.0738* [0.0350]	0.0759 [0.0482]	0.0934** [0.0301]
Funds (Ben- efits)	0.0163 [0.0398]	- 0.0312 [0.0496]	0.124 [0.0665]	0.0511 [0.0343]	0.0256 [0.0430]	0.123* [0.0561]	0.0134 [0.0395]	- 0.0276 [0.0495]	0.109 [0.0650]	0.0490 [0.0417]
Computers	0.00801** [0.00252]	0.00701* [0.00311]	0.00745 [0.00430]	0.00517* [0.00217]	0.00410 [0.00270]	0.00511 [0.00363]	0.00753* [0.00250]	0.00662 [0.00311]	0.00662 [0.00421]	0.00846** [0.00264]
Girls	0.0360*** [0.000798]	0.0478*** [0.00119]	0.0265*** [0.00107]	0.0195*** [0.000704]	0.0271*** [0.00106]	0.0130*** [0.000927]	0.0279*** [0.000836]	0.0417*** [0.00126]	0.0161*** [0.00110]	0.0377*** [0.000867]
Ownership (1)	- 31.71*** [0.810]	- 28.59*** [0.995]	- 38.24*** [1.381]	- 1.963** [0.738]	- 2.313* [0.908]	- 0.722 [1.259]	- 27.37*** [0.819]	- 26.48*** [1.009]	- 29.42*** [1.381]	- 30.55*** [0.856]
Mother (Educa- tion—2)				5.662* [2.257]	9.378** [3.171]	6.230 [3.208]				
Mother (Educa- tion—3)				18.05*** [2.401]	23.80*** [3.426]	17.94*** [3.371]				

Table 4 (continued)

	A1 (1) All sample	B1 (2) Only OECD	C1 (3) Only non- OECD	D1 (4) All sample	E1 (5) Only OECD	F1 (6) Only non- OECD	G1 (7) All sample	H1 (8) Only OECD	I1 (9) ONLY NON- OECD	L1 (10) ALL SAMPLE
Mother (Education—4)	37.07*** [2.507]	44.00*** [3.537]			35.38*** [3.573]					
Mother (Education—5)	62.11*** [2.595]	67.93*** [3.619]			63.91*** [3.812]					
Mother (Education—6)	86.25*** [2.803]	88.27*** [3.862]			96.74*** [4.171]					
Father (Education—2)	— 16.55*** [2.465]	— 32.23*** [3.474]			3.652 [3.477]					
Father (Education—3)	— 11.67*** [2.565]	— 28.50*** [3.666]			9.962** [3.581]					
Father (Education—4)	4.065 [2.660]	— 12.41*** [3.762]			25.66*** [3.768]					
Father (Education—5)	26.09*** [2.736]	10.50** [3.831]			43.96*** [3.979]					
Father (Education—6)	51.73*** [2.922]	37.41*** [4.029]			66.89*** [4.348]					
Community (2)							11.50*** [0.953]	8.535*** [1.202]	13.53*** [1.555]	
Community (3)							20.18*** [0.935]	15.21*** [1.186]	25.43*** [1.517]	
Community (4)							25.93*** [0.983]	16.18*** [1.261]	40.04*** [1.560]	
Community (5)							33.36*** [1.203]	18.62*** [1.558]	53.16*** [1.876]	

Table 4 (continued)

	A1 (1) All sample	B1 (2) Only OECD	C1 (3) Only non- OECD	D1 (4) All sample	E1 (5) Only OECD	F1 (6) Only non- OECD	G1 (7) All sample	H1 (8) Only OECD	I1 (9) ONLY NON- OECD	L1 (10) ALL SAMPLE
Size										– 0.0712** [0.0267]
Constant	384.2*** [4.523]	472.3*** [4.488]	386.5*** [5.988]	291.7*** [4.392]	371.8*** [4.625]	263.6*** [6.148]	369.1*** [4.523]	461.6*** [4.556]	363.6*** [5.919]	381.1*** [4.742]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dum- mies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	46,597	30,090	16,194	46,597	30,090	16,194	46,001	29,879	15,809	43,035
		M1 (11) ONLY OECD		N1 (12) ONLY NON-OECD		O1 (13) ALL SAMPLE		P1 (14) ONLY OECD		Q1 (15) ONLY NON-OECD
Funds (Government)		Y = Science score 0.0529 [0.0346]		Y = Reading score 0.0845 [0.0489]		Y = Maths score 0.0489* [0.0245]		Y = Science score 0.0588 [0.0300]		Y = Reading score 0.0354 [0.0414]
Funds (Student fees)		0.0967** [0.0367]		0.0897 [0.0519]		0.0561* [0.0259]		0.0736* [0.0319]		0.0312 [0.0439]
Funds (Benefits)		0.00664 [0.0517]		0.152* [0.0698]		0.0687 [0.0360]		0.0607 [0.0449]		0.115 [0.0591]
Computers		0.00777* [0.00324]		0.00789 [0.00449]		0.00613** [0.00228]		0.00494 [0.00281]		0.00724 [0.00382]
Girls		0.0493*** [0.00129]		0.0302*** [0.00118]		0.0203*** [0.000792]		0.0294*** [0.00120]		0.0131*** [0.00105]

Table 4 (continued)

	M1 (11) ONLY OECD	N1 (12) ONLY NON-OECD	O1 (13) ALL SAMPLE	P1 (14) ONLY OECD	Q1 (15) ONLY NON-OECD
Ownership (1)	- 27.91*** [1.044]	- 36.36*** [1.475]	- 1.472 [0.781]	- 3.012** [0.952]	1.502 [1.352]
Mother (Education—2)			6.673** [2.439]	10.97** [3.436]	6.787* [3.440]
Mother (Education—3)			19.07*** [2.605]	25.93*** [3.727]	18.08*** [3.631]
Mother (Education—4)			39.27*** [2.715]	47.42*** [3.833]	35.80*** [3.854]
Mother (Education—5)			63.94*** [2.799]	71.03*** [3.911]	63.31*** [4.091]
Mother (Education—6)			88.09*** [3.011]	91.47*** [4.151]	95.16*** [4.471]
Father (Education—2)			- 20.93*** [2.658]	- 39.07*** [3.740]	1.575 [3.744]
Father (Education—3)			- 16.69*** [2.771]	- 34.09*** [3.958]	5.170 [3.868]
Father (Education—4)			- 0.443 [2.873]	- 17.22*** [4.052]	20.63*** [4.081]
Father (Education—5)			21.98*** [2.953]	6.739 [4.125]	38.23*** [4.304]
Father (Education—6)			48.12*** [3.143]	35.60*** [4.325]	59.06*** [4.686]
Community (2)			2.727** [0.870]	1.256 [1.093]	3.474* [1.426]

Table 5 Multivariate regression

	A2 (1) ALL SAM- PLE	B2 (2) ONLY OECD	C2 (3) ONLY NON- OECD	D2 (4) ALL SAM- PLE	E2 (5) ONLY OECD	F2 (6) ONLY NON- OECD	G2 (7) ALL SAM- PLE	H2 (8) ONLY OECD	I2 (9) ONLY NON- OECD	L2 (10) ALL SAMPLE
	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score
Funds (Gov- ernment)	0.0512 [0.0264]	0.0433 [0.0329]	0.0646 [0.0444]	0.0430 [0.0228]	0.0456 [0.0287]	0.0402 [0.0377]	0.0431 [0.0264]	0.0396 [0.0329]	0.0584 [0.0437]	0.0648* [0.0278]
Funds (Stu- dent fees)	0.0833** [0.0280]	0.0832* [0.0348]	0.0884 [0.0471]	0.0535* [0.0242]	0.0549 [0.0304]	0.0576 [0.0400]	0.0707* [0.0280]	0.0765* [0.0349]	0.0769 [0.0463]	0.0991*** [0.0295]
Funds (Ben- efits)	0.0317 [0.0389]	- 0.0192 [0.0493]	0.134* [0.0634]	0.0656 [0.0336]	0.0367 [0.0429]	0.133* [0.0539]	0.0302 [0.0388]	- 0.0137 [0.0493]	0.124* [0.0624]	0.0701 [0.0408]
Computers	0.00659** [0.00246]	0.00560 [0.00310]	0.00560 [0.00410]	0.00380 [0.00213]	0.00271 [0.00270]	0.00328 [0.00348]	0.00618* [0.00246]	0.00586 [0.00310]	0.00415 [0.00404]	0.00674** [0.00258]
Girls	0.0385*** [0.000781]	0.0510*** [0.00118]	0.0282*** [0.00102]	0.0225*** [0.000691]	0.0307*** [0.00106]	0.0155*** [0.000891]	0.0314*** [0.000821]	0.0460*** [0.00125]	0.0188*** [0.00105]	0.0403*** [0.000849]
Ownership (1)	- 31.52*** [0.793]	- 28.63*** [0.990]	- 37.63*** [1.317]	- 2.847*** [0.724]	- 2.951** [0.906]	- 2.648* [1.209]	- 27.78*** [0.804]	- 26.98*** [1.004]	- 29.82*** [1.326]	- 30.52*** [0.839]
Mother (Edu- cation—2)				8.109*** [2.215]	13.54*** [3.163]	6.947* [3.081]				
Mother (Edu- cation—3)				19.80*** [2.357]	26.93*** [3.417]	18.67*** [3.238]				
Mother (Edu- cation—4)				37.67*** [2.461]	46.72*** [3.528]	34.31*** [3.432]				
Mother (Edu- cation—5)				63.03*** [2.547]	71.31*** [3.610]	61.89*** [3.661]				
Mother (Edu- cation—6)				85.49*** [2.751]	90.33*** [3.852]	91.94*** [4.006]				

Table 5 (continued)

	A2 (1) ALL SAM- PLE	B2 (2) ONLY OECD	C2 (3) ONLY NON- OECD	D2 (4) ALL SAM- PLE	E2 (5) ONLY OECD	F2 (6) ONLY NON- OECD	G2 (7) ALL SAM- PLE	H2 (8) ONLY OECD	I2 (9) ONLY NON- OECD	L2 (10) ALL SAMPLE
Father (Education—2)	– 13.93*** [2.419]				– 29.81*** [3.464]	4.940 [3.340]				
Father (Education—3)	– 9.575*** [2.517]				– 28.30*** [3.656]	11.88*** [3.440]				
Father (Education—4)	6.242* [2.611]				– 12.06** [3.752]	27.16*** [3.619]				
Father (Education—5)	27.51*** [2.686]				10.45** [3.821]	43.76*** [3.822]				
Father (Education—6)	50.82*** [2.868]				35.60*** [4.018]	63.85*** [4.177]				
Community (2)							10.12*** [0.936]	7.301*** [1.196]	12.14*** [1.493]	
Community (3)							18.29*** [0.918]	13.33*** [1.180]	23.40*** [1.457]	
Community (4)							23.02*** [0.965]	13.92*** [1.254]	35.51*** [1.498]	
Community (5)							29.14*** [1.181]	14.25*** [1.550]	48.92*** [1.802]	
Size										– 0.0785** [0.0262]
Constant	388.5*** [4.424]	478.8*** [4.461]	393.8*** [5.709]	294.9*** [4.311]	376.4*** [4.613]	274.7*** [5.905]	374.9*** [4.441]	469.8*** [4.534]	372.6*** [5.683]	385.0*** [4.647]

Table 5 (continued)

	A2 (1)	B2 (2)	C2 (3)	D2 (4)	E2 (5)	F2 (6)	G2 (7)	H2 (8)	I2 (9)	L2 (10)
	ALL SAM- PLE	ONLY OECD	ONLY NON- OECD	ALL SAM- PLE	ONLY OECD	ONLY NON- OECD	ALL SAM- PLE	ONLY OECD	ONLY NON- OECD	ALL SAMPLE
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Time dum- mies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	46,597	30,090	16,194	46,597	30,090	16,194	46,001	29,879	15,809	43,035
	M2 (11)		N2 (12)		O2 (13)		P2 (14)		Q2 (15)	
	ONLY OECD		ONLY NON-OECD		ALL SAMPLE		ONLY OECD		ONLY NON-OECD	
Funds (Government)	Y = Science score		Y = Reading score		Y = Maths score		Y = Science score		Y = Reading score	
	0.0514		0.0867		0.0503*		0.0578		0.0393	
	[0.0345]		[0.0467]		[0.0241]		[0.0300]		[0.0401]	
Funds (Student fees)	0.0940*		0.107*		0.0643*		0.0734*		0.0520	
	[0.0366]		[0.0495]		[0.0256]		[0.0318]		[0.0425]	
Funds (Benefits)	0.0145		0.181**		0.0916**		0.0698		0.150**	
	[0.0515]		[0.0666]		[0.0355]		[0.0448]		[0.0573]	
Computers	0.00609		0.00590		0.00446*		0.00355		0.00460	
	[0.00322]		[0.00428]		[0.00225]		[0.00281]		[0.00370]	
Girls	0.0527***		0.0319***		0.0240***		0.0341***		0.0162***	
	[0.00129]		[0.00112]		[0.000782]		[0.00119]		[0.00101]	
Ownership (1)	- 28.06***		- 35.86***		- 2.760***		- 3.969***		- 0.744	
	[1.040]		[1.409]		[0.771]		[0.952]		[1.309]	

Table 5 (continued)

	M2 (11) ONLY OECD	N2 (12) ONLY NON-OECD	O2 (13) ALL SAMPLE	P2 (14) ONLY OECD	Q2 (15) ONLY NON-OECD
Mother (Education—2)			8.932 ^{***} [2.407]	15.00 ^{***} [3.435]	7.400 [*] [3.333]
Mother (Education—3)			21.07 ^{***} [2.570]	29.64 ^{***} [3.726]	18.79 ^{***} [3.517]
Mother (Education—4)			40.10 ^{***} [2.679]	50.58 ^{***} [3.832]	34.72 ^{***} [3.733]
Mother (Education—5)			65.07 ^{***} [2.762]	74.77 ^{***} [3.910]	61.24 ^{***} [3.962]
Mother (Education—6)			87.93 ^{***} [2.971]	94.37 ^{***} [4.150]	90.77 ^{***} [4.331]
Father (Education—2)			— 18.44 ^{***} [2.623]	— 36.58 ^{***} [3.739]	2.648 [3.627]
Father (Education—3)			— 14.35 ^{***} [2.734]	— 33.85 ^{***} [3.956]	7.488 [*] [3.747]
Father (Education—4)			2.085 [2.835]	— 16.66 ^{***} [4.051]	22.59 ^{***} [3.953]
Father (Education—5)			23.91 ^{***} [2.914]	6.946 [4.123]	38.93 ^{***} [4.169]
Father (Education—6)			47.97 ^{***} [3.102]	34.14 ^{***} [4.323]	57.44 ^{***} [4.540]
Community (2)			1.188 [0.859]	— 0.242 [1.093]	2.181 [1.381]
Community (3)			2.114 [*] [0.855]	— 0.333 [1.090]	4.355 ^{***} [1.382]

Table 5 (continued)

	M2 (11) ONLY OECD	N2 (12) ONLY NON-OECD	O2 (13) ALL SAMPLE	P2 (14) ONLY OECD	Q2 (15) ONLY NON-OECD
Community (4)			– 2.233 [*] [0.914]	– 8.146 ^{***} [1.173]	6.555 ^{***} [1.456]
Community (5)			– 1.913 [1.124]	– 10.86 ^{***} [1.454]	11.14 ^{***} [1.767]
Size	0.0214 [0.0304]	– 0.432 ^{***} [0.0522]	– 0.0262 [0.0227]	0.0214 [0.0265]	– 0.205 ^{***} [0.0449]
Constant	476.0 ^{***} [4.652]	394.4 ^{***} [6.045]	294.4 ^{***} [4.548]	375.3 ^{***} [4.836]	277.8 ^{***} [6.330]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES
Observations	28,005	14,839	42,485	27,822	14,472

Determinants of science test score

Math score: school performance, i.e. test score of student averaged by school in Math; Reading score: school performance, i.e. test score of student averaged by school in Reading; Science score: school performance, i.e. test score of student averaged by school in Science; Funds (Government): Funding obtained by each school by the Government (%); Funds (Student fees): Funding obtained by each school by Student fees (%); Funds (Benefits): Funding obtained by each school by Benefits (%); Funds (Other Source): Funding obtained by each school by other source (%); Computers: Number of computers connected to the internet; Girls: Number of girls enrolled in the school; Ownership: Set of dummies (0=public; 1=private) denoting the typology of school (private is used as benchmark group); Father (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 3B; 6=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 5B; 6=ISCED level 5A) describing the mothers' education (1 used as benchmark group); Community: Set of dummies ((1=village (>3,000 people); 2=small town (3,000 < people < 15,000); 3=town (15,000 < people < 100,000); 4=city (100,000 < people < 1,000,000); 5=large city (>1,000,000 people)) describing the community in which school is located (1 used as benchmark group); Size: Student-teacher ratio. The estimation allows for time and Country-level fixed effects. Standard errors are in parenthesis. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level; Standard errors in brackets

Table 6 Multivariate regression

	A3 (1) ALL SAM- PLE	B3 (2) ONLY OECD	C3 (3) ONLY NON- OECD	D3 (4) ALL SAM- PLE	E3 (5) ONLY OECD	F3 (6) ONLY NON- OECD	G3 (7) ALL SAM- PLE	H3 (8) ONLY OECD	I3 (9) ONLY NON- OECD	L3 (10) ALL SAMPLE
	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score
Funds (Gov- ernment)	0.0528 [0.0277]	0.0377 [0.0338]	0.0769 [0.0482]	0.0442 [0.0241]	0.0391 [0.0296]	0.0495 [0.0411]	0.0459 [0.0276]	0.0337 [0.0337]	0.0758 [0.0473]	0.0658* [0.0291]
Funds (Stu- dent fees)	0.0894** [0.0294]	0.0853* [0.0358]	0.100 [0.0511]	0.0584* [0.0255]	0.0558 [0.0313]	0.0659 [0.0436]	0.0768** [0.0292]	0.0768* [0.0357]	0.0925 [0.0501]	0.104*** [0.0308]
Funds (Ben- efits)	- 0.000176 [0.0408]	- 0.0472 [0.0505]	0.0963 [0.0688]	0.0351 [0.0355]	0.0107 [0.0443]	0.0964 [0.0587]	- [0.0405]	- 0.0416 [0.0505]	0.0881 [0.0675]	0.0343 [0.0427]
Computers	0.00612* [0.00258]	0.00463 [0.00318]	0.00589 [0.00445]	0.00322 [0.00225]	0.00170 [0.00278]	0.00353 [0.00379]	0.00551* [0.00257]	0.00472 [0.00317]	0.00413 [0.00437]	0.00650* [0.00270]
Girls	0.0506*** [0.000818]	0.0650*** [0.00122]	0.0389*** [0.00111]	0.0339*** [0.000729]	0.0441*** [0.00109]	0.0252*** [0.000970]	0.0418*** [0.000857]	0.0582*** [0.00128]	0.0277*** [0.00114]	0.0529*** [0.000888]
Ownership (1)	- 35.03*** [0.831]	- 32.00*** [1.016]	- 41.74*** [1.430]	- 5.471*** [0.764]	- 6.270*** [0.935]	- 3.967** [1.317]	- 30.27*** [0.840]	- 29.60*** [1.028]	- 32.38*** [1.435]	- 33.78*** [0.877]
Mother (Edu- cation—2)				10.72*** [2.336]	12.43*** [3.265]	12.67*** [3.356]				
Mother (Edu- cation—3)				22.70*** [2.485]	27.27*** [3.528]	23.46*** [3.526]				
Mother (Edu- cation—4)				41.26*** [2.595]	47.19*** [3.642]	40.20*** [3.738]				
Mother (Edu- cation—5)				67.36*** [2.685]	72.14*** [3.726]	69.44*** [3.987]				

Table 6 (continued)

	A3 (1) ALL SAM- PLE	B3 (2) ONLY OECD	C3 (3) ONLY NON- OECD	D3 (4) ALL SAM- PLE	E3 (5) ONLY OECD	F3 (6) ONLY NON- OECD	G3 (7) ALL SAM- PLE	H3 (8) ONLY OECD	I3 (9) ONLY NON- OECD	L3 (10) ALL SAMPLE
Mother (Education—6)	92.14*** [2.901]	91.44*** [3.976]	105.5*** [4.363]	92.14*** [2.901]	91.44*** [3.976]	105.5*** [4.363]				
Father (Education—2)	— 11.07*** [2.551]	— 23.18*** [3.576]	4.078 [3.637]	— 11.07*** [2.551]	— 23.18*** [3.576]	4.078 [3.637]				
Father (Education—3)	— 6.486* [2.654]	— 19.34*** [3.774]	9.543* [3.746]	— 6.486* [2.654]	— 19.34*** [3.774]	9.543* [3.746]				
Father (Education—4)	9.943*** [2.753]	— 3.135 [3.873]	26.52*** [3.942]	9.943*** [2.753]	— 3.135 [3.873]	26.52*** [3.942]				
Father (Education—5)	30.79*** [2.832]	18.75*** [3.944]	43.29*** [4.163]	30.79*** [2.832]	18.75*** [3.944]	43.29*** [4.163]				
Father (Education—6)	54.42*** [3.024]	43.06*** [4.148]	65.14*** [4.549]	54.42*** [3.024]	43.06*** [4.148]	65.14*** [4.549]				
Community (2)							12.29*** [0.978]	8.282*** [1.225]	16.21*** [1.616]	
Community (3)							22.10*** [0.959]	16.19*** [1.208]	28.39*** [1.576]	
Community (4)							28.46*** [1.009]	17.88*** [1.285]	43.13*** [1.621]	
Community (5)							35.94*** [1.234]	20.12*** [1.587]	56.86*** [1.950]	
Size										— 0.0799** [0.0274]

Table 6 (continued)

	A3 (1) ALL SAM- PLE	B3 (2) ONLY OECD	C3 (3) ONLY NON- OECD	D3 (4) ALL SAM- PLE	E3 (5) ONLY OECD	F3 (6) ONLY NON- OECD	G3 (7) ALL SAM- PLE	H3 (8) ONLY OECD	I3 (9) ONLY NON- OECD	L3 (10) ALL SAMPLE
Constant	370.8*** [4.639]	480.4*** [4.578]	373.7*** [6.199]	269.1*** [4.545]	369.5*** [4.762]	245.3*** [6.431]	353.9*** [4.639]	469.1*** [4.643]	347.4*** [6.149]	367.4*** [4.859]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	46,597	30,090	16,194	46,597	30,090	16,194	46,001	29,879	15,809	43,035
	M3 (11) ONLY OECD		N3 (12) ONLY NON-OECD		O3 (13) ALL SAMPLE		P3 (14) ONLY OECD		Q3 (15) ONLY NON-OECD	
Funds (Government)	Y = Science score		Y = Reading score		Y = Maths score		Y = Science score		Y = Reading score	
	0.0501		0.0899		0.0527*		0.0562		0.0440	
	[0.0352]		[0.0507]		[0.0254]		[0.0309]		[0.0436]	
Funds (Student fees)	0.0990**		0.110*		0.0688*		0.0769*		0.0557	
	[0.0374]		[0.0538]		[0.0269]		[0.0328]		[0.0462]	
Funds (Benefits)	- 0.00830		0.128		0.0576		0.0472		0.0988	
	[0.0526]		[0.0724]		[0.0373]		[0.0462]		[0.0623]	
Computers	0.00523		0.00673		0.00401		0.00250		0.00527	
	[0.00330]		[0.00465]		[0.00236]		[0.00289]		[0.00402]	
Girls	0.0675***		0.0428***		0.0348***		0.0472***		0.0251***	
	[0.00132]		[0.00122]		[0.000821]		[0.00123]		[0.00110]	

Table 6 (continued)

	M3 (11) ONLY OECD	N3 (12) ONLY NON-OECD	O3 (13) ALL SAMPLE	P3 (14) ONLY OECD	Q3 (15) ONLY NON-OECD
Ownership (1)	- 30.98*** [1.063]	- 40.16*** [1.530]	- 4.695*** [0.810]	- 6.579*** [0.980]	- 1.640 [1.424]
Mother (Education—2)			11.72*** [2.529]	14.64*** [3.536]	12.38*** [3.623]
Mother (Education—3)			23.45*** [2.701]	29.82*** [3.835]	22.55*** [3.824]
Mother (Education—4)			43.22*** [2.815]	50.91*** [3.945]	39.66*** [4.059]
Mother (Education—5)			68.93*** [2.902]	75.57*** [4.025]	67.55*** [4.308]
Mother (Education—6)			93.79*** [3.122]	95.08*** [4.272]	102.8*** [4.709]
Father (Education—2)			- 14.27*** [2.756]	- 28.83*** [3.849]	2.953 [3.943]
Father (Education—3)			- 10.71*** [2.873]	- 24.42*** [4.073]	5.540 [4.074]
Father (Education—4)			5.857* [2.979]	- 7.862 [4.170]	22.14*** [4.298]
Father (Education—5)			26.72*** [3.062]	14.60*** [4.244]	38.23*** [4.533]
Father (Education—6)			50.54*** [3.259]	40.59*** [4.451]	57.76*** [4.936]
Community (2)			2.794** [0.903]	0.183 [1.125]	5.281*** [1.501]

Table 6 (continued)

	M3 (11) ONLY OECD	N3 (12) ONLY NON-OECD	O3 (13) ALL SAMPLE	P3 (14) ONLY OECD	Q3 (15) ONLY NON-OECD
Community (3)			5.486*** [0.899]	1.977 [1.122]	8.511*** [1.502]
Community (4)			2.499** [0.960]	- 4.793*** [1.207]	12.55*** [1.583]
Community (5)			4.201*** [1.181]	- 5.338*** [1.496]	16.77*** [1.922]
Size	0.0294 [0.0311]	- 0.447*** [0.0567]	- 0.0307 [0.0239]	0.0234 [0.0273]	- 0.215*** [0.0488]
Constant	476.2*** [4.754]	375.5*** [6.566]	267.0*** [4.779]	366.1*** [4.979]	247.6*** [6.882]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES
Observations	28,005	14,839	42,485	27,822	14,472

Determinants of reading test score

Math score: school performance, i.e. test score of student averaged by school in Math; Reading score: school performance, i.e. test score of student averaged by school in Reading; Science score: school performance, i.e. test score of student averaged by school in Science; Funds (Government): Funding obtained by each school by the Government (%); Funds (Student fees): Funding obtained by each school by Student fees (%); Funds (Benefits): Funding obtained by each school by Benefits (%); Funds (Other Source): Funding obtained by each school by other source (%); Computers: Number of computers connected to the internet; Girls: Number of girls enrolled in the school; Ownership: Set of dummies (0=public; 1=private) denoting the typology of school (private is used as benchmark group); Father (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 3B; 6=ISCED level 3B or 3C; 4=ISCED level 1 used as benchmark group); Mother (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 3B; 6=ISCED level 3B or 3C; 4=ISCED level 1 used as benchmark group); Community: Set of dummies ((1=village (>3,000 people); 2=small town (3,000 < people < 15,000); 3=town (15,000 < people < 100,000); 4=city (100,000 < people < 1,000,000); 5=large city (>1,000,000 people)) describing the community in which school is located (1 used as benchmark group); Size: Student-teacher ratio. The estimation allows for time and Country-level fixed effects. Standard errors are in parenthesis. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level; Standard errors in brackets

Appendix 3: Tables on quantile regression

See Tables 7, 8, 9, 10

Table 7 Quantile regression

	A1 (1) ALL SAMPLE ONLY OECD	B1 (2) ONLY NON- OECD	C1 (3) ONLY NON- OECD	D1 (4) ALL SAMPLE ONLY OECD	E1 (5) ONLY NON- OECD	F1 (6) ONLY NON- OECD	G1 (7) ALL SAMPLE ONLY OECD	H1 (8) ONLY NON- OECD	I1 (9) ONLY NON- OECD	L1 (10) ALL SAMPLE
	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score
Funds (Govern- ment)	0.0604* [0.0256]	0.0599* [0.0256]	0.0603 [0.0386]	0.0603* [0.0216]	0.0522* [0.0249]	0.104** [0.0327]	0.0682* [0.0277]	0.0566* [0.0280]	0.0795* [0.0393]	0.0893** [0.0272]
Funds (Student fees)	0.0724** [0.0274]	0.0828** [0.0278]	0.0571 [0.0423]	0.0581* [0.0231]	0.0473 [0.0273]	0.119** [0.0362]	0.0753* [0.0293]	0.0801** [0.0302]	0.0889* [0.0421]	0.103*** [0.0291]
Funds (Ben- efits)	0.00750 [0.0410]	- 0.0295 [0.0443]	0.146* [0.0676]	0.0736* [0.0374]	0.0195 [0.0480]	0.198*** [0.0566]	0.0274 [0.0452]	- 0.0476 [0.0474]	0.122* [0.0609]	0.0936* [0.0463]
Computers	0.00623* [0.00245]	0.00424* [0.00201]	0.00939* [0.00423]	0.00222 [0.00202]	0.00128 [0.00288]	0.00117 [0.00397]	0.00594** [0.00183]	0.00411 [0.00218]	0.00599 [0.00376]	0.00648* [0.00261]
Girls	0.0407*** [0.000980]	0.0491*** [0.000907]	0.0322*** [0.00120]	0.0182*** [0.000451]	0.0228*** [0.000669]	0.0141*** [0.000605]	0.0316*** [0.000723]	0.0438*** [0.00124]	0.0187*** [0.00126]	0.0424*** [0.00111]
Ownership (1)	- 33.00*** [1.037]	- 29.99*** [1.157]	- 40.60*** [1.966]	- 3.002*** [0.767]	- 3.317*** [0.923]	- 2.109 [1.473]	- 29.56*** [0.936]	- 28.04*** [1.175]	- 33.16*** [1.857]	- 32.18*** [1.067]
Mother (Educa- tion—2)				13.24*** [2.532]	18.32*** [4.654]	8.522* [3.346]				
Mother (Educa- tion—3)				26.98*** [2.681]	34.10*** [4.868]	22.22*** [3.499]				
Mother (Educa- tion—4)				45.22*** [2.782]	53.82*** [4.947]	38.85*** [3.707]				

Table 7 (continued)

	A1 (1) ALL SAMPLE	B1 (2) ONLY OECD	C1 (3) ONLY NON- OECD	D1 (4) ALL SAMPLE	E1 (5) ONLY OECD	F1 (6) ONLY NON- OECD	G1 (7) ALL SAMPLE	H1 (8) ONLY OECD	I1 (9) ONLY NON- OECD	L1 (10) ALL SAMPLE
Mother (Education—5)				70.48*** [2.869]	78.35*** [5.021]	66.01*** [4.036]				
Mother (Education—6)				93.93*** [3.050]	97.77*** [5.198]	99.04*** [4.540]				
Father (Education—2)				- 7.877* [3.448]	- 18.13** [6.789]	5.017 [3.810]				
Father (Education—3)				- 3.026 [3.529]	- 16.48* [6.903]	11.08** [3.879]				
Father (Education—4)				12.38*** [3.624]	- 2.115 [6.981]	27.03*** [3.982]				
Father (Education—5)				33.24*** [3.684]	18.44** [7.016]	45.89*** [4.287]				
Father (Education—6)				59.23*** [3.803]	45.75*** [7.150]	68.61*** [4.803]				
Community (2)							9.151*** [0.867]	5.165*** [1.155]	14.24*** [1.618]	
Community (3)							14.98*** [0.912]	9.476*** [1.195]	23.47*** [1.643]	
Community (4)							21.63*** [0.976]	12.15*** [1.342]	36.57*** [1.667]	
Community (5)							28.32*** [1.353]	13.52*** [1.796]	48.97*** [2.411]	
Size										- 0.0698 [0.0400]

Table 7 (continued)

	A1 (1) ALL SAMPLE	B1 (2) ONLY OECD	C1 (3) ONLY NON- OECD	D1 (4) ALL SAMPLE	E1 (5) ONLY OECD	F1 (6) ONLY NON- OECD	G1 (7) ALL SAMPLE	H1 (8) ONLY OECD	I1 (9) ONLY NON- OECD	L1 (10) ALL SAMPLE
Constant	389.2*** [6.358]	473.5*** [4.176]	390.9*** [7.354]	278.8*** [5.723]	357.7*** [6.873]	253.9*** [6.522]	375.7*** [6.192]	467.0*** [4.486]	371.3*** [6.646]	382.1*** [6.903]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	46,723	30,214	16,196	46,723	30,214	16,196	46,126	30,002	15,811	43,154
	M1 (11) ONLY OECD		N1 (12) ONLY NON-OECD		O1 (13) ALL SAMPLE		P1 (14) ONLY OECD		Q1 (15) ONLY NON-OECD	
Funds (Government)	Y = Science score		Y = Reading score		Y = Maths score		Y = Science score		Y = Reading score	
	0.0900** [0.0275]		0.0502 [0.0435]		0.0591*** [0.0152]		0.0642* [0.0299]		0.0768 [0.0430]	
Funds (Student fees)	0.114*** [0.0299]		0.0434 [0.0473]		0.0626*** [0.0173]		0.0654* [0.0323]		0.0934* [0.0461]	
Funds (Benefits)	0.0267 [0.0463]		0.198** [0.0617]		0.0945** [0.0350]		0.0636 [0.0515]		0.176** [0.0643]	
Computers	0.00411 [0.00255]		0.00898* [0.00447]		0.00273 [0.00239]		0.000817 [0.00244]		0.00512 [0.00472]	
Girls	0.0496*** [0.000836]		0.0360*** [0.00144]		0.0193*** [0.000594]		0.0259*** [0.000695]		0.0143*** [0.00113]	
Ownership (1)	- 29.13*** [1.205]		- 39.76*** [2.077]		- 2.648** [0.825]		- 4.643*** [0.994]		- 0.332 [1.577]	

Table 7 (continued)

	M1 (11) ONLY OECD	N1 (12) ONLY NON-OECD	O1 (13) ALL SAMPLE	P1 (14) ONLY OECD	Q1 (15) ONLY NON-OECD
Mother (Education—2)			14.61 ^{***}	19.55 ^{***}	9.630 ^{**}
			[3.513]	[5.073]	[3.480]
Mother (Education—3)			28.41 ^{***}	35.37 ^{***}	24.13 ^{***}
			[3.665]	[5.337]	[3.651]
Mother (Education—4)			47.64 ^{***}	56.47 ^{***}	39.70 ^{***}
			[3.762]	[5.429]	[3.970]
Mother (Education—5)			72.67 ^{***}	80.85 ^{***}	66.11 ^{***}
			[3.828]	[5.494]	[4.288]
Mother (Education—6)			96.64 ^{***}	101.2 ^{***}	98.27 ^{***}
			[4.003]	[5.689]	[4.796]
Father (Education—2)			− 9.981 [*]	− 23.67 ^{**}	1.205
			[4.139]	[7.695]	[4.222]
Father (Education—3)			− 6.359	− 19.76 [*]	5.152
			[4.217]	[7.858]	[4.429]
Father (Education—4)			10.21 [*]	− 4.428	20.81 ^{***}
			[4.300]	[7.937]	[4.641]
Father (Education—5)			31.32 ^{***}	17.56 [*]	39.31 ^{***}
			[4.362]	[7.976]	[4.893]
Father (Education—6)			58.02 ^{***}	46.59 ^{***}	60.47 ^{***}
			[4.506]	[8.083]	[5.354]
Community (2)			1.543	− 0.745	4.610 ^{**}
			[0.881]	[1.002]	[1.616]
Community (3)			0.913	− 1.802	5.026 ^{**}
			[0.851]	[1.022]	[1.683]

Table 7 (continued)

	M1 (11) ONLY OECD	N1 (12) ONLY NON-OECD	O1 (13) ALL SAMPLE	P1 (14) ONLY OECD	Q1 (15) ONLY NON-OECD
Community (4)			− 1.790 [*] [0.897]	− 8.040 ^{***} [1.101]	9.334 ^{***} [1.742]
Community (5)			− 0.429 [1.147]	− 9.511 ^{***} [1.517]	12.93 ^{***} [2.145]
Size	0.0354 [0.0280]	− 0.407 ^{***} [0.0553]	− 0.0179 [0.0101]	0.0358 [0.0207]	− 0.215 ^{***} [0.0400]
Constant	468.7 ^{***} [4.133]	393.9 ^{***} [7.638]	276.3 ^{***} [5.985]	354.5 ^{***} [7.728]	260.7 ^{***} [7.895]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES
Observations	28,122	14,841	42,603	27,938	14,474

Determinants of math test score

Math score: school performance, i.e. test score of student averaged by school in Math; Reading score: school performance, i.e. test score of student averaged by school in Reading; Science score: school performance, i.e. test score of student averaged by school in Science; Funds (Government): Funding obtained by each school by the Government (%); Funds (Student fees): Funding obtained by each school by Student fees (%); Funds (Benefits): Funding obtained by each school by Benefits (%); Funds (Other Source): Funding obtained by each school by other source (%); Computers: Number of computers connected to the internet; Girls: Number of girls enrolled in the school; Ownership: Set of dummies (0=public; 1=private) denoting the typology of school (private is used as benchmark group); Father (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 3B; 6=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 5B; 6=ISCED level 5A) describing the mothers' education (1 used as benchmark group); Mother (Education): set of dummies (1 used as benchmark group); Community: Set of dummies ((1=village (>3,000 people); 2=small town (3,000 < people < 15,000); 3=town (15,000 < people < 100,000); 4=city (100,000 < people < 1,000,000); 5=large city (>1,000,000 people)) describing the community in which school is located (1 used as benchmark group); Size: Student-teacher ratio. The estimation allows for time and Country-level fixed effects. Standard errors are in parenthesis. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level; Standard errors in brackets

Table 8 Quantile regression

	A2 (1) ALL SAM- PLE	B2 (2) ONLY OECD	C2 (3) ONLY NON- OECD	D2 (4) ALL SAM- PLE	E2 (5) ONLY OECD	F2 (6) ONLY NON- OECD	G2 (7) ALL SAM- PLE	H2 (8) ONLY OECD	I2 (9) ONLY NON- OECD	L2 (10) ALL SAMPLE
	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score
Funds (Gov- ernment)	0.0481** [0.0185]	0.0636* [0.0273]	0.0365 [0.0501]	0.0683*** [0.0191]	0.0899*** [0.0223]	0.0456 [0.0388]	0.0686* [0.0268]	0.0789** [0.0302]	0.0926* [0.0469]	0.0543* [0.0242]
Funds (Stu- dent fees)	0.0656** [0.0207]	0.0826** [0.0295]	0.0514 [0.0531]	0.0702*** [0.0210]	0.0856*** [0.0246]	0.0683 [0.0407]	0.0809** [0.0286]	0.0932** [0.0324]	0.106* [0.0503]	0.0739** [0.0265]
Funds (Ben- efits)	0.0228 [0.0329]	- 0.0183 [0.0426]	0.130 [0.0784]	0.0890** [0.0305]	0.0698 [0.0359]	0.159** [0.0556]	0.0534 [0.0425]	0.0149 [0.0505]	0.175** [0.0651]	0.0587 [0.0397]
Computers	0.00834** [0.00262]	0.00599* [0.00250]	0.0109* [0.00466]	0.00557** [0.00191]	0.00443 [0.00275]	0.00416 [0.00313]	0.00730** [0.00257]	0.00656** [0.00214]	0.00716 [0.00564]	0.00772** [0.00257]
Girls	0.0420*** [0.000788]	0.0491*** [0.00107]	0.0351*** [0.00123]	0.0208*** [0.000372]	0.0256*** [0.000546]	0.0153*** [0.000888]	0.0337*** [0.000594]	0.0447*** [0.000740]	0.0233*** [0.00132]	0.0438*** [0.000785]
Ownership (1)	- 33.02*** [1.012]	- 30.45*** [1.129]	- 38.41*** [1.881]	- 3.566*** [0.769]	- 3.657*** [0.928]	- 2.896* [1.260]	- 29.28*** [1.014]	- 28.61*** [1.153]	- 31.51*** [1.841]	- 32.47*** [1.083]
Mother (Edu- cation—2)				13.29*** [2.192]	23.10*** [4.084]	7.580* [3.117]				
Mother (Edu- cation—3)				25.60*** [2.351]	37.79*** [4.373]	19.65*** [3.290]				
Mother (Edu- cation—4)				42.36*** [2.474]	56.16*** [4.479]	33.82*** [3.516]				
Mother (Edu- cation—5)				67.83*** [2.578]	81.06*** [4.554]	60.39*** [3.832]				
Mother (Edu- cation—6)				89.49*** [2.786]	98.67*** [4.764]	90.86*** [4.247]				

Table 8 (continued)

	A2 (1) ALL SAM- PLE	B2 (2) ONLY OECD	C2 (3) ONLY NON- OECD	D2 (4) ALL SAM- PLE	E2 (5) ONLY OECD	F2 (6) ONLY NON- OECD	G2 (7) ALL SAM- PLE	H2 (8) ONLY OECD	I2 (9) ONLY NON- OECD	L2 (10) ALL SAMPLE
Father (Education—2)				– 5.535 [3.370]	– 19.67*** [4.570]	4.046 [4.286]				
Father (Education—3)				– 1.895 [3.449]	– 20.48*** [4.730]	11.44** [4.431]				
Father (Education—4)				13.40*** [3.557]	– 6.026 [4.834]	28.16*** [4.594]				
Father (Education—5)				33.03*** [3.618]	13.77** [4.891]	46.06*** [4.800]				
Father (Education—6)				57.83*** [3.773]	40.87*** [5.022]	66.45*** [5.239]				
Community (2)							6.816*** [0.875]	3.196** [1.023]	11.38*** [1.389]	
Community (3)							13.27*** [0.892]	8.077*** [1.041]	21.39*** [1.620]	
Community (4)							18.34*** [0.972]	9.980*** [1.177]	30.81*** [1.641]	
Community (5)							23.66*** [1.409]	9.296*** [1.708]	42.45*** [2.123]	
Size										– 0.0812*** [0.0164]
Constant	391.6*** [4.063]	488.5*** [4.318]	393.7*** [6.186]	278.8*** [4.840]	365.8*** [4.869]	273.4*** [7.378]	378.3*** [5.067]	480.7*** [4.455]	371.8*** [6.566]	387.9*** [4.780]

Table 8 (continued)

	A2 (1) ALL SAM- PLE	B2 (2) ONLY OECD	C2 (3) ONLY NON- OECD	D2 (4) ALL SAM- PLE	E2 (5) ONLY OECD	F2 (6) ONLY NON- OECD	G2 (7) ALL SAM- PLE	H2 (8) ONLY OECD	I2 (9) ONLY NON- OECD	L2 (10) ALL SAMPLE
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Time dum- mies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	46,725	30,217	16,195	46,725	30,217	16,195	46,127	30,004	15,810	43,156
	M2 (11) ONLY OECD		N2 (12) ONLY NON-OECD		O2 (13) ALL SAMPLE		P2 (14) ONLY OECD		Q2 (15) ONLY NON-OECD	
Funds (Government)	Y = Science score		Y = Reading score		Y = Maths score		Y = Science score		Y = Reading score	
	0.0685 [*]		0.0447		0.0844 ^{***}		0.0942 ^{***}		0.0314	
	[0.0330]		[0.0470]		[0.0218]		[0.0233]		[0.0375]	
Funds (Student fees)	0.0882 [*]		0.0545		0.0908 ^{***}		0.100 ^{***}		0.0448	
	[0.0352]		[0.0501]		[0.0233]		[0.0259]		[0.0395]	
Funds (Benefits)	0.0142		0.177 [*]		0.128 ^{***}		0.106 ^{**}		0.176 ^{**}	
	[0.0463]		[0.0728]		[0.0330]		[0.0377]		[0.0569]	
Computers	0.00554 [*]		0.00991		0.00587 ^{**}		0.00406		0.00434	
	[0.00259]		[0.00515]		[0.00206]		[0.00336]		[0.00320]	
Girls	0.0512 ^{***}		0.0391 ^{***}		0.0237 ^{***}		0.0301 ^{***}		0.0167 ^{***}	
	[0.000846]		[0.00132]		[0.000431]		[0.000759]		[0.000878]	
Ownership (1)	- 30.01 ^{***}		- 36.79 ^{***}		- 3.676 ^{***}		- 5.350 ^{***}		- 1.305	
	[1.145]		[2.020]		[0.805]		[1.009]		[1.265]	

Table 8 (continued)

	M2 (11) ONLY OECD	N2 (12) ONLY NON-OECD	O2 (13) ALL SAMPLE	P2 (14) ONLY OECD	Q2 (15) ONLY NON-OECD
Mother (Education—2)			15.04 ^{***} [2.831]	27.33 ^{***} [5.019]	6.813 [3.791]
Mother (Education—3)			28.19 ^{***} [2.988]	41.93 ^{***} [5.335]	18.64 ^{***} [3.983]
Mother (Education—4)			45.53 ^{***} [3.089]	61.44 ^{***} [5.427]	33.44 ^{***} [4.182]
Mother (Education—5)			70.71 ^{***} [3.177]	85.99 ^{***} [5.494]	59.77 ^{***} [4.442]
Mother (Education—6)			92.48 ^{***} [3.376]	104.3 ^{***} [5.642]	90.12 ^{***} [4.823]
Father (Education—2)			— 10.63 ^{***} [3.664]	— 24.88 ^{***} [5.670]	1.320 [5.308]
Father (Education—3)			— 6.762 [3.729]	— 24.47 ^{***} [5.813]	7.184 [5.408]
Father (Education—4)			9.875 [*] [3.835]	— 7.672 [5.929]	23.59 ^{***} [5.569]
Father (Education—5)			29.93 ^{***} [3.903]	13.77 [*] [5.997]	40.67 ^{***} [5.766]
Father (Education—6)			56.09 ^{***} [4.075]	42.81 ^{***} [6.123]	58.91 ^{***} [6.106]
Community (2)			— 0.916 [0.822]	— 2.507 [*] [1.126]	1.624 [1.433]
Community (3)			— 1.567 [0.850]	— 3.564 ^{**} [1.116]	2.683 [1.520]

Table 8 (continued)

	M2 (11)	N2 (12)	O2 (13)	P2 (14)	Q2 (15)
Community (4)	ONLY OECD	ONLY NON-OECD	ALL SAMPLE	ONLY OECD	ONLY NON-OECD
Community (5)					
Size	0.00774 [0.0261]	− 0.501*** [0.0551]	− 4.792*** [0.912]	− 10.48*** [1.204]	5.373*** [1.576]
Constant	486.1*** [4.701]	397.9*** [5.801]	− 5.084*** [1.182]	− 14.59*** [1.518]	9.289*** [1.839]
Wald test (<i>p</i> value)	0.000	0.000	0.0423*** [0.00939]	0.0229 [0.0182]	− 0.230*** [0.0421]
Time dummies	YES	YES	280.2*** [5.166]	363.1*** [5.997]	277.6*** [7.991]
Country dummies	YES	YES	0.000	0.000	0.000
Observations	28,125	14,840	YES	YES	YES
			42,604	27,940	14,473

Determinants of science test score

Math score: school performance, i.e. test score of student averaged by school in Math; Reading score: school performance, i.e. test score of student averaged by school in Reading; Science score: school performance, i.e. test score of student averaged by school in Science; Funds (Government): Funding obtained by each school by the Government (%); Funds (Student fees): Funding obtained by each school by Student fees (%); Funds (Benefits): Funding obtained by each school by Benefits (%); Funds (Other Source): Funding obtained by each school by other source (%); Computers: Number of computers connected to the internet; Girls: Number of girls enrolled in the school; Ownership: Set of dummies (0=public; 1=private) denoting the typology of school (private is used as benchmark group); Father (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 3B; 6=ISCED level 5A) describing the fathers' education (1 used as benchmark group); Mother (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 5B; 6=ISCED level 5A) describing the mothers' education (1 used as benchmark group); Community: Set of dummies ((1=village (>3,000 people); 2=small town (3,000 < people < 15,000); 3=town (15,000 < people < 100,000); 4=city (100,000 < people < 1,000,000); 5=large city (>1,000,000 people)) describing the community in which school is located (1 used as benchmark group); Size: Student-teacher ratio. The estimation allows for time and Country-level fixed effects. Standard errors are in parenthesis. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level; Standard errors in brackets

Table 9 Quantile regression

	A3 (1) ALL SAM- PLE	B3 (2) ONLY OECD	C3 (3) ONLY NON- OECD	D3 (4) ALL SAM- PLE	E3 (5) ONLY OECD	F3 (6) ONLY NON- OECD	G3 (7) ALL SAM- PLE	H3 (8) ONLY OECD	I3 (9) ONLY NON- OECD	L3 (10) ALL SAMPLE
	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score
Funds (Gov- ernment)	0.0557* [0.0234]	0.0265 [0.0282]	0.1119* [0.0555]	0.0598* [0.0260]	0.0665* [0.0312]	0.0680 [0.0510]	0.0488 [0.0259]	0.0342 [0.0334]	0.0810 [0.0535]	0.0657* [0.0266]
Funds (Stu- dent fees)	0.0892*** [0.0234]	0.0570 [0.0282]	0.148* [0.0555]	0.0682* [0.0260]	0.0761* [0.0312]	0.0847 [0.0510]	0.0762** [0.0259]	0.0669 [0.0334]	0.104 [0.0535]	0.0945*** [0.0266]
Funds (Ben- efits)	0.0253 [0.0153]	0.0311 [0.0279]	0.0592 [0.0222]	0.0276 [0.0560]	0.0330 [0.0252]	0.0538 [0.140]	0.0275 [0.000334]	0.0362 [0.0617]	0.0565 [0.116]	0.0285 [0.0599]
Computers	0.0406 [0.00609]	0.0422 [0.00530]	0.0737 [0.0108]	0.0415 [0.00579]	0.0480 [0.00285]	0.0734 [0.00266]	0.0357 [0.00653]	0.0475 [0.00400]	0.0728 [0.00649]	0.0424 [0.00679]
Girls	0.00263 [0.0560]	0.00300 [0.0641]	0.00579 [0.0459]	0.00270 [0.0337]	0.00319 [0.0398]	0.00479 [0.0269]	0.00298 [0.0451]	0.00284 [0.0571]	0.00509 [0.0312]	0.00284 [0.0579]
Ownership (1)	0.000534 [0.000534]	0.00117 [0.00117]	0.000804 [0.000804]	0.000702 [0.000702]	0.000530 [0.000530]	0.00116 [0.00116]	0.000577 [0.000577]	0.000534 [0.000534]	0.00151 [0.00151]	0.000910 [0.000910]
	- 36.47*** [0.896]	- 34.80*** [1.058]	- 42.91*** [2.119]	- 5.298*** [0.843]	- 6.761*** [1.026]	- 2.470 [1.551]	- 32.32*** [0.978]	- 31.62*** [1.073]	- 34.32*** [1.967]	- 35.85*** [0.977]
Mother (Edu- cation—2)				14.14*** [3.556]	19.92*** [4.689]	10.95** [3.641]				
Mother (Edu- cation—3)				27.10*** [3.698]	34.79*** [4.907]	22.55*** [3.860]				

Table 9 (continued)

	A3 (1) ALL SAM- PLE	B3 (2) ONLY OECD	C3 (3) ONLY NON- OECD	D3 (4) ALL SAM- PLE	E3 (5) ONLY OECD	F3 (6) ONLY NON- OECD	G3 (7) ALL SAM- PLE	H3 (8) ONLY OECD	I3 (9) ONLY NON- OECD	L3 (10) ALL SAMPLE
Mother (Education—4)				44.53 ^{***}	53.06 ^{***}	38.70 ^{***}				
Mother (Education—5)				[3.806] 70.94 ^{***}	[5.019] 78.19 ^{***}	[4.122] 70.55 ^{***}				
Mother (Education—6)				[3.882] 94.65 ^{***}	[5.088] 96.45 ^{***}	[4.445] 107.5 ^{***}				
Father (Education—2)				[4.041] − 2.731	[5.275] − 14.84 ^{**}	[4.915] 7.570				
Father (Education—3)				[3.944] 2.758	[5.099] − 11.11 [*]	[3.989] 13.86 ^{***}				
Father (Education—4)				[4.022] 19.35 ^{***}	[5.266] 4.790	[4.141] 31.48 ^{***}				
Father (Education—5)				[4.108] 39.64 ^{***}	[5.339] 25.42 ^{***}	[4.360] 48.25 ^{***}				
Father (Education—6)				[4.175] 64.60 ^{***}	[5.402] 51.28 ^{***}	[4.652] 68.76 ^{***}				
Community (2)				[4.299]	[5.541]	[5.122]	9.238 ^{***}	5.338 ^{***}	15.97 ^{***}	

Table 9 (continued)

	A3 (1) ALL SAM- PLE	B3 (2) ONLY OECD	C3 (3) ONLY NON- OECD	D3 (4) ALL SAM- PLE	E3 (5) ONLY OECD	F3 (6) ONLY NON- OECD	G3 (7) ALL SAM- PLE	H3 (8) ONLY OECD	I3 (9) ONLY NON- OECD	L3 (10) ALL SAMPLE
Community (3)							[0.807] 16.45***	[0.990] 10.74***	[1.540] 25.70***	
Community (4)							[0.856] 24.20***	[1.033] 14.40***	[1.634] 39.48***	
Community (5)							[0.928] 30.42***	[1.139] 15.66***	[1.710] 51.31***	
Size							[1.376]	[1.668]	[2.248]	- 0.135*** [0.0386] 372.0*** [4.083] 0.000
Constant	372.5*** [5.045]	492.2*** [4.428]	370.4*** [6.853]	257.6*** [6.250]	363.4*** [5.655]	239.2*** [7.377]	359.7*** [4.241]	484.5*** [4.653]	350.6*** [6.370]	
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Time dum- mies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	46,615	30,105	16,197	46,615	30,105	16,197	46,016	29,891	15,812	43,053
	M3 (11) ONLY OECD		N3 (12) ONLY NON-OECD		O3 (13) ALL SAMPLE		P3 (14) ONLY OECD		Q3 (15) ONLY NON-OECD	
	Y = Science score		Y = Reading score		Y = Maths score		Y = Science score		Y = Reading score	

Table 9 (continued)

	M3 (11) ONLY OECD	N3 (12) ONLY NON-OECD	O3 (13) ALL SAMPLE	P3 (14) ONLY OECD	Q3 (15) ONLY NON-OECD
Funds (Government)	0.0365 [0.0317]	0.0804 [0.0666]	0.0789* [0.0270]	0.0792** [0.0265]	0.0446 [0.0548]
Funds (Student fees)	0.0716* [0.0345]	0.111 [0.0697]	0.0926** [0.0284]	0.0966*** [0.0289]	0.0657 [0.0563]
Funds (Benefits)	– 0.0506 [0.0518]	0.206* [0.0814]	0.0885* [0.0408]	0.0676 [0.0422]	0.0948 [0.0758]
Computers	0.00466 [0.00334]	0.0108 [0.00656]	0.00530* [0.00268]	0.000151 [0.00322]	0.00612 [0.00575]
Girls	0.0665*** [0.00146]	0.0509*** [0.00136]	0.0352*** [0.000763]	0.0433*** [0.000721]	0.0268*** [0.00128]
Ownership (1)	– 33.96*** [1.140]	– 41.09*** [2.102]	– 4.870*** [0.866]	– 8.076*** [1.018]	– 0.446 [1.623]
Mother (Education—2)			15.10*** [2.872]	20.23*** [4.788]	12.49* [5.130]
Mother (Education—3)			27.76*** [3.090]	36.28*** [5.123]	25.01*** [5.328]
Mother (Education—4)			46.25*** [3.242]	55.31*** [5.245]	42.09*** [5.582]
Mother (Education—5)			72.94*** [3.331]	80.33*** [5.317]	71.75*** [5.836]
Mother (Education—6)			97.04*** [3.535]	98.33*** [5.515]	107.6*** [6.149]
Father (Education—2)			– 3.532 [3.870]	– 16.92** [5.908]	4.705 [5.744]

Table 9 (continued)

	M3 (11) ONLY OECD	N3 (12) ONLY NON-OECD	O3 (13) ALL SAMPLE	P3 (14) ONLY OECD	Q3 (15) ONLY NON-OECD
Father (Education—3)			1.063 [4.036]	- 12.76 [*] [6.117]	8.667 [5.884]
Father (Education—4)			17.47 ^{***} [4.137]	3.758 [6.213]	24.61 ^{***} [6.088]
Father (Education—5)			37.71 ^{***} [4.208]	25.14 ^{***} [6.271]	42.09 ^{***} [6.335]
Father (Education—6)			62.64 ^{***} [4.361]	52.87 ^{***} [6.412]	60.84 ^{***} [6.641]
Community (2)			1.390 [0.925]	- 1.564 [1.054]	3.850 [*] [1.618]
Community (3)			2.639 ^{**} [0.902]	- 1.518 [1.068]	6.422 ^{***} [1.698]
Community (4)			- 0.301 [0.983]	- 7.429 ^{***} [1.162]	9.844 ^{***} [1.807]
Community (5)			2.093 [1.312]	- 7.496 ^{***} [1.580]	14.24 ^{***} [2.083]
Size	0.0224 [0.0430]	- 0.515 ^{***} [0.0612]	- 0.0814 ^{***} [0.00977]	0.0178 [0.0395]	- 0.274 ^{***} [0.0508]
Constant	488.5 ^{***} [4.426]	380.3 ^{***} [8.511]	253.5 ^{***} [6.395]	359.6 ^{***} [6.339]	243.4 ^{***} [9.132]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES
Observations	28,020	14,842	42,500	27,834	14,475

Table 9 (continued)

Determinants of reading test score

Math score: school performance, i.e. test score of student averaged by school in Math; Reading score: school performance, i.e. test score of student averaged by school in Reading; Science score: school performance, i.e. test score of student averaged by school in Science; Funds (Government): Funding obtained by each school by the Government (%); Funds (Student fees): Funding obtained by each school by Student fees (%); Funds (Benefits: Funding obtained by each school by Benefits (%); Funds (Other Source): Funding obtained by each school by other source (%); Computers: Number of computers connected to the internet; Girls: Number of girls enrolled in the school; Ownership: Set of dummies (0=public; 1=private) denoting the typology of school (private is used as benchmark group); Father (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 3B; 6=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 5B; 6=ISCED 5A) describing the mothers' education (1 used as benchmark group); Mother (Education): set of dummies (1=ISCED level 1 only or no school; 2=ISCED level 2 only; 3=ISCED level 3B or 3C; 4=ISCED level 3A; 5=ISCED level 5B; 6=ISCED 5A) describing the fathers' education (1 used as benchmark group); Community: Set of dummies (1=village (> 3,000 people); 2=small town (3,000 < people < 15,000); 3=town (15,000 < people < 100,000); 4=city (100,000 < people < 1,000,000); 5=large city (> 1,000,000 people)) describing the community in which school is located (1 used as benchmark group); Size: Student-teacher ratio. The estimation allows for time and Country-level fixed effects. Standard errors are in parenthesis. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level; Standard errors in brackets

Table 10 Quantile Regression

	A4 (1) ALL SAM- PLE	B4 (2) ONLY OECD	C4 (3) ONLY NON- OECD	D4 (4) ALL SAM- PLE	E4 (5) ONLY OECD	F4 (6) ONLY NON- OECD	G4 (7) ALL SAM- PLE	H4 (8) ONLY OECD	I4 (9) ONLY NON- OECD	L4 (10) ALL SAMPLE
	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score	Y = Science score	Y = Reading score	Y = Maths score
Funds (Gov- ernment)	0.0711** [0.0223]	0.0588 [0.0314]	0.0744* [0.0317]	0.0748** [0.0246]	0.0809** [0.0293]	0.109** [0.0362]	0.0587* [0.0269]	0.0597 [0.0320]	0.0717 [0.0447]	0.0742** [0.0285]
Funds (Stu- dent fees)	0.0908*** [0.0241]	0.0856** [0.0329]	0.0698 [0.0369]	0.0762** [0.0257]	0.0800** [0.0310]	0.118** [0.0390]	0.0756** [0.0284]	0.0799* [0.0338]	0.0883 [0.0478]	0.0981** [0.0303]
Funds (Ben- efits)	0.0372 [0.0349]	- 0.0187 [0.0485]	0.168** [0.0557]	0.0729 [0.0395]	0.0313 [0.0450]	0.228*** [0.0417]	0.0361 [0.0469]	- 0.0176 [0.0488]	0.134* [0.0562]	0.0713 [0.0443]
Computers	0.00745** [0.00288]	0.00524 [0.00287]	0.00831 [0.00530]	0.00446* [0.00184]	0.00327 [0.00228]	0.00365 [0.00262]	0.00494* [0.00224]	0.00463* [0.00211]	0.00395 [0.00433]	0.00684* [0.00310]
Girls	0.0474*** [0.000766]	0.0553*** [0.000866]	0.0388*** [0.00127]	0.0245*** [0.000582]	0.0296*** [0.000757]	0.0185*** [0.00101]	0.0381*** [0.000515]	0.0494*** [0.000718]	0.0250*** [0.00121]	0.0493*** [0.000686]
Ownership (1)	- 34.31*** [0.897]	- 31.50*** [1.037]	- 41.08*** [1.918]	- 3.871*** [0.742]	- 5.048*** [0.898]	- 3.360* [1.332]	- 30.25*** [0.924]	- 29.28*** [1.084]	- 33.02*** [1.828]	- 33.40*** [0.947]
Mother (Edu- cation—2)				11.59*** [2.674]	20.01*** [4.936]	8.267** [2.887]				
Mother (Edu- cation—3)				24.80*** [2.824]	35.53*** [5.084]	21.71*** [3.177]				
Mother (Edu- cation—4)				42.72*** [2.942]	54.21*** [5.188]	38.25*** [3.433]				
Mother (Edu- cation—5)				68.96*** [3.020]	79.70*** [5.255]	66.16*** [3.733]				
Mother (Edu- cation—6)				91.68*** [3.199]	97.10*** [5.430]	100.1*** [4.196]				

Table 10 (continued)

	A4 (1) ALL SAM- PLE	B4 (2) ONLY OECD	C4 (3) ONLY NON- OECD	D4 (4) ALL SAM- PLE	E4 (5) ONLY OECD	F4 (6) ONLY NON- OECD	G4 (7) ALL SAM- PLE	H4 (8) ONLY OECD	I4 (9) ONLY NON- OECD	L4 (10) ALL SAMPLE
Father (Education—2)				– 2.978 [3.171]	– 17.98** [6.120]	5.114 [3.294]				
Father (Education—3)				1.238 [3.292]	– 16.52** [6.211]	11.58** [3.528]				
Father (Education—4)				17.57*** [3.374]	– 0.784 [6.291]	29.12*** [3.755]				
Father (Education—5)				37.02*** [3.439]	18.93** [6.340]	46.33*** [3.982]				
Father (Education—6)				62.40*** [3.548]	45.89*** [6.448]	66.77*** [4.442]				
Community (2)							8.353*** [0.836]	3.836*** [1.103]	13.10*** [1.354]	
Community (3)							15.25*** [0.881]	9.127*** [1.133]	23.55*** [1.498]	
Community (4)							21.75*** [0.923]	11.71*** [1.212]	35.78*** [1.566]	
Community (5)							27.97*** [1.332]	12.79*** [1.613]	47.14*** [1.927]	
Size										– 0.0733*** [0.00433]
Constant	382.0*** [3.963]	484.7*** [4.314]	386.0*** [5.330]	270.4*** [5.044]	365.1*** [6.664]	251.4*** [6.628]	368.3*** [4.685]	478.1*** [4.595]	363.3*** [6.448]	380.0*** [4.778]

Table 10 (continued)

	A4 (1)	B4 (2)	C4 (3)	D4 (4)	E4 (5)	F4 (6)	G4 (7)	H4 (8)	I4 (9)	L4 (10)
	ALL SAM- PLE	ONLY OECD	ONLY NON- OECD	ALL SAM- PLE	ONLY OECD	ONLY NON- OECD	ALL SAM- PLE	ONLY OECD	ONLY NON- OECD	ALL SAMPLE
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Time dum- mies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	46,597	30,090	16,194	46,597	30,090	16,194	46,001	29,879	15,809	43,035
	M4 (11)		N4 (12)		O4 (13)		P4 (14)		Q4 (15)	
	ONLY OECD		ONLY NON-OECD		ALL SAMPLE		ONLY OECD		ONLY NON-OECD	
Funds (Government)	Y = Science score		Y = Reading score		Y = Maths score		Y = Science score		Y = Reading score	
	0.0653		0.0735		0.0757**		0.0782**		0.0869*	
	[0.0353]		[0.0491]		[0.0266]		[0.0256]		[0.0381]	
Funds (Student fees)	0.0905*		0.0636		0.0840**		0.0891**		0.0978*	
	[0.0366]		[0.0527]		[0.0280]		[0.0278]		[0.0411]	
Funds (Benefits)	0.0202		0.218***		0.0946*		0.0525		0.199***	
	[0.0497]		[0.0654]		[0.0429]		[0.0436]		[0.0490]	
Computers	0.00604*		0.00818		0.00512**		0.00412***		0.00683*	
	[0.00291]		[0.00592]		[0.00194]		[0.00119]		[0.00283]	
Girls	0.0568***		0.0436***		0.0263***		0.0334***		0.0191***	
	[0.000396]		[0.00137]		[0.000520]		[0.000793]		[0.00101]	
Ownership (1)	- 30.45***		- 39.38***		- 3.597***		- 5.881***		- 0.902	
	[1.085]		[1.926]		[0.807]		[0.954]		[1.390]	

Table 10 (continued)

	M4 (11) ONLY OECD	N4 (12) ONLY NON-OECD	O4 (13) ALL SAMPLE	P4 (14) ONLY OECD	Q4 (15) ONLY NON-OECD
Mother (Education—2)			13.94 ^{***} [2.743]	24.00 ^{***} [4.938]	9.669 ^{***} [2.539]
Mother (Education—3)			27.69 ^{***} [2.915]	40.18 ^{***} [5.159]	21.53 ^{***} [2.841]
Mother (Education—4)			46.96 ^{***} [3.041]	59.27 ^{***} [5.292]	38.61 ^{***} [3.169]
Mother (Education—5)			73.16 ^{***} [3.118]	84.79 ^{***} [5.359]	65.74 ^{***} [3.461]
Mother (Education—6)			96.61 ^{***} [3.325]	102.8 ^{***} [5.540]	99.03 ^{***} [3.855]
Father (Education—2)			— 6.682 [3.536]	— 24.00 ^{***} [6.656]	2.020 [2.785]
Father (Education—3)			— 3.156 [3.680]	— 21.12 ^{**} [6.836]	6.828 [*] [3.089]
Father (Education—4)			13.75 ^{***} [3.763]	— 3.618 [6.908]	23.54 ^{***} [3.383]
Father (Education—5)			33.59 ^{***} [3.832]	17.28 [*] [6.960]	40.60 ^{***} [3.651]
Father (Education—6)			59.30 ^{***} [3.970]	46.30 ^{***} [7.061]	59.52 ^{***} [4.079]
Community (2)			0.501 [0.805]	— 1.764 [1.026]	3.098 [*] [1.319]
Community (3)			0.496 [0.828]	— 2.815 ^{**} [1.015]	4.395 ^{**} [1.405]

Table 10 (continued)

	M4 (11) ONLY OECD	N4 (12) ONLY NON-OECD	Q4 (13) ALL SAMPLE	P4 (14) ONLY OECD	Q4 (15) ONLY NON-OECD
Community (4)			− 2.471**	− 9.095***	8.027***
			[0.906]	[1.111]	[1.484]
Community (5)			− 1.506	− 10.39***	11.58***
			[1.162]	[1.470]	[1.882]
Size	0.0278**	− 0.513***	− 0.0442**	0.0154	− 0.254***
	[0.00918]	[0.0544]	[0.0155]	[0.0321]	[0.0207]
Constant	481.3***	390.6***	269.7***	361.0***	259.1***
	[4.621]	[6.677]	[5.817]	[6.815]	[6.576]
Wald test (<i>p</i> value)	0.000	0.000	0.000	0.000	0.000
Time dummies	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES
Observations	28,005	14,839	42,485	27,822	14,472

Determinants of (mean) test score

Math score: school performance, i.e. test score of student averaged by school in Math; Reading score: school performance, i.e. test score of student averaged by school in Reading; Science score: school performance, i.e. test score of student averaged by school in Science; Funds (Government): Funding obtained by each school by the Government (%); Funds (Student fees): Funding obtained by each school by Student fees (%); Funds (Benefits): Funding obtained by each school by Benefits (%); Funds (Other Source): Funding obtained by each school by other source (%); Computers: Number of computers connected to the internet; Girls: Number of girls enrolled in the school; Ownership: Set of dummies (0 = public; 1 = private) denoting the typology of school (private is used as benchmark group); Father (Education): set of dummies (1 = ISCED level 1 only or no school; 2 = ISCED level 2 only; 3 = ISCED level 3B or 3C; 4 = ISCED level 3A; 5 = ISCED level 5B; 6 = ISCED 5A) describing the fathers' education (1 used as benchmark group); Mother (Education): set of dummies (1 = ISCED level 1 only or no school; 2 = ISCED level 2 only; 3 = ISCED level 3B or 3C; 4 = ISCED level 3A; 5 = ISCED level 5B; 6 = ISCED 5A) describing the mothers' education (1 used as benchmark group); Community: Set of dummies (1 = village (> 3,000 people); 2 = small town (3,000 < people < 15,000); 3 = town (15,000 < people < 100,000); 4 = city (100,000 < people < 1,000,000); 5 = large city (> 1,000,000 people)) describing the community in which school is located (1 used as benchmark group); Size: Student-teacher ratio. The estimation allows for time and Country-level fixed effects. Standard errors are in parenthesis. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level; Standard errors in brackets

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References

- Agasisti, T., Longobardi, S.: Equality of educational opportunities, schools' characteristics and resilient students: an empirical study of EU-15 Countries using OECD PISA 2009 data. *Soc. Indic. Res.* **134**, 917–953 (2017)
- Agasisti, T., Vittadini, G.: Regional economic disparities as determinants of students' achievement in Italy. *Res. Appl. Econ.* **4**(2), 33–54 (2012)
- Agasisti, T., Longobardi, S., Regoli, A.: A cross-country panel approach to exploring the determinants of educational equity through PISA data. *Qual. Quant.* **51**(3), 1243–1260 (2017)
- Akiba, M., Letendre, G.K., Scribner, J.K.: Teacher quality, opportunity gap, and national achievement in 46 countries. *Educ. Res.* **36**(7), 369–387 (2007)
- Angrist, J.D., Lavy, V.: Using Maimonides' rule to estimate the effect of class size on scholastic achievement. *Q. J. Econ.* **114**(2), 533–575 (1999)
- Angrist, J.D., Newey, W.K.: Over-identification tests in earnings functions with fixed effects. *J. Bus. Econ. Stat.* **9**, 317–323 (1991)
- Bandiera, O., Larcinese, V., Rasul, I.: Heterogeneous class size effects: new evidence from a panel of university students. *Econ. J.* **120**(549), 1365–1398 (2010)
- Banerjee, A.V., Duflo, E.: *Good Economics for Hard Times*. Public Affairs, New York (2019)
- Banerjee, A.V., Shawn, C., Duflo, E., Linden, L.: Remedying education: evidence from two randomized experiments in India. *Q. J. Econ.* **122**(3), 1235–1264 (2007)
- Beese, J., Liang, X.: Do resources matter? PISA science achievement comparisons between students in the United States, Canada and Finland. *Improv Sch* **13**(3), 266–279 (2010)
- Belanger, C.H., Akbary, F., Madgett, P.J.: Why some youths do not realise their post-secondary education aspirations. *Tert. Educ. Manag.* **15**(3), 209–225 (2009)
- Bingley, P., Jensen, V.M., Walker, I.: The effect of school class size on length of post-compulsory education: some cost-benefit analysis. IZA Discussion Paper 1605 (2005)
- Bonacini, L., Brunetti, I., Gallo, G.: Choose the school, choose the performance. New evidence on the determinants of student performance in eight European countries, GLO Discussion Paper, No. 905, Global Labor Organization (GLO), Essen (2021)
- Booher-Jennings, J.: Below the Bubble: 'Educational triage' and the Texas accountability system. *Am. Educ. Res. J.* **42**, 231–268 (2005)

- Boyd, D., Grossman, P., Lankford, H., Loeb, S., Wyckoff, J.: Teacher preparation and student achievement. *Educ. Eval. Policy Anal.* **31**(4), 416–440 (2009)
- Browning, M., Heinesen, E.: Class size, teacher hours and educational attainment. *Scand. J. Econ.* **109**(2), 415–438 (2007)
- Brunello, G., Checchi, D.: School quality and family background in Italy. *Econ. Educ. Rev.* **24**, 563–577 (2005)
- Buddin, R., Zimmer, R.: Student achievement in charter schools: a complex picture. *J. Policy Anal. Manag.* **24**, 351–371 (2005)
- Card, D.A., Payne, A.: School finance reform, the distribution of school spending, and the distribution of student test scores. *J. Public Econ.* **83**, 49–82 (2002)
- Card, D., Krueger, A.B.: School resources and student outcomes: an overview of the literature and *) new evidence from north and south Carolina. *J. Econ. Perspect.* **10**(4), 31–50 (1996). <https://doi.org/10.1257/jep.10.4.3>
- Carlson, D., Cowen, J.: Student neighborhoods, schools, and test score growth: evidence from Milwaukee, Wisconsin. *Sociol. Educ.* **88**(1), 38–55 (2015)
- Chaudhary, L.: Education inputs, student performance and school finance reform in Michigan. *Econ. Educ. Rev.* **28**, 90–98 (2009)
- Checchi, D.: Da dove vengono le competenze scolastiche? L'indagine PISA 2000 in Italia. *Stato e Mercato* **72**, 413–445 (2004)
- Ciccone, A., Garcia-Fontes, W.: The quality of the Catalan and Spanish education systems: a perspective from PISA. IESE Research Papers D/810, IESE Business School (2009)
- Coleman, J.S., et al.: Equality of Educational Opportunity. U.S. Government Printing Office, Washington, DC (1966)
- Collins, M., Odders-White, E.: A framework for developing and testing financial capability education programs targeted to elementary schools. *J. Econ. Educ.* **46**(1), 105–120 (2015)
- Coupé, T., Olefir, A., Alonso, J.D.: Class size, school size and the size of the school network. *Educ. Econ.* **24**(3), 329–351 (2016)
- Darling-Hammond, L.: Teacher quality and student achievement: a review of State policy evidence. *Educ. Policy Anal. Arch.* **8**(1) (2000)
- Dee, T.S., Jacob, B.A.: The impact of no child left behind on student achievement. *J. Policy Anal. Manag.* **30**(3), 285–313 (2011)
- Denny, K., Oppedisano, V.: The surprising effect of larger class sizes. *Labour Econ.* **23**, 57–65 (2013)
- Eide, E., Showalter, M.H.: The effect of school quality on student performance: a quantile regression approach. *Econ. Lett.* **58**, 345–350 (1998)
- Escueta, M., Nickow, A.J., Oreopoulos, P., Quan, V.: Upgrading education with technology: insights from experimental research. *J. Econ. Lit.* **58**(4), 897–996 (2020)
- Faria, S., Portela, M.C.: Student performance in mathematics using PISA-2009 data for Portugal, No 01, Working Papers de Gestão (Management Working Papers), Católica Porto Business School, Universidade Católica Portuguesa, (2016). <https://EconPapers.repec.org/RePEc:cap:mpaper:012016>
- Fuchs, T., Woessmann, L.: What accounts for international differences in student performance? A re-examination using PISA data. *Empir. Econ.* **32**(2–3), 433–462 (2007)
- Gamazo, A., Martínez-Abad, F., Olmos-Migueláñez, S., Rodríguez-Conde, M.J.: Assessment of factors related to school effectiveness in PISA 2015. A multilevel analysis. *Rev. Educ.* **379**, 56–84 (2018). <https://doi.org/10.4438/1988-592X-RE-2017-379-369>
- Giambona, F., Porcu, M.: Student background determinants of reading achievement in Italy. A quantile regression analysis. *Int. J. Educ. Dev.* **44**(C), 95–107 (2015)
- Glick, P., Randrianarisoa, J.C., Sah, D.E.: Family background, school characteristics, and children's cognitive achievement in Madagascar. *Educ. Econ.* **19**(4), 363–396 (2011)
- Goldstein, H.: Methods in school effectiveness research. School effectiveness and school improvement. *Int. J. Res. Policy Pract.* **8**, 369–395 (1997)
- Hanushek, E.: The economics of schooling: production and efficiency in public schools. *J. Econ. Lit.* **49**(3), 1141–1177 (1986)
- Hanushek, E.: Evidence, politics, and the class-size debate. In: Mishel, L., Rothstein, R. (eds.) *The Class Size Debate*, pp. 37–66. Economic Policy Institute, Washington, DC (2002)
- Hanushek, E.: School resources. In: Hanushek, E.A., Welch, F. (eds.) *Handbook of the Economics of Education*, pp. 865–908. North Holland, Amsterdam (2006)
- Hanushek, E., Luque, J.A.: Efficiency and equity in schools around the world. *Econ. Educ. Rev.* **22**, 481–502 (2003)
- Hoxby, C.: The effects of class size on student achievement: new evidence from population Variation. *Q. J. Econ.* **115**(4), 1239–1285 (2000)

- Jennings, J., Sohn, H.: Measure for measure: how proficiency-based accountability systems affect inequality in academic achievement. *Sociol. Educ.* **87**, 125–141 (2014)
- Karakolidis, A., Pitsia, V., Emvalotis, A.: Examining students' achievement in mathematics: a multilevel analysis of the programme for international student assessment (PISA) 2012 data for Greece. *Int. J. Educ. Res.* **79**, 106–115 (2016). <https://doi.org/10.1016/j.ijer.2016.05.013>
- Konstantopoulos, S., Borman, G.D.: Family background and school effects on student achievement: a multilevel analysis of the Coleman data. *Teach. Coll. Rec.* **113**, 97–132 (2011)
- Konstantopoulos, S., Hedges, L.V.: How large an effect can we expect from school reforms? *Teach. Coll. Rec.* **110**, 1613–1640 (2008)
- Lee, J.W., Barro, R.J.: Schooling quality in a cross-section of countries. *Economica* **68**(271), 465–488 (2001)
- Litt, E.: Measuring users' internet Skills: a review of past assessments and a look toward the future. *New Media Soc.* **15**(4), 612–630 (2013)
- Mackenzie, J.: Public school funding and performance. University of Delaware (2006)
- Martins, L., Veiga, P.: Do inequalities in parents' education play an important role in PISA students' mathematics achievement test score disparities? *Econ. Educ. Rev.* **29**(6), 1016–1033 (2010)
- Murat, M., Bonacini, L.: Coronavirus pandemic, remote learning and education inequalities. GLO Discussion Paper 679 (2020)
- Pagani, L., Argentin, G., Gui, M., Stanca, L.: The impact of digital skills on educational outcomes: evidence from performance tests. *Educ. Stud.* **42**(2), 137–162 (2016)
- Perason, K.: On the influence of double selection in the variation and correlation of two characters. *Biometrika* **6**, 111–112 (1908)
- Pholphirul, P.: Pre-primary education and long-term education performance: evidence from programme for international student assessment (PISA) Thailand. *J. Early Child. Res.* **15**, 410–432 (2016). <https://doi.org/10.1177/1476718x15616834>
- Quintano, C., Castellano, R., Longobardi, S.: L'influenza dei fattori socio-economici sulle competenze degli studenti italiani. Un'analisi multilevel dei dati PISA 2006. *Riv. Econ. Stat. Territ.* **2**, 109–149 (2009)
- Rouse, C.E.: Private school vouchers and student achievement: an evaluation of the milwaukee parental choice program. *Q. J. Econ.* **113**, 553–602 (1998)
- Teodorovic, J.: Student background factors influencing student achievement in Serbia. *Educ. Stud.* **38**(1), 89–110 (2012)
- Thapa, A.: Public and private school performance in Nepal: an analysis using the SLC examination. *Educ. Econ.* **23**(1), 47–62 (2015)
- Tiebout, C.M.: A pure theory of local expenditures. *J. Polit. Econ.* **64**, 416–424 (1956)
- Vyverman, V., Vettenburg, N.: School well-being among young people: is it influenced by the parents' socioeconomic background? *Educ. Stud.* **35**(2), 191–204 (2009)
- Woessman, L.: Schooling resources, educational institutions, and student performance: the international evidence". *Oxf. Bull. Econ. Stat.* **65**(2), 117–170 (2003)
- Woessmann, L., Schuetz, G.: Efficiency and equity in European education and training systems, European Expert Network on Economics of Education (EENEE) analytical Report, no. 1, EENEE, [Munich], (2006)
- Wolf, P.J., Kisida, B., Gutmann, B., Puma, M., Eissa, N., Rizzo, L.: School vouchers and student outcomes: experimental evidence from Washington, DC. *J. Policy Anal. Manag.* **32**(2), 246–270 (2013)
- Wooldridge, J.: *Econometric Analysis of Cross-Section and Panel Data*. MIT press, Cambridge (2010)