On Cross-Country Heterogeneity of Selection into Private Schooling †

Giuseppe Bertola (EDHEC Business School, U. di Torino, CEPR)

Daniele Checchi (University of Milan, IZA, EIEF)

Veruska Oppedisano (London Metropolitan University)

October 2012

Abstract

Private schools are more expensive than public schools, but their students do not always perform better in standardized tests. We suggest that this may be explained by self-selection of less capable students into private schools. To assess the empirical relevance of this mechanism, we exploit cross-country variation in the PISA 2009 survey of differences between private and public school as regards organizational features that suit students with high or low learning ability. We find that private schools cater to slower learners, and deliver worse test performances, in countries where public schooling is better suited to high-talent students.

Keywords: private education; selectivity; PISA survey

† Previous version of the paper analyzed the PISA 2003 survey and benefited from helpful comments by seminar participants at the Geary Institute, UCD; the Workshop on Economics of Education at the University of Barcelona; the PISA Research Conference in Kiel; and the EQUALSOC-EVAED conference in Madrid. Corresponding author: Daniele.Checchi@unimi.it. Veruska Oppedisano acknowledges the generous support of the Marie Curie Intra European Fellowship for Career Development while based at UCL.

1. Introduction

It might be natural to expect private institutions to deliver better educational outcomes for students who can afford to attend them. In standard economic models, innate or early-life resources are complementary to human capital in the production of life outcomes, and a larger human capital investment is optimal for better-endowed individuals. Expensive private schools can then coexist with cheaper public ones because they allow families to choose higher human capital investment: if public schools provide a uniform amount of education, individuals who are brighter than the political majority are willing to pay for larger amounts of privately provided human capital (Stiglitz 1974). Equilibrium selection is broadly similar if the quality of students itself drives schooling choices and outcomes, in that individual human capital accumulation is positively influenced by peer effects (Epple and Romano, 2004): when schools populated by better students are more attractive, private schools' tuition and admission policies imply that they should educate the more talented segment of the student population. If perfect financial markets could ensure that only talent shapes the distribution of educational investments, then private schools should deliver better educational outcomes, as their students are better and can exploit more educational resources as well as favorable peer effects. In reality, of course, borrowing constraints and other financial market imperfections imply that selection into private schooling is also shaped by wealth heterogeneity, and may have undesirable socio-economic implications (see OECD 2012b). Unless wealth and talent are negatively correlated, however, the larger educational investments or better peer quality that complement richer students' talent still imply that they should do better than public school students (De Fraja 2002).

In reality, of course, private schooling may be attractive for other reasons, such as a better social climate or provision of extended hours, better facilities, individual tutoring and counseling, or religious education. Private education, like tracking and streaming, can be motivated by social stratification and segregation, rather than economic human capital accumulation. In practice, country-specific studies find that private education is associated with better future performance in terms of college attendance and labor market prospects in the United States (Evans and Schwab 1995, Rouse 1998, Figlio and Stone 2001) and in the United Kingdom (Green et al. 2011), but private schooling is associated with poorer outcomes in Italy (Bertola and Checchi 2004, Bertola, Checchi and Oppedisano 2007) and

Ireland (Pfeffermann and Landsman 2011), while in Chile public and private schools are differently effective for students from different family backgrounds (Contreras, Sepulvedaand Busto 2010). Vandenberghe and Robin's (2004) cross-country analysis of the 2000 PISA survey finds that private education is associated with higher competencies in some countries, to lower competencies in others.

In this paper, we relate heterogeneous public/private test performances to qualitative differences between each country's public and private educational establishments which, like the overall size of the private education sector (West and Woessmann, 2010), are exogenously determined by each country's historical experience. Not only the amount of resources, but also the organization and objectives of educational processes are qualitatively different across public and private schools. Private schools cater to students who not only can better afford to pay higher fees, but also find that public schools are less suitable for them. Brunello and Rocco (2008) suggest that students who cannot meet the standards of public school may in some countries choose to pay to obtain degrees and certifications from less demanding private education. Since the student pool of the private sector is then worse than that of public schools, it would then not be surprising to find empirically that private school students' performance on standardized tests is in such countries worse than that of public school students. More generally, public and private schools supply education (and not just degrees) that differs along dimensions that influence the characteristics of the students they attract or select.

Across countries, differences in the relevant features of public and private schools can lead to positive or negative selection, and account for the cross-country differences in the private/public performance. In countries where historically determined organizational features of public schools provide only basic egalitarian education, and do not reward students' talent, then the private sector attracts better students and displays better achievements. In countries where the public sector instead caters to stronger students, the private sector attracts lower quality students.

To detect empirically such "product differentiation" across educational establishments, we exploit information about school-level teaching techniques in the PISA international survey data to assess whether educations is organized in ways that complement or substitute student talent in the production of educational outcomes. To characterize the determinants of different selection and outcomes in different countries, we focus on the relationship between cross-country differentials in public/private test performance and features of public and private education that may lead students with heterogeneous learning ability to self-select into private schooling.

2. Modeling selection into private schools

We consider school choice by individuals who are heterogeneous both as regards their ability to learn (or "talent" for short) and ability to pay (or "wealth"). The educational outcome Y_{ij} resulting from individual i's attendance of school j depends positively on individual talent θ_i according to

$$Y_{ij} = a_j + b_j \theta_i , \qquad (1)$$

where the intercept, a_j, measures school j's absolute effect, irrespective of individual characteristics; and the slope, b_j, is an indicator of how strongly educational outcomes depend on individual talent.

These parameters may differ across educational establishments along a variety of dimensions, including that between more or less demanding vocational and academic tracks. To characterize the choice between public and private schooling, we let not only the outcome as in (1) but also the cost of school attendance to depend on whether $j=1$ indexes a private school or $j=0$ a public school. Formally, we suppose that the cost for individual i of choosing school j is

$$C_{ij} = \left(1 - cZ_i\right) f_j , \qquad (2)$$

where $f_1 > f_0$ indicates that private schools are more expensive and the cost is allowed to also differ across individuals indexed by i so as to account for the heterogeneous opportunity costs implied by financial market imperfections: the parameter $c > 0$ indexes the extent to which financial costs are less burdensome for individuals whose financial resources, denoted Z_i, are more plentiful.

As school choice aims at making $Y_{ij} - C_{ij}$ as large as possible, individual i prefers the private $j=1$ school to the public $j=0$ school if

$$a_1 + b_1\theta_i - \left(1 - cZ_i\right) f_1 > a_0 + b_0\theta_i - \left(1 - cZ_i\right) f_0 . \qquad (3)$$

Rearranging this condition to

$$(b_1 - b_0)\theta_i + (f_1 - f_0)cZ_i + (a_1 - a_0) + (f_1 - f_0) > 0 \tag{4}$$

we see that if $b_1 > b_0$, i.e. private schooling is better suited to education of brighter individuals as in Epple and Romano (1998) or in De Fraja (2002), then higher talent θ_i and higher resources Z_i are both associated with selection into private schooling. If instead less expensive public schools reward talent more strongly ($b_1 < b_0$), then the higher cost $f_1 > f_0$ of private schooling can be justified by higher talent-independent payoffs $a_1 > a_0$ for students with sufficiently large financial resources Z_i and sufficiently low talent θ_i. In this case, students who enroll in private schools are negatively selected, and their performance may be worse despite the larger resources expended in their education.

In this simple choice model, all school features that influence learning outcomes are summarized by the parameters of the selection equations; private schools are attended by richer students if they are more expensive, but need not attract better students if public schools cater to high-talent students. We will study below how empirical indicators of school and student heterogeneity contribute to shaping the talent pool selected into public and private schools.

As we do so, we will need to keep in mind that the model does not explicitly account for other potentially relevant determinants of public/private choices, such as the availability of religious education, luxurious facilities, and more general features that need not directly bear on educational outcomes, but may vary along both individual and cross-country dimensions.

The model's parameters, and the empirical indicators considered below, can instead represent well the organizational features that play a more relevant role in determining educational outcomes (Woessmann 2003, Hanushek, Link and Woessmann 2011), as well as the peer effects emphasized by Epple and Romano (1998) and Epple, Figlio and Romano (2004): while evidence from the US suggests that private schools differentiate themselves from public schools that are not selective and use a teaching approach suitable for low-talent students, elsewhere public school may provide education suitable for high-talent students, as in the academic track of Continental European systems, and favourable peer effects.

School funding could also be quantitatively different across public and private schools to a different extent in different countries, but there is little or no evidence of relationships between the level of spending and students' achievement at primary and secondary school levels (Hanushek, 1986). A potentially more relevant shortcoming of the model's simple structure is the fact that its ex-ante perspective neglects issues of effort choice and asymmetric information on talent (Bishop and Woessmann 2004). MacLeod and Urquiola (2009) have shown that if schools select students, and talent is imperfectly observable, then students can rely on the fact that admission to selective institutions is signal of high talent and have lower incentives to accumulate skills. This may provide an alternative explanation for worse performance of students admitted in selective private colleges at least in developing countries like India (Rubinstein and Sekhri 2008), or in situations like that of Chile where, after introduction of vouchers in 1981, up to 55% of students were attending a private institution, without any effect on average competencies (Contreras, Sepulveda and Busto 2010).

3. Data and descriptive statistics

The selection mechanisms we focus on are certainly also at work inside each country, both across vocational and academic tracks, and across more or less expensive and demanding schools. The issues we analyze are in fact similar to those analyzed in specific countries and educational segments. For example, Stange (2012) and his references focus on the extent to which sorting of students across more or less selective and resource-rich post-secondary institutions may explain their different educational and labor market performance. Empirical analysis of international data empirical cannot exploit the rich information available to country-specific studies, and its results are unavoidably less precise. Even suggestive evidence can be valuable when obtained in a more general setting, however, and the international dimension offers a plausibly exogenous source of observable variation, in that the structure of private schooling services is shaped by largely predetermined and country-specific features of public educational systems.

We consider empirical indicators of public vs. private schooling differences across the countries and regions covered by the 2009 Program for International Student Assessment (PISA) survey, documented in OECD (2012a). This survey, repeated every three years, provides an internationally comparable assessment of reading, math and science competences of 15 year old students. It also gathers from students, parents, and school heads a wealth of additional information regarding students' individual characteristics, family backgrounds, and schools' resources endowment and educational practices.

While the international dimension of the PISA data set can help assess the empirical relevance of qualitative self-sorting effects on average school performance, the data as usual leaves much to be desired in other respects. As regards the public-private distinction, the choice model's private school is more expensive for its users, and its educational offer may be more or less strongly complementary to student talent. In the data, two survey questions to school heads collect relevant information: we known how much of the school's funding originates from the government, from student fees, or from benefactors (variables *sc03q01* to *sc03q04*); and we known whether the school is autonomous from central government because it is managed by non-government organizations or other private institutions (variable *sc02q01*).

For the 72 countries or sub-national units for which PISA 2009 data are available, Table 1 reports the numbers of students surveyed in public and private schools. Here, and in what follows, the latter correspond to those that are managed independently from the government, regardless of whether they also receive most of their funding from non-government sources. [1] This is the definition adopted by the OECD (2012b) study of socio-economic stratification across public and private school systems, and is indeed the most appropriate for the purpose of detecting differences rooted in private schools' ability to manage resources flexibly, whether in order to offer more efficient and cost-effective services, or in order to cater to specific student body characteristics.

Fewer schools are classified as "private" if the definition is based on receiving most of their funding from non-government sources. While this alternative definition should indeed be more restrictive, in the data the two definitions overlap (for example, a non-negligible number of government-controlled schools are funded by fees to a larger extent than private schools in the same countries, presumably because of geographical or field heterogeneity). More importantly for our purposes, the alternative definition of "private" can exploit international variation only within a smaller number of countries, because the many countries where privately managed schools are to a large extent funded by the government drop out of the sample (Austria, Czech Republic, Finland, Germany, Hungary, Iceland, Latvia, Lithuania, Netherlands, Norway, Slovak Republic, Serbia, Slovenia, and Sweden). The results reported

[1] According to the PISA 2009 manual (OECD 2012a) this includes schools where *schtype*=2 ("government dependent private schools" controlled by a non-government organization or with a governing board not selected by a government agency which receive more than 50% of their core funding from government agencies) or *schtype*=3 ("government independent private schools" controlled by a non-government organisation or with a governing board not selected by a government agency which receive less than 50% of their core funding from government agencies).

in the rest of the paper use management as the criterion for public vs private classification, and include country-level aggregate tuition statistics to control for funding variation; an Appendix, not intended for publication, shows that the results are similar when the alternative definition is used instead.

In total, there are observations from 18 029 schools and 476 980 student records, about a quarter of which has to be dropped because of missing values for variables we include in our specifications.[2] As defined, private schools enroll approximately 20 percent of the student population on average. They attract less than 10 percent of students in United Kingdom, United State, Germany, and more than 30 percent in Chile, Indonesia, Spain, Ireland and Netherlands.

Figure 1 plots country specific ratios of private to public students' median PISA math test scores on the horizontal axis, and ratios of math test score standard deviations on the vertical axis.[3] If the best students were everywhere selected into a private sector that supplies better education, country-specific observations should cluster to the right of the vertical line of median score equality. That selection mechanism might also imply that the student population is more homogeneous within the smaller private sector, so that countries should be observed below the horizontal line of equal standard deviations. Most countries are indeed observed in the bottom-right quadrant of the figure: notably, we find there the Anglo-Saxon countries (United States, United Kingdom, Canada, Australia, and New Zealand) where private education is widely thought to provide better education. In many other countries, however, public schools are found to deliver better and/or less dispersed PISA test scores than private schools.

Inasmuch as cross-country heterogeneity reflects selection of differently able students into public and private education, it suggests that care should be taken in interpreting test scores as a measure of school performance. The PISA test measures each student's "*ability to apply the knowledge and skills learned at school to real-life challenges*" at age 15: like any other outcome Y_{ij} in equation (1), combines individual characteristics (that might be innate or result

[2] The complete PISA 2009 file contains 515 858 student records from 18 641 schools. We drop all observations from France and Moldova, where no information is available regarding whether schools are public or private, and 23 060 observations of students who are 15 year old but are attending grades that differ from the modal grade by more than one year.

[3] In the PISA data, the math test score is less strongly related to family background than literacy and science test scores. Using averages of the three scores produces a very similar picture.

from previous life experiences) with school-specific features that, in most countries, have already operated for one or two years by the time the test is taken. It is not easy to disentangle individual and school heterogeneity in the data.

As regards individual students, the PISA data set does not include any indicators (like previous schooling performance, or IQ test scores) that might be empirical counterparts of the theoretical model's "talent" variable. To extract information on the "talent" or ability-to-learn dimension of student heterogeneity, we consider two alternative measures:

i) A "*Residual ability*" proxy for talent, the estimated error term of math test score regressions on individual characteristics and parental background information: gender, age, previous schooling experience, parental education and occupational prestige, number of books at home, presence of two parents, whether parents or child born abroad, and whether they speak a different language at home (see the note to Table 2 for detailed references to PISA variable codes);

ii) A "*Principal component*" proxy extracted by factor analysis from the literacy, math, and science test scores, and only two such background variables: parental education, and number of books at home.

Table 2 reports for each country's public and private schools the median values of PISA test scores and of these two proxies. *Residual ability* focuses on the students' "talent" as assessed on the basis of whether individual test scores are surprisingly high or low relative to what family background would predict; *Principal component* also captures the contribution to test scores of two family background indicators that are likely very relevant to the student's ability to learn. All three indicators include the contribution to achievements of the school students have been attending when they are tested, and all feature similarly ranked private-public differentials across countries. While in most countries students are positively selected into the private sector, in about a fifth of the countries (shown in shaded cells) both the *Residual ability* and *Principal component* proxies for the quality of public school students are higher than those of private school students. This suggests that much of the test score differential across public and private schools may indeed be driven by selection of heterogeneous students, rather than by the effects of the one or two years of different education already experienced at test time. In what follows, we report results in terms of the *Residual ability* measure. This may be more theoretically appealing, as it excludes from "talent" measurement all background variation that may be relevant to individual ability to pay as well as to learn.

Results, however, are broadly similar for specifications that use the *Principal component* as a proxy of "talent".

As regards the definition and measurement of the school characteristics that are relevant on families' enrolment choices, the PISA data offers very limited direct information. In the 2009 survey we analyze, parents in some countries were asked to indicate reasons they chose the school their children were attending. In many of the 15 countries where such data are available, safety and pleasantness of the environment are the most typical reasons for choosing private schools; only in New Zealand, Hungary, and Qatar academic standards or reputation also appear relevant, along with geographical proximity, ideology, special programs, and past attendance by other family members.[4] These data confirm that self-sorting of students into private schools is not always motivated by better academic quality, but are very scarce and noisy: the parental survey was carried out in only one Anglo-Saxon country (New Zealand), and self-declared motivations may not truthfully reveal that remedial features were the reason for the family's choice of private schooling. For our purpose of identifying structural determinants of student selection into private schooling, we prefer to focus on the information provided by the PISA survey on schools' educational techniques.

Aiming to measure organizational features that are especially well suited to high-ability individuals, or instead foster educational outcomes regardless of individual ability, we consider eight indicators of differences across private and public schooling in each country:

(R_1) **Selectivity** in student admission;

(R_2) **Accountability:** the school provides information to parents on the academic performance of their children in comparison to students in other schools;

(R_3) **Competition:** school clubs or school competitions (for foreign language, math or science) are used to promote student engagement.

(R_4) **Streaming:** level and needs are taken into account when setting academic standards, students are grouped according to their achievement level in some subjects or for all the subjects.

[4] In Pisa 2003 a similar question was asked to the students themselves in all countries. In Italy, Austria, and Japan "special programs" were the more prominent answers; in Canada, Germany and UK, "better quality education" was mentioned most often.

(R_5) **Individualized evaluation:** "Teachers' judgmental ratings" is indicated as the school's prevailing assessment technique.[5]

(R_6) **Repeaters:** the fraction of students that are repeating a year.

(R_7) **Autonomy:** positive answers to items ("Establishing student assessment policies", "Choosing which textbooks are used", "Determining course content", and "Deciding which courses are offered") indicating that the school chooses its own educational techniques.

(R_8) **Disciplinary climate** is a summary measure of student behavior within a school, capturing disruptive events (like absenteeism, lack of respect for teachers, use of alcohol or illegal drugs, bullying) as perceived by school principal.

Details of indicator definitions, with references to questionnaire items, are reported in the note to Table 3. We expect some of these features to be associated with positive or negative selection of talented students: **Selectivity**, **Accountability**, and **Competition** are arguably attractive for high-talent students; **Streaming**, **Individualized evaluation**, and **Repeaters** appear better suited to weaker students. For other features, priors are less clear: **Autonomy** may allow schools to formulate curricula that are attractive for more or less motivated students; **Disciplinary climate** may draw attention from parents worried by the potential risk for their talented children, it may also indirectly measure low teaching quality.

Information for all these variables (and some information about school fees, discussed below) is available at the school level, but the surveyed schools are only a small proportion of those present in each country and their geographical location is not recorded. Hence, it is not possible to assess how costs and other school features teaching organization influence selection of private schools within each household's choice set.[6] Like OECD (2012b), therefore, we only exploit variation across country-level aggregates of this variable. Table 3 reports the mean difference across private and public schools of the eight indicators across all available countries or regions; shaded cells again highlight those where PISA performance is better in public schools than in private schools. To characterize patterns of co-variation of these features we report at the bottom of Table 3 the results of factor analysis across all

[5] This appears more flexible and adaptable to students' individual needs than the alternative survey items ("Standardised tests", "Teacher-developed tests", "Student portfolios", "Student assignments/projects/ homework").

[6] As in e.g. Martínez-Mora (2006), who finds that low-quality private schools exist in US localities where low property tax revenues support only low-quality public schools.

schools observed. As factors are orthogonal by construction, this procedure disentangles the extent to which different schools offer services that are complementary to students' talent, or instead privilege talent-independent value added. Private vs. public country mean differences in A**ccountability** and **Autonomy** are strongly related to the second factor, which could therefore represent positive selection; the third factor is strongly related to **Streaming** and **Individualized evaluation**, and may therefore be associated with negative selection.

To assess the empirical relevance of these indicators of internationally heterogeneous private vs. public differences in terms of teaching techniques and student selection, we proceed to inspect their coefficients' statistical significance and sign in descriptive regressions for selection of heterogeneous students into private education.

4. Regression evidence

The specifications we run are in the form of the theoretical selection relationship (4), but cannot implement it directly because the available data do not make it possible to disentangle cleanly the educational outcome (Y_{ij}) and its talent (θ_i) and family wealth (Z_i). Individual choices and outcomes depend on talent, which as discussed above is not directly observable, and on financial considerations that reflect poorly measured variation between and within countries of family resources and of the relative cost of private and public education. At the school level, only the budget portions drawn from private and public sources are surveyed in PISA.[7] At the individual level, PISA collects a variety of household background variables that relate not only to the family's ability to pay to for private schooling, but also to the student's ability to learn.

One way to characterize heterogeneity across countries indexed by s of the theoretical determinants and implications of the selection process into private schooling is to run a linear probability model in the form

$$p_{is} = \alpha_s + \beta_s \theta_{is} + \mathbf{X}_{is}\boldsymbol{\gamma} + \varepsilon_i \tag{5}$$

on individual data indexed by i, where $p_{is} = 1$ if the individual is observed attending a private school in country s, $p_{is} = 0$ otherwise; θ_i is the individual's *Residual ability* talent

[7] The parental questionnaire collected in very few countries gathers often missing information about the direct cost of schooling for country specific income brackets (variable *pa12q01*). That cost is higher in each country for reporting households with students in private schools, but the data cannot be compared to disposable income and across countries.

proxy;[8] and $\mathbf{X}_i$ is a vector of controls including the family background variables used to compute *Residual ability* above, to which θ_i is orthogonal by construction, as well as indicators of family wealth (proxied by an OECD estimate based on country specific information as regards ownership of durable goods) and of the household's school-choice set (proxied by the size of the town of residence), both of which may be more relevant to private school enrolment than to test performance. The regression constrains the vector $\boldsymbol{\gamma}$ of control coefficients to be the same across countries, but the talent slope estimates from unconstrained country-specific regressions are very similar to those we report.

Comparing (4) and (5) we see that if θ_i measured talent accurately and independently of the error term ε_i, then the empirical equation's slope β_s would correspond to the difference $b_1 - b_0$ between private and public school's talent-rewarding features, and its intercept would correspond to the $a_1 - a_0$ difference between the two school type's talent-independent remedial features. Of course, there are many reasons why country-specific regressions in the form (5) do not provide structural estimates of these parameters: the empirically available talent proxy picks up some of the ability-to-pay variation represented by Z_i in the theoretical model, and the regression's error term is certainly polluted by lack of controls for variation across individuals and schools of the $f_1 - f_0$ cost differential element of the selection mechanism, as well as of religious, ideological, geographical, and features that need not bear on students' test performance. Still, these regressions' results can provide at least suggestive evidence of our theoretical perspective's empirical fit.

Figure 2 reports the $\hat{\beta}_s$ country-specific slope estimates from the pooled linear probability regression for private enrollment (5). In the United States, Canada, and the United Kingdom (as well as in Brazil and Uruguay), $\hat{\beta} > 0$ suggest that private schools attract more talented students. For other countries (like Italy, Indonesia, Israel), however, we estimate $\hat{\beta} < 0$, indicating that private schools appear less attractive than public schools for highly talented students. To assess the role of different organizational features and teaching techniques in determining the cross-country pattern of talent selection slopes, we run regressions in the form

[8] The results are very similar when *Principal component* or raw test scores are used to proxy individual talent variation.

$$\hat{\beta}_s = \sum_{k=1}^{8} \sigma_{bk} \cdot \left(\overline{R}_{ks,\text{private}} - \overline{R}_{ks,\text{public}}\right) + \omega_{bs} \tag{6}$$

of country-specific $\hat{\beta}_s$ estimates on within-country mean differences between private and public schools of the eight teaching indicators discussed in the previous section. Table 4 reports the results. Talent selection into private schooling is significantly and positively associated with country-specific **Accountability** differences, and negatively and in some cases significantly associated with country-specific differences in **Streaming**, **Individualized evaluation**, and **Repeaters**. The significant negative coefficient of **Competition** is less consistent with prior expectations; **Selectivity** is not significant, like **Disciplinary climate**, while **Autonomy** appears on average to be used in ways that appeal to highly talented individuals.

Of course, the estimated slopes of within-country selection equations are influenced by country-specific determinants of private school enrolment other than the organizational features and/or teaching technique indicators of interest, such as the average cost of private education and the intensity of any religious connotation or contextual effects. We next explore the empirical fit of our perspective in a cross-country pooled individual choice regression that allows fixed effects to absorb all country-specific variation and models the internationally heterogeneous relevance of talent in private school selection as a linear combination of country-specific differences between the eight private and public school feature differences discussed above.

Formally, we run linear regressions in the form

$$\begin{aligned} p_{is} = \alpha_s + \beta \cdot \theta_{is} + \sum_{k=1}^{8} \sigma_k \cdot \left[\left(\overline{R}_{ks,\text{private}} - \overline{R}_{ks,\text{public}}\right) \cdot \theta_{is}\right] + \\ + \eta \cdot Z_{is} + \delta \cdot \left(\bar{f}_{s,\text{private}} - \bar{f}_{s,\text{public}}\right) + \lambda \cdot Z_{is} \cdot \left(\bar{f}_{s,\text{private}} - \bar{f}_{s,\text{public}}\right) + \boldsymbol{\gamma}'\mathbf{X}_{is} + \varepsilon_{ijs} \end{aligned} \tag{7}$$

where the left-hand side variable is the same as in (5); we also show below results from probit rather than linear specifications.

On the right-hand side, α_s is a country-specific intercept, and the individual θ_{is} *residual ability* indicator is constructed as the component of the math test score-based that cannot be predicted on the basis of the background characteristics listed above and in the note to Table 2. Its effect on private enrolment is allowed to vary across countries, around a main parameter β, in ways explained by interactions with private/public differences of country-level averages of teaching feature indicators. The sign and significance of these interaction terms can be interpreted from our theoretical perspective, where private schools can adapt their organization to the characteristics of their students, who are more or less talented depending on whether the predetermined teaching organization of public schools caters to low or high ability students. To assess the empirical relevance of cost differentials between public and private schools, the specification includes the individual durable-ownership-based wealth proxy, denoted Z_i in (8), and its interaction with the country level private-public average difference in the proportion of funds coming from students' tuition fees, which corresponds to the $f_1 - f_0$ cost element of the theoretical selection equation.[9] Table 5 reports these coefficient estimates, which are those of interest from our theoretical perspective, and lists in note the other individual controls $\mathbf{X}_i$ included in the specification. Most of these are the same as those used to construct the *residual ability* indicator (we exclude only "pre-primary school attendance" and "availability at home of educational resources like encyclopaedias, dictionaries, internet connection"); as in specification (5), city size is included as a proxy of the family's choice set.

The first two columns of Table 5 exclude interactions and compare a probit (column 1) and a linear probability model (column 2). The sign and statistical significance are reassuringly similar, indicating that functional forms do not drive the sensible results shown: students selected into private education are on average more talented; come from families where parents hold more prestigious occupations;[10] are less likely to be first-generation immigrant (not shown) and/or repeating students, and more likely to be enrolled in vocational education. In column 3 we introduce our proxy for tuition: the results indicate that private education is less likely in countries where the differential in tuition contribution between private and public school is higher, and that financial considerations are less relevant for richer families.

Next, we introduce interactions of the individual ability proxy with private-public country-level differentials in the schooling features introduced and discussed above. Positive interaction coefficients indicate that the school feature is associated in the data with positive

[9] This is the country-level mean difference across private and public schools of PISA variable *SC03Q02*, the school manager's answer to "About what percentage of your total funding for a typical school year comes from school fees or school charges paid by parents?". Since the PISA data do not provide location information, it is impossible to explore as in Martínez-Mora (2006) the relevance of school-specific and other local variation in public vs private choice sets.

[10] These families are presumably wealthier, but not necessarily better educated: among the "highest parental education" included as controls but not shown in the table only the "Parent with type-A tertiary education" dummy coefficient is significantly larger than zero. This is consistent with the positive correlation between ability and family income predicted by the peer-quality-based selection mechanism of Epple, Figlio and Romano.(2004).

individual talent selection, negative ones that it is more attractive for low-talent students. In columns 4-7 of Table 5, the private/public differences in **Repeaters** and in **Individualized evaluation** indeed feature significantly negative interactions; that of **Streaming** is also negative, albeit not significant when standard deviations are computed on the basis of residual clustering by schools (which turns out to be a conservative assumption: this interaction coefficient is significant at $p<0.05$ when estimated standard errors are robust to heteroskedasticity of unknown form). **Selectivity** talent interactions are positive, but not robustly or significantly so when residuals are clustered by school; **Accountability** is not significant; the regression yields a significantly negative coefficient for the **Competition** indicator, which again appears related to negative talent selection, and a significantly positive interaction with **Disciplinary climate**, indicating that more talented students are attracted by less disruptive schools.

5. Conclusions

Private school attendance need not always deliver better learning outcomes. It does so when private schools' teaching techniques are complementary to students' ability to learn, so that better students select into private education. When high ability students are well served by public schools, conversely, private schools may cater to worse students. Our empirical analysis generalizes and interprets the contrast between country-specific evidence of positive selection into private schooling in the US (as in Epple, Figlio, and Romano 2004) and negative selection in Italy (as in Bertola, Checchi, and Oppedisano 2007). Along the cross-country dimension of the PISA 2009 survey data set, we find that the relative selectivity of private schools is associated with enrolment of more talented students, while such features as individualized evaluation and the presence of repeating students are associated with selection of less talented students. Peer effects cannot be reliably measured in the data, but if they are relevant, then the relative quality of private and public schools' student bodies is directly related to that of their educational offering at similar resource levels. In terms of such features, private schools appear better suited to good students in countries like Canada, the United States, and the United Kingdom, where private schools deliver better test performances. In countries such as Italy and Indonesia, conversely, the teaching indicators of private schools are less attractive for good students than those of public schools, and private schooling is not associated with better achievements.

Our theoretical perspective and empirical results may suggest caution in advocating public voucher schemes and other policies meant to make private education affordable for poorer families. If liquidity constraints keep poor and talented youth from attending better private schools, then such policies improve equality of opportunities at the same time as they enhance the productivity of society's educational resources. In countries where high-quality public schools attract the brightest segment of the student pool, however, public funding of privately organized education benefits a segment of low-ability students who are not rich or disadvantaged enough to purchase unsubsidized remedial education. While the resulting redistribution across differently wealthy and differently able individuals may be politically attractive in some cases, it need not be preferable, depending on the relative efficiency of public and private education production, for the purpose of enhancing equality of opportunities and the overall efficiency of the education system.

References

Bertola, G., Checchi D. (2004), “Sorting and private education in Italy” in *Education, Training and Labour Market Outcomes*, ed. by Checchi, D. and Lucifora, C., Palgrave-McMillan.

Bertola, G., Checchi D., Oppedisano V. (2007), “Private School Quality in Italy", *Giornale degli Economisti e Annali di Economia*, Vol. 66(3): 375-400

Bishop, J., Woessmann, L. (2004) “Institutional Effects in a Simple Model of Educational Production” *Education Economics*, Vol. 12(1): 17-38

Brunello, G., Rocco, L. (2008), “Educational Standards in Private and Public Schools" *Economic Journal*, vol. 118(533): 1866-1887

Contreras, D., Sepulveda, P., Busto S. (2010) “When Schools Are the Ones that Choose: The Effects of Screening in Chile” *Social Science Quarterly*, Volume 91(5): 957-976

De Fraja, G. (2002), “The design of optimal educational policies”, *Review of Economic Studies*, vol. 69: 437-466.

Epple, D., Romano, R. (1998) “Competition between private and public schools, vouchers, and peer-group effects”, *American Economic Review*, vol. 88(1): 33-62.

Epple, D., Figlio, D., Romano, R. (2004) “Competition between private and public schools: testing stratification and pricing predictions.” *Journal of Public Economics* 88: 1215–1245

Evans W., Schwab R. (1995) "Finishing High School and Starting College: do Catholic Schools Make a Difference?", *The Quarterly Journal of Economics*, Vol. 110(4): 941-974

Figlio D., Stone J. (2001) "Can Public Policy Affect Private School Cream Skimming?" *Journal of Urban Economics*, vol. 49(2): 240-266,

Green F., S.Machin, R.Murphy,Y.Zhu. (2011) “The Changing Economic Advantage from Private Schools.” *Economica*. 79/316: 658–679

Hanushek, E. (1986), “The Economics of Schooling: Production and Efficiency in Public Schools", *Journal of Economic Literature*, Vol. 24: 1141-1177

Hanushek, E., Link S., Woessmann, L. (2011) “Does School Autonomy Make Sense Everywhere? Panel Estimates from PISA”. NBER wp.17591

MacLeod, W.B., Urquiola, M. (2009) “Anti-Lemons: School Reputation and Educational Quality”. NBER Working Paper 15112.

Martínez-Mora, F. (2006). “The existence of non-elite private schools” *Journal of Public Economics* 90 1505–1518.

OECD (2012a) *PISA 2009 Technical Report*. Paris: Organization for Economic Cooperation and Development.

OECD (2012b) *Public and Private Schools. How management and funding relate to their socio-economic profile*. Paris: Organization for Economic Cooperation and Development.

Pfeffermann, D., Landsman, V. (2011). “Are Private Schools Better Than Public Schools? Appraisal for Ireland by Methods for Observational Studies.” mimeo

Rouse, C. (1998) “Private School Vouchers and Student Achievement: An Evaluation of the Milwaukee Parental Choice Program” *Quarterly Journal of Economics* 113(2): 553-602

Rubinstein, Y., Sekhri S. (2008) “Do Public Colleges in Developing Countries Provide Better Education than Private ones? Evidence from General Education Sector in India.” Virginia Economics Online Papers 375

Stange, K.M. (2012) “Ability Sorting and the Importance of College Quality to Student Achievement: Evidence from Community Colleges” *Education Finance and Policy* 7(1): 74-105

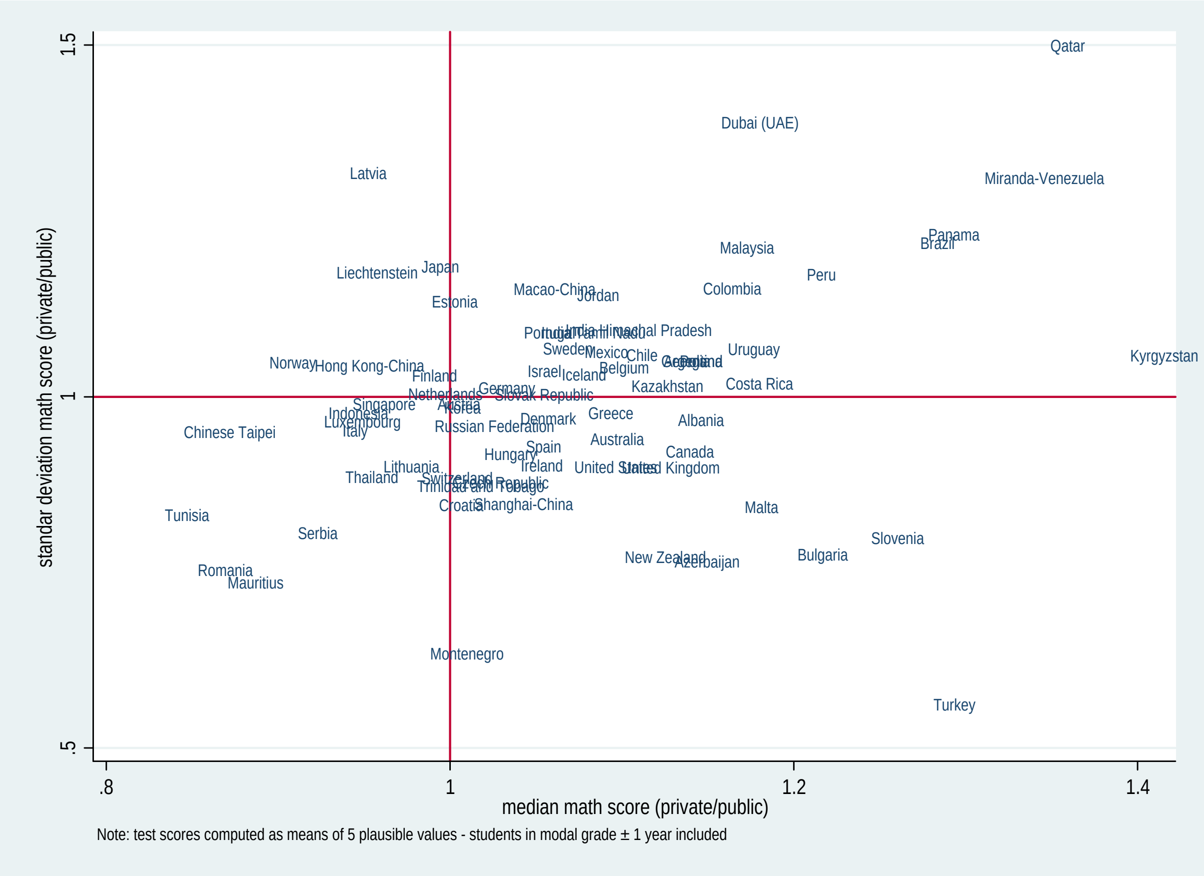
Stiglitz, J. (1974), “The demand for education in public and private school system”, *Journal of Public Economics*, vol. 3: 349-385.

Vandenberghe, V., Robin, S. (2004), “Evaluating the effectiveness of private education across countries: a comparison of methods”, *Labor Economics*, vol. 11(4): 487-506.

West, M.R., Woessmann, L. (2010) ‘Every catholic child in a catholic school’: Historical resistance to state schooling, contemporary private competition and student achievement across countries.” *The Economic Journal*, 120 (August): F229–F255

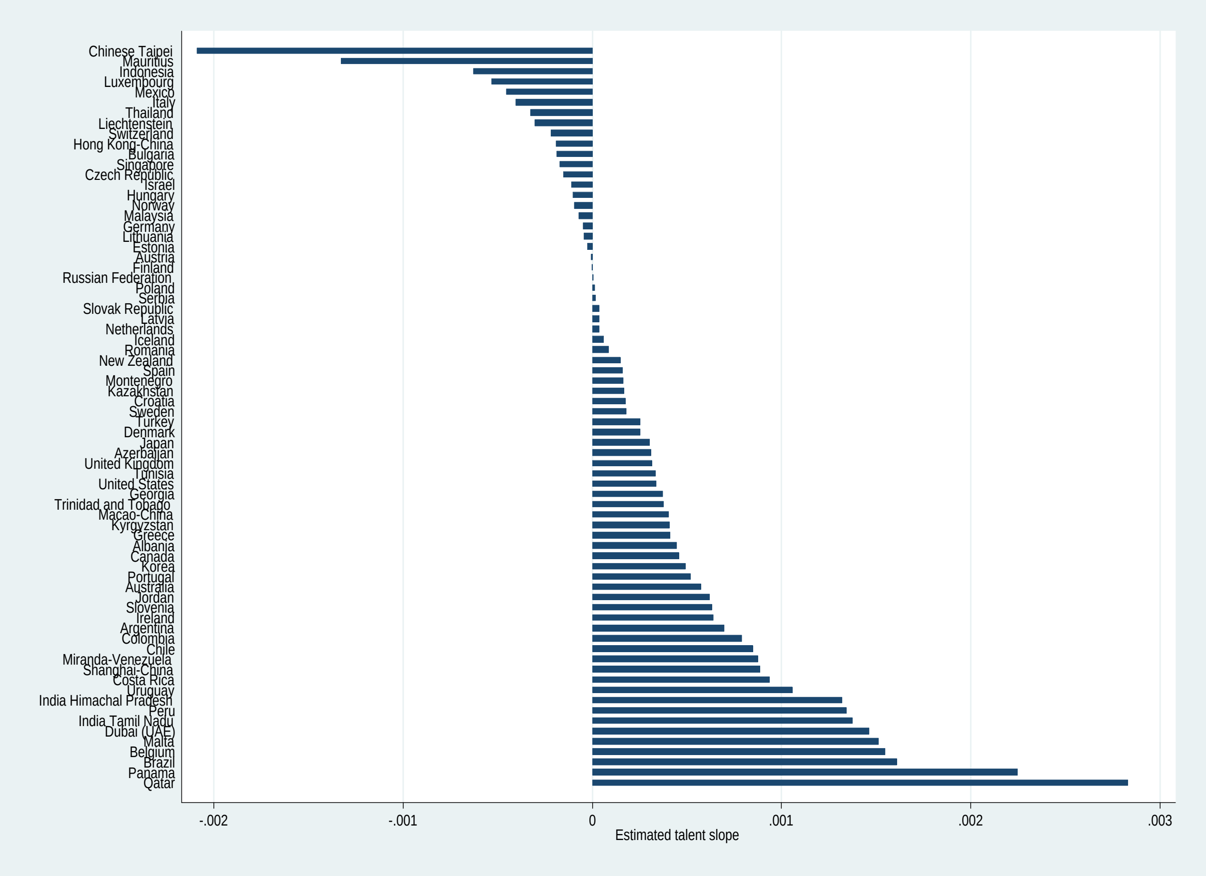
Woessmann, L. (2003) “Schooling Resources, Educational Institutions and Student Performance: the International Evidence", *Oxford Bulletin of Economics and Statistics*, Vol. 65(2): 117-170

Figure 1 – Median and standard deviation of math test scores by country and school type – Pisa 2009



Note: Our computations on PISA 2009 data. Schools are classified as private according to the OECD variable *schtyp*, including both (2) government dependent private schools (1300 schools controlled by a non-government organization or with a governing board not selected by a government agency which receive more than 50% of their core funding from government agencies) and (3) government independent private schools (1310 schools controlled by a non-government organization or with a governing board not selected by a government agency which receive less than 50% of their core funding from government agencies)

Figure 2 –Talent slope coefficients of country-specific selection into private schooling regressions.



Note: Our computations on PISA 2009 data. Schools are classified as private as in Figure 1. The graph plots the estimated coefficients of country-specific talent slopes of a linear probability model for choosing private, where in addition to most of the controls used for estimating residual ability (gender, age, number of years repeated in the same grade, whether attending vocational education, attending the modal grade, parental education, parental occupational category and occupational status, number of books at home, single parent, speaking dialect at home, non native) we include a proxy for family wealth (bases on durable goods ownership– variable *wealth*) and city size (dummies from variable *sc04q01*). Observations are weighed using student weights.

Table 1 Distribution of students by school type and country - PISA 2009

	% public	% private	student observations	school observations
Albania	91.4	8.6	4 570	181
Azerbaijan	98.17	1.83	4 643	162
Argentina	63.36	36.64	3 976	189
Australia	61.17	38.83	14 226	353
Austria	86.36	13.64	6 098	234
Belgium	29.79	70.21	7 866	255
Brazil	87.72	12.28	17 558	939
Bulgaria	98.6	1.4	4 433	178
Canada	92.86	7.14	22 960	974
Chile	40.86	59.14	5 015	164
Shanghai-China	89.95	10.05	4 854	151
Chinese Taipei	61.8	38.2	5 824	158
Colombia	80.24	19.76	6 775	273
Costa Rica	82.91	17.09	3 476	178
Croatia	98.58	1.42	4 994	158
Czech Republic	95.28	4.72	5 725	261
Denmark	82.11	17.89	5 819	285
Estonia	97.32	2.68	4 664	175
Finland	95.23	4.77	5 771	193
Georgia	94.79	5.21	4 566	225
Germany	94.63	5.37	4 470	215
Greece	93.31	6.69	4 920	183
Hong Kong-China	6.94	93.06	4 366	151
Hungary	88.14	11.86	4 545	185
Iceland	99.36	0.64	3 305	131
Indonesia	54.09	45.91	4 812	181
Ireland	36.74	63.26	3 386	144
Israel	82.56	17.44	5 590	176
Italy	94.56	5.44	30 109	1 062
Japan	72.54	27.46	6 088	186
Kazakhstan	97.4	2.6	5 381	199
Jordan	86.16	13.84	6 408	210
Korea	61.94	38.06	4 987	157
Kyrgyzstan	97.81	2.19	4 938	173
Latvia	99.16	0.84	4 395	180
Liechtenstein	94.48	5.52	326	12
Lithuania	99.02	0.98	4 477	196
Luxembourg	85.52	14.48	4 580	39
Macao-China	2.92	97.08	4 415	45
Malaysia	95.83	4.17	4 992	152
Malta	58.16	41.84	3 246	52
Mauritius	53.89	46.11	4 190	182
Mexico	88.99	11.01	36 007	1 530
Montenegro	99.19	0.81	4 825	52
Netherlands	38.59	61.41	4 553	185
New Zealand	94.79	5.21	4 641	163
Norway	98.78	1.22	4 578	197
Panama	71.56	28.44	3 281	188
Peru	79.04	20.96	5 291	237
Poland	93.14	6.86	4 882	185
Portugal	88.64	11.36	5 204	214
Qatar	71.01	28.99	8 012	151
Romania	99.37	0.63	4 776	159
Russian Federation	99.77	0.23	5 217	213

Serbia	98.99	1.01	5 439	190
Singapore	97.6	2.4	5 081	171
Slovak Republic	92.31	7.69	4 411	188
Slovenia	97.9	2.1	6 154	341
Spain	58.96	41.04	23 130	886
Sweden	88.12	11.88	4 563	189
Switzerland	96.83	3.17	11 548	426
Thailand	87.02	12.98	6 181	230
Trinidad and Tobago	84.57	15.43	4 025	149
Dubai (UAE)	42.49	57.51	10 114	369
Tunisia	98.23	1.77	3 900	164
Turkey	99.3	0.7	4 847	150
United Kingdom	96.1	3.9	11 545	482
United States	93.42	6.58	5 224	164
Uruguay	79.17	20.83	4 926	225
Miranda-Venezuela	9.77	90.23	2 631	121
India Himachal Pradesh	83.03	16.97	1 355	66
India Tamil Nadu	62.38	37.62	2 900	147
Total	81.33	18.67	476 980	18 029

Note: Only students in the modal grade ± 1 year.
France and Moldova are excluded because they do not report the information needed to classify schools into the private group.

Table 2 – Median test scores and alternative measures for talent, including median differences between private and public schools, by country – PISA 2009

		public	private	private-public			public	private	private-public
Albania	test score	378.32	447.72	69.40	Lithuania	test score	479.39	489.03	9.64
	residual ability	1.79	22.62	20.83		residual ability	0.78	-1.79	-2.57
	principal component	374.55	445.94	71.39		principal component	480.09	481.43	1.34
Azerbaijan	test score	385.46	452.24	66.78	Luxembourg	test score	489.07	471.06	-18.01
	residual ability	-5.19	5.17	10.36		residual ability	5.07	-5.63	-10.70
	principal component	390.82	469.62	78.80		principal component	498.63	471.69	-26.94
Argentina	test score	387.20	451.39	64.19	Macao-China	test score	503.04	530.81	27.77
	residual ability	-6.47	7.44	13.91		residual ability	-4.61	0.28	4.89
	principal component	385.42	457.01	71.59		principal component	467.94	502.04	34.10
Australia	test score	503.53	547.55	44.02	Malaysia	test score	414.55	474.80	60.25
	residual ability	-2.38	14.28	16.66		residual ability	-3.08	39.29	42.37
	principal component	508.17	554.17	46.00		principal component	413.49	477.60	64.11
Austria	test score	496.55	515.44	18.89	Malta	test score	423.77	520.46	96.69
	residual ability	0.53	-7.67	-8.20		residual ability	-20.53	25.52	46.05
	principal component	492.73	516.35	23.62		principal component	427.18	521.57	94.39
Belgium	test score	491.00	543.13	52.13	Mauritius	test score	448.00	399.11	-48.89
	residual ability	-15.78	6.96	22.74		residual ability	12.84	-10.67	-23.51
	principal component	496.50	544.30	47.80		principal component	447.77	397.18	-50.59
Brazil	test score	389.66	505.11	115.45	Mexico	test score	422.73	459.55	36.82
	residual ability	-2.49	50.03	52.52		residual ability	1.10	-4.76	-5.86
	principal component	374.20	500.94	126.74		principal component	405.51	464.50	58.99
Bulgaria	test score	434.22	503.46	69.24	Montenegro	test score	404.04	405.83	1.79
	residual ability	2.11	52.80	50.69		residual ability	3.39	-33.80	-37.19
	principal component	440.16	524.95	84.79		principal component	411.46	403.96	-7.50
Canada	test score	528.15	578.27	50.12	Netherlands	test score	531.87	519.68	-12.19
	residual ability	9.79	52.43	42.64		residual ability	-0.02	-4.91	-4.89
	principal component	530.61	582.49	51.88		principal component	529.35	514.25	-15.10
Chile	test score	416.29	459.05	42.76	New Zealand	test score	527.93	587.01	59.08
	residual ability	-9.71	3.24	12.95		residual ability	-0.75	33.93	34.68
	principal component	407.37	455.43	48.06		principal component	529.86	594.75	64.89
Shanghai-China	test score	587.52	606.77	19.25	Norway	test score	503.59	467.93	-35.66
	residual ability	4.96	28.31	23.35		residual ability	2.53	-41.78	-44.31
	principal component	565.16	592.94	27.78		principal component	513.18	482.18	-31.00
Chinese Taipei	test score	549.23	486.91	-62.32	Panama	test score	356.78	456.23	99.45
	residual ability	26.13	-37.65	-63.78		residual ability	-14.64	25.29	39.93
	principal component	540.56	481.49	-59.07		principal component	358.75	464.21	105.46
Colombia	test score	396.57	455.22	58.65	Peru	test score	361.51	435.85	74.34
	residual ability	-8.00	5.99	13.99		residual ability	-8.51	21.49	30.00
	principal component	386.84	460.80	73.96		principal component	357.87	440.54	82.67
Costa Rica	test score	432.52	505.70	73.18	Poland	test score	501.80	569.01	67.21
	residual ability	-1.25	12.07	13.32		residual ability	-3.07	28.47	31.54
	principal component	415.37	506.07	90.70		principal component	493.02	580.95	87.93
Croatia	test score	475.57	501.23	25.66	Portugal	test score	506.91	527.95	21.04
	residual ability	1.19	-54.08	-55.27		residual ability	1.62	14.69	13.07
	principal component	468.71	507.88	39.17		principal component	489.70	521.16	31.46
Czech Republic	test score	490.05	517.23	27.18	Qatar	test score	341.50	469.44	127.94
	residual ability	-13.49	-11.75	1.74		residual ability	-27.72	63.96	91.68
	principal component	488.96	523.53	34.57		principal component	363.05	482.14	119.09
Denmark	test score	499.00	515.24	16.24	Romania	test score	426.69	356.51	-70.18
	residual ability	6.75	8.72	1.97		residual ability	1.23	-68.49	-69.72
	principal component	500.27	517.84	17.57		principal component	429.59	368.43	-61.16
Estonia	test score	516.97	521.98	5.01	Russian Federation	test score	469.60	492.01	22.41
	residual ability	1.57	-3.50	-5.07		residual ability	-0.55	32.57	33.12
	principal component	519.78	530.60	10.82		principal component	477.80	502.67	24.87
Finland	test score	548.79	554.97	6.18	Serbia	test score	442.20	428.06	-14.14
	residual ability	8.63	-7.91	-16.54		residual ability	-1.24	-31.64	-30.40
	principal component	550.91	561.01	10.10		principal component	440.62	432.29	-8.33
Georgia	test score	373.11	426.51	53.40	Singapore	test score	554.68	513.78	-40.90
	residual ability	-1.12	17.69	18.81		residual ability	11.20	-36.73	-47.93
	principal component	398.04	451.32	53.28		principal component	541.94	511.17	-30.77
Germany	test score	519.68	531.92	12.24	Slovak Republic	test score	490.11	506.33	16.22
	residual ability	3.64	8.95	5.31		residual ability	0.94	4.57	3.63
	principal component	521.99	548.67	26.68		principal component	486.46	503.91	17.45

Greece	test score	474.07	527.77	53.70	Slovenia	test score	498.15	593.74	95.59
	residual ability	0.54	13.66	13.12		residual ability	13.81	67.13	53.32
	principal component	475.74	550.83	75.09		principal component	491.67	592.43	100.76
Hong Kong-China	test score	584.57	559.56	-25.01	Spain	test score	490.45	517.51	27.06
	residual ability	31.41	0.54	-30.87		residual ability	-2.51	-2.61	-0.10
	principal component	553.32	531.62	-21.70		principal component	485.78	524.07	38.29
Hungary	test score	503.21	513.46	10.25	Sweden	test score	494.40	530.23	35.83
	residual ability	-1.43	-1.50	-0.07		residual ability	-0.46	13.10	13.56
	principal component	506.28	521.04	14.76		principal component	505.52	548.88	43.36
Iceland	test score	503.80	550.90	47.10	Switzerland	test score	522.51	527.89	5.38
	residual ability	2.71	26.72	24.01		residual ability	5.80	-10.90	-16.70
	principal component	510.90	560.88	49.98		principal component	518.28	528.97	10.69
Indonesia	test score	389.56	372.14	-17.42	Thailand	test score	420.94	403.46	-17.48
	residual ability	5.19	-6.10	-11.29		residual ability	-4.49	-16.03	-11.54
	principal component	377.86	361.21	-16.65		principal component	403.24	392.57	-10.67
Ireland	test score	476.91	514.79	37.88	Trinidad and Tobago	test score	424.90	461.80	36.90
	residual ability	-5.82	6.18	12.00		residual ability	-2.26	12.75	15.01
	principal component	481.85	518.96	37.11		principal component	435.15	471.89	36.74
Israel	test score	462.12	482.76	20.64	Dubai (UAE)	test score	411.01	464.85	53.84
	residual ability	1.69	6.20	4.51		residual ability	-22.52	13.58	36.10
	principal component	468.55	504.00	35.45		principal component	411.39	473.46	62.07
Italy	test score	496.46	449.84	-46.62	Tunisia	test score	411.95	336.38	-75.57
	residual ability	-0.75	-43.77	-43.02		residual ability	-0.07	-4.68	-4.61
	principal component	491.37	452.43	-38.94		principal component	395.40	321.91	-73.49
Japan	test score	540.96	535.84	-5.12	Turkey	test score	454.48	544.16	89.68
	residual ability	-4.11	20.32	24.43		residual ability	-3.40	47.26	50.66
	principal component	539.00	540.01	1.01		principal component	436.14	569.17	133.03
Kazakhstan	test score	392.63	445.88	53.25	United Kingdom	test score	499.05	564.05	65.00
	residual ability	-5.57	29.38	34.95		residual ability	0.92	24.34	23.42
	principal component	404.80	454.17	49.37		principal component	502.66	572.76	70.10
Jordan	test score	400.88	432.49	31.61	United States	test score	490.22	560.95	70.73
	residual ability	-8.28	13.57	21.85		residual ability	-0.41	13.78	14.19
	principal component	404.23	435.66	31.43		principal component	487.21	569.15	81.94
Korea	test score	542.84	552.43	9.59	Uruguay	test score	431.90	507.07	75.17
	residual ability	-3.10	4.18	7.28		residual ability	-4.28	16.75	21.03
	principal component	544.22	554.01	9.79		principal component	416.49	508.72	92.23
Kyrgyzstan	test score	318.54	459.45	140.91	Miranda-Venezuela	test score	323.10	437.85	114.75
	residual ability	-5.53	77.03	82.56		residual ability	-41.84	2.80	44.64
	principal component	332.67	472.01	139.34		principal component	315.69	447.89	132.20
Latvia	test score	493.33	509.69	16.36	India Himachal Pradesh	test score	326.32	364.50	38.18
	residual ability	-1.88	8.25	10.13		residual ability	-1.57	22.20	23.77
	principal component	496.45	529.59	33.14		principal component	326.39	372.78	46.39
Liechtenstein	test score	525.58	517.93	-7.65	India Tamil Nadu	test score	330.53	362.46	31.93
	residual ability	10.13	-60.32	-70.45		residual ability	-3.72	21.17	24.89
	principal component	517.65	534.43	16.78		principal component	322.38	359.69	37.31

Note: In grey we indicate countries/state/regions where the public sector dominates the private one. Median values are obtained using individual student weights. Test score reports the mean of literacy, numeracy and scientific knowledge, each in turn taken as mean of five plausible values. Residual ability (our preferred proxy for talent) is obtained as the residual of a regression of PISA test scores (numeracy, obtained as mean of the five plausible values) on gender, age (months), having attended preprimary education (variable *st05q01*=2 or =3), number of years repeated in the same grade (constructed from variables *st07q01*, *st07q02* and *st07q03*), whether attending vocational education (variable *iscedo*=2 or =3), attending the modal grade (variable *grade*), parental education (dummies obtained from variable *hisced*), parental occupational category (white/blue collar – variable *hsecateg*) and occupational status (variable *hisei*), number of books (variable *st22q01*) and educational resources (variable *hedres*) at home, single parent (variable *famstruc*=1), speaking dialect at home (variable *st19q01*), non native (variable *immig*=2 or=3) and country fixed effects. The R^2 of the regression is 0.49. The principal component variable is the first factor extracted from factor analysis (principal component method) applied to reading, mathematics and science scores, highest parental education and number of books at home; it explains 63% of total variance. Since by construction principal component has zero mean and unitary standard deviation, it has been rescaled in order to match the mean and standard deviation of the average test score.

Table 3 Private-public heterogeneity with respect to features that may influence the strength of talent selection effects

	private-public (mean)							
country	Δ selectivity	Δ accountability	Δ competition	Δ streaming	Δindividualized evaluation	Δ repeaters	Δ autonomy	Δ disciplinary climate
Albania	0.56	-0.18	-0.34	-0.10	0.05	-1.22	0.80	0.73
Azerbaijan	0.46	-0.17	-0.12	-0.26	1.25	-2.37	-0.41	0.64
Argentina	0.62	0.02	-0.10	0.15	0.36	-6.26	0.46	0.94
Australia	0.05	0.04	0.07	0.11	-0.31	-0.48	0.37	1.10
Austria	0.19	-0.01	-0.04	-0.03	0.34	-1.38	-0.12	0.61
Belgium	0.10	0.00	0.01	0.02	0.32	-3.95	0.22	0.30
Brazil	0.34	0.04	-0.18	0.19	-0.07	-5.25	1.26	1.14
Bulgaria	0.06	0.26	-0.09	0.26	1.02	-0.36	0.19	1.51
Canada	0.62	0.02	-0.17	-0.29	-0.16	-6.35	1.30	1.47
Chile	0.62	-0.11	-0.30	0.33	0.65	-4.76	0.75	1.18
Shanghai-China	0.48	0.03	-0.02	0.00	-0.16	-0.35	0.47	0.15
Chinese Taipei	0.33	0.07	-0.13	0.24	-0.45	-0.04	0.26	0.59
Colombia	0.62	-0.03	-0.18	0.25	0.06	-1.57	0.86	1.04
Costa Rica	0.31	-0.08	-0.25	0.13	-0.29	-5.82	1.09	1.56
Croatia	-0.32	-0.14	-0.15	0.78	0.77	-2.76	1.44	1.31
Czech Republic	0.66	-0.15	-0.03	-0.04	-0.49	-0.17	-0.09	0.13
Denmark	0.20	-0.06	-0.09	0.19	-0.03	-0.20	0.53	0.74
Estonia	0.13	-0.01	0.20	0.66	-0.15	-0.11	-0.85	-0.25
Finland	1.02	0.10	0.40	-0.11	-0.73	0.71	1.02	0.05
Georgia	0.26	0.14	-0.14	0.00	0.06	0.02	0.48	0.56
Germany	0.47	-0.02	0.04	0.18	-0.27	-0.74	0.38	-0.07
Greece	1.01	0.07	-0.16	0.47	0.63	-0.64	0.35	-0.01
Hong Kong-China	-0.06	-0.08	-0.10	0.31	0.17	2.73	0.63	-0.29
Hungary	0.59	0.03	0.09	0.37	0.19	-1.56	0.33	0.85
Iceland	0.68	-0.27	-0.47	0.18	-0.16	0.00	-0.11	0.89
Indonesia	-0.28	-0.01	0.15	-0.20	-0.22	-4.59	0.37	0.02
Ireland	-0.24	-0.04	0.01	0.04	0.30	0.51	0.00	0.39
Israel	0.31	0.20	0.26	-0.09	0.20	-0.14	0.63	0.53
Italy	-0.10	-0.01	0.40	-0.15	-0.12	-2.86	-0.12	0.14
Japan	-0.13	0.05	-0.26	0.21	-0.39	0.00	0.27	-0.04
Kazakhstan	0.82	0.32	-0.03	0.54	0.29	-0.07	0.37	-0.47
Jordan	0.39	-0.02	-0.27	0.07	0.07	-0.46	0.60	-0.10
Korea	0.71	-0.08	0.21	-0.07	-0.21	0.00	0.06	0.28
Kyrgyzstan	-0.03	0.05	-0.09	0.13	-0.55	-1.11	0.18	1.25
Latvia	-0.53	0.19	-0.09	0.25	-0.20	-2.26	0.12	0.14
Liechtenstein	-0.70	-0.70	0.11	-0.50	0.80	-1.50	1.83	0.99
Lithuania	1.43	-0.60	-0.30	-0.62	0.45	-0.27	-0.57	0.70
Luxembourg	-0.03	0.10	0.11	-0.07	0.20	1.58	0.96	0.93
Macao-China	-0.10	-0.02	0.12	-0.33	1.95	-2.28	1.20	1.38
Malaysia	0.24	0.31	-0.01	-1.21	-0.13	0.00	0.61	1.04
Malta	0.26	-0.05	-0.12	-0.55	-0.34	0.24	1.58	1.08
Mauritius	-0.15	0.04	-0.04	0.36	0.33	5.56	0.84	0.07
Mexico	0.36	0.20	-0.24	0.11	-0.43	-1.84	0.35	0.38
Montenegro	0.53	0.17	0.34	0.48	-0.84	3.49	-0.11	0.37
Netherlands	-0.12	-0.02	-0.06	-0.14	-0.31	-2.09	-0.07	0.32
New Zealand	0.38	0.30	0.50	0.30	0.12	9.75	0.38	1.08
Norway	0.00	0.47	0.15	0.25	-0.09	0.00	-0.04	0.49
Panama	0.27	0.10	0.11	-0.03	-0.63	-5.96	0.66	0.52
Peru	0.26	0.01	-0.15	-0.17	-0.30	-1.98	1.05	0.51
Poland	0.28	-0.18	0.12	0.24	-0.61	-0.18	0.12	0.76
Portugal	0.42	0.09	0.14	0.09	-0.09	-9.50	0.81	1.21
Qatar	0.81	0.15	-0.05	-0.29	-0.15	-2.77	0.97	0.39
Romania	-1.14	0.44	0.59	1.10	-3.01	-0.46	-0.23	-1.47
Russian Federation	0.32	-0.45	-0.16	-1.06	-0.02	-0.17	-0.65	0.09
Serbia	0.22	-0.33	0.45	-0.33	0.39	-1.25	0.04	1.13
Singapore	0.18	-0.52	-0.12	0.03	0.19	-0.83	1.46	-0.01
Slovak Republic	0.51	0.23	-0.03	-0.12	-0.04	0.55	-0.54	0.36

Slovenia	0.83	0.12	-0.02	0.05	0.00	-2.24	-0.04	0.73
Spain	0.07	-0.04	0.05	-0.03	-0.10	-9.61	0.60	1.03
Sweden	-0.01	-0.03	0.11	-0.03	0.14	-1.07	0.51	0.68
Switzerland	-0.20	-0.44	0.14	0.06	-0.62	-0.10	1.34	0.79
Thailand	0.39	0.24	-0.08	0.39	-0.58	-0.28	-0.34	-0.26
Trinidad and Tobago	-0.03	0.03	0.00	0.14	0.41	2.64	0.46	0.57
Dubai (UAE)	0.66	0.20	-0.13	-0.20	-0.23	-4.90	1.28	1.01
Tunisia	0.80	0.40	0.18	0.63	0.36	-4.65	0.18	0.30
Turkey	0.66	-0.22	-0.55	-0.86	2.01	-4.59	0.28	-1.89
United Kingdom	1.23	0.04	0.00	-0.09	-0.14	0.32	0.56	1.57
United States	1.28	0.46	0.40	-0.21	-0.05	-4.38	0.48	0.71
Uruguay	0.70	0.00	-0.16	0.06	0.09	-17.34	0.56	1.49
Miranda-Venezuela	0.50	0.07	0.02	-0.05	-0.50	-2.87	0.15	0.64
India Himachal P	0.16	0.29	-0.07	0.02	-0.33	-5.55	-0.14	0.61
India Tamil Nadu	0.45	0.18	-0.16	0.03	-0.05	4.74	-0.07	0.16
Total	0.44	0.06	0.13	-0.06	-0.30	-1.51	0.56	0.68
factor analysis (principal component method) applied to schools – factor loadings								
factor 1 (var.expl.0.19)	0.5468	-0.3238	-0.5153	0.3558	-0.0911	-0.6045	0.4002	0.4483
factor 2 (var.expl.0.14)	-0.1247	0.6262	0.0535	-0.3327	0.3136	-0.0822	0.5996	0.3474
factor 3 (var.expl.0.13)	-0.2056	-0.192	-0.1822	0.3518	0.8659	0.0309	0.0266	-0.1828
uniqueness	0.6431	0.4662	0.6984	0.6389	0.1437	0.6269	0.4796	0.645

Note: School-weighed mean differences between private and public schools along 8 dimensions of teaching organization:

1) **Selectivity** in admission = PISA variable *selsch* ranging between 1 and 3 (computed by assigning schools to four different categories: (1) schools where neither of two factors (students' academic record (including placement tests) and the recommendation of feeder schools) is considered for student admittance, (2) schools considering at least one of these two factors, (3) schools where at least one of these two factors is a prerequisite for student admittance.)
2) **Accountability** = PISA dummy variable *sc21q03* (Does your school provide information to parents on the academic performance of students as a group relative to students in the same grade in other schools?) coded 1 if selected
3) **Competition** = PISA dummy variable *sc13q07* (This academic year, which of the following activities does your school offer to students? School club or school competition for foreign language, math or science) coded 1 if selected
4) **Streaming** or ability grouping = PISA variable *abgroup* ranging between 1 and 3 (derived from the two items by assigning schools to three categories: (1) schools with no ability grouping for any subjects, (2) schools with one of these forms of ability grouping between classes for some subjects and (3) schools with one of these forms of ability grouping for all subjects.)
5) **Individualized evaluation** based on teacher judgment = PISA variable *sc15q03* (Generally, in your school, how often are students assessed using teachers' judgmental ratings?) ranging between 1 (never, selected by 8.7% of schools, and 5 (more than once a month, the modal reply at 39.1% of schools).
6) **Repeaters**: fraction of repeating students = PISA variable *sc07q02* ("The approximate percentage of students repeating a grade at ISCED 3 in this school last year was …"). Missing information for Iceland, Japan, Korea, Malaysia, Norway, Poland (only private) was set equal to zero.
7) **Autonomy**: school responsibility in curriculum assessment = PISA variable *respcurr* (computed from four items measuring the school principal's report concerning who had responsibility for curriculum and assessment ("Establishing student assessment policies", "Choosing which textbooks are used", "Determining course content", and "Deciding which courses are offered"). Higher values indicate relatively higher levels of school responsibility in this area. Range between -1.36 and +1.36, with unitary standard deviation
8) **Disciplinary climate** = PISA variable *studbeha* (index on the student-related aspects of school climate, with higher WLEs representing good behavior as regards: Student absenteeism; Disruption of classes by students; Students skipping classes; Students lacking respect for teachers; Student use of alcohol or illegal drugs; Students intimidating or bullying other students.). Range between -3.41 and +2.36, with unitary standard deviation

Table 4– Cross-country regressions of talent-slope estimates from $y_{is} = \alpha_s + \beta_s \theta_{is} + \mathbf{X}_{is}\boldsymbol{\gamma} + \varepsilon_i$

	$\hat{\beta}$
Δ selectivity	0.025
	[0.000]
Δ accountability	0.531**
	[0.000]
Δ competition	-0.801***
	[0.000]
Δ streaming	-0.295*
	[0.000]
Δ individualized evaluation	-0.145*
	[0.000]
Δ repeaters	-0.040***
	[0.000]
Δ autonomy	0.103
	[0.000]
Δ disciplinary climate	0.138
	[0.000]
Observations	72
R^2	0.327

Note: See the note to Figure 2, which shows the left-hand side of these regressions, for details of how country-specific slopes are estimated. This table reports coefficients from regressions on the eight indicators listed in Table 3. Observations are weighted by the inverse of the estimated coefficient's standard error. Robust standard errors in brackets; statistical significance: *** p<0.01, ** p<0.05, * p<0.1. The coefficients of the last column are multiplied by 1000 for readability.

Table 5 – Selection into private schools – PISA 2009

	1	2	3	4	5	6	7
VARIABLES	probit (marginal effects)	linear probability model	linear probability model	linear probability model	linear probability model	linear probability model	linear probability model
residual ability	0.176***	0.218***	0.216***	0.005	-0.167*	-0.146	-0.128
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δ repeaters × residual ability				-0.093***	-0.127***	-0.109***	-0.102***
				[0.000]	[0.000]	[0.000]	[0.000]
Δ individualized evaluation × residual ability					-0.484***	-0.611***	-0.416***
					[0.000]	[0.000]	[0.000]
Δ streaming × residual ability						-0.14	-0.108
						[0.000]	[0.000]
Δ selectivity × residual ability				-0.05	0.357**	0.248*	0.03
				[0.000]	[0.000]	[0.000]	[0.000]
Δ accountability × residual ability					-0.573**	0.076	0.114
					[0.000]	[0.000]	[0.000]
Δ competition × residual ability						-1.729***	-1.761***
						[0.000]	[0.000]
Δ autonomy × residual ability							-0.129
							[0.000]
Δ disciplinary climate × residual ability							0.288***
							[0.000]
number of books at home	0.012995***	0.012824***	0.012641***	0.012568***	0.012366***	0.012405***	0.012420***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
highest parental occupational status (*hisei*)	0.001519***	0.001778***	0.001757***	0.001731***	0.001719***	0.001712***	0.001704***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
wealth	0.026664***	0.033152***	0.007275	0.006979	0.006958	0.006414	0.0061
	[0.003]	[0.004]	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]
wealth × Δ school cost covered by tuition fees (*sc03q02*)			0.000517***	0.000509***	0.000509***	0.000516***	0.000520***
			[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δ school cost covered by tuition fees (*sc03q02*)			-0.01429***	-0.01431***	-0.01432***	-0.01435***	-0.01436***
			[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
attending vocational education	0.142404***	0.158910***	0.157365***	0.158707***	0.158713***	0.156970***	0.156319***
	[0.030]	[0.025]	[0.025]	[0.025]	[0.025]	[0.025]	[0.025]
number of years repeated in the same grade	-0.01499***	-0.01847***	-0.01751***	-0.01722***	-0.01767***	-0.01800***	-0.01836***
	[0.005]	[0.006]	[0.006]	[0.007]	[0.007]	[0.007]	[0.007]
Observations	419966	419966	419966	419966	419966	419966	419966
Number of countries	72	72	72	72	72	72	72
R^2	0.274	0.247	0.248	0.25	0.251	0.253	0.254

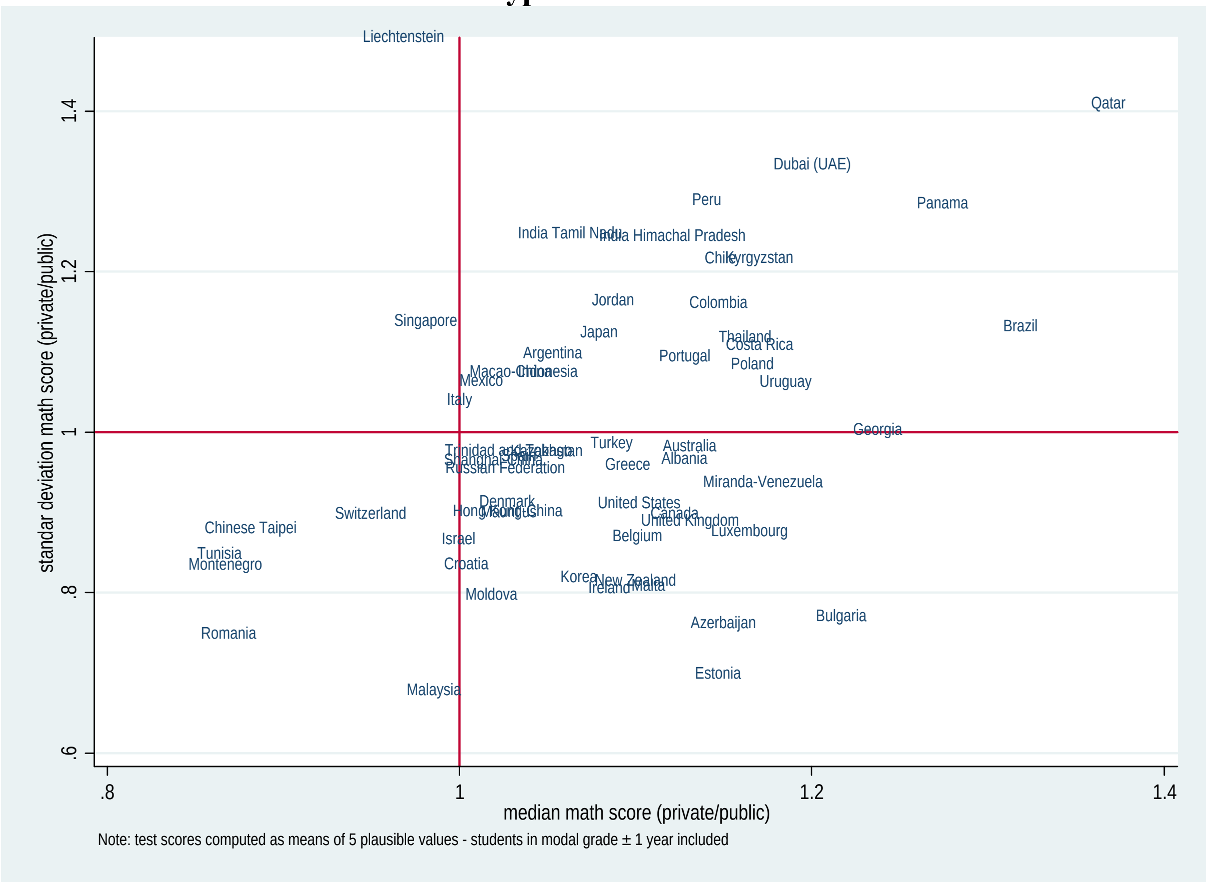
Note: Δ indicates (private-public) mean difference at country level. All regressions also include a constant, gender, age, single parent, parental education, parental occupational category, speaking dialect at home, non native, city size and country fixed effects. Standard errors in brackets allow errors to be clustered at the school level. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1. The estimated coefficients of residual ability and its interactions in the first nine rows are multiplied by 1000 for readability.

Appendix (not intended for publication)

We present here the full set of empirical results when a more restrictive definition of private school is adopted, relying on more than 50% of funds obtained from household contribution. Starting from the full dataset, in the main text we loose 1 country (France has no information about school control or funding). Adopting this definition the sample loses Austria (no information on funding) and 13 more countries where no students are enrolled in this type of private (which therefore do not contribute to the identification of the sorting mechanism). We are therefore left with 59 countries/regions.

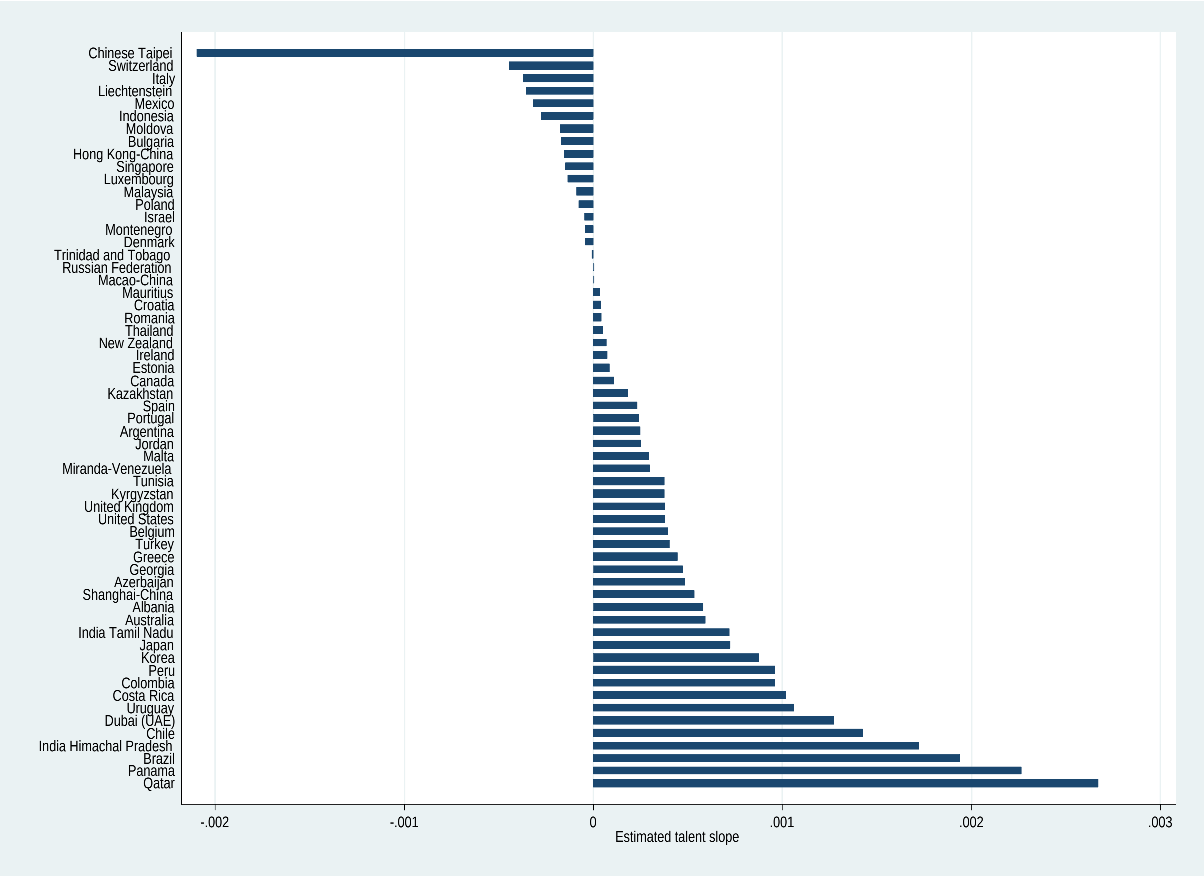
country code iso 3-digit	Private that receive more than 50% from student fees 0	1	Total
Czech Republic	5,444	0	5,444
Finland	5,810	0	5,810
Germany	3,439	0	3,439
Hungary	3,705	0	3,705
Iceland	1,341	0	1,341
Latvia	3,172	10	3,182
Lithuania	3,308	0	3,308
Netherlands	4,287	0	4,287
Norway	4,578	0	4,578
Serbia	5,272	2	5,274
Slovak Republic	4,466	0	4,466
Slovenia	4,249	0	4,249
Sweden	4,489	0	4,489
Total	53,560	12	53,572

Figure 1 – Median and standard deviation of math test scores by country and school type – Pisa 2009



Note: Our computations on PISA 2009 data. Schools are classified as private according to the OECD variable *schtyp*, including only (3) government independent private schools (1310 schools controlled by a non-government organization or with a governing board not selected by a government agency which receive less than 50% of their core funding from government agencies)

Figure 2 –Talent slope coefficients of country-specific selection into private schooling regressions.



Note: Our computations on PISA 2009 data. Schools are classified as private as in Figure 1. The graph plots the estimated coefficients of country-specific talent slopes of a linear probability model for choosing private, where in addition to most of the controls used for estimating residual ability (gender, age, number of years repeated in the same grade, whether attending vocational education, attending the modal grade, parental education, parental occupational category and occupational status, number of books at home, single parent, speaking dialect at home, non native) we include a proxy for family wealth (bases on durable goods ownership– variable *wealth*) and city size (dummies from variable *sc04q01*). Observations are weighed using student weights.

Table 1 Distribution of students by school type and country - PISA 2009

	larger definition		stricter definition			
	% public	% private	% public	% private	student observations	school observations
Albania	91.4	8.6	91.23	8.77	4 570	181
Azerbaijan	98.17	1.83	98.17	1.83	4 643	162
Argentina	63.36	36.64	80.07	19.93	3 976	189
Australia	61.17	38.83	86.83	13.17	14 226	353
Austria	86.36	13.64			6 098	234
Belgium	29.79	70.21	97.47	2.53	7 866	255
Brazil	87.72	12.28	84.49	15.51	17 558	939
Bulgaria	98.6	1.4	98.60	1.40	4 433	178
Canada	92.86	7.14	96.00	4.00	22 960	974
Chile	40.86	59.14	75.98	24.02	5 015	164
Shanghai-China	89.95	10.05	88.76	11.24	4 854	151
Chinese Taipei	61.8	38.2	63.43	36.57	5 824	158
Colombia	80.24	19.76	75.00	25.00	6 775	273
Costa Rica	82.91	17.09	83.38	16.62	3 476	178
Croatia	98.58	1.42	98.40	1.60	4 994	158
Czech Republic	95.28	4.72			5 725	261
Denmark	82.11	17.89	98.52	1.48	5 819	285
Estonia	97.32	2.68	99.33	0.67	4 664	175
Finland	95.23	4.77			5 771	193
Georgia	94.79	5.21	96.52	3.48	4 566	225
Germany	94.63	5.37			4 470	215
Greece	93.31	6.69	89.95	10.05	4 920	183
Hong Kong-China	6.94	93.06	97.75	2.25	4 366	151
Hungary	88.14	11.86			4 545	185
Iceland	99.36	0.64			3 305	131
Indonesia	54.09	45.91	67.99	32.01	4 812	181
Ireland	36.74	63.26	91.72	8.28	3 386	144
Israel	82.56	17.44	90.55	9.45	5 590	176
Italy	94.56	5.44	93.85	6.15	30 109	1 062
Japan	72.54	27.46	80.55	19.45	6 088	186
Kazakhstan	97.4	2.6	95.74	4.26	5 381	199
Jordan	86.16	13.84	91.45	8.55	6 408	210
Korea	61.94	38.06	52.85	47.15	4 987	157
Kyrgyzstan	97.81	2.19	93.55	6.45	4 938	173
Latvia	99.16	0.84	99.71	0.29	4 395	180
Liechtenstein	94.48	5.52	86.86	13.14	326	12
Lithuania	99.02	0.98			4 477	196
Luxembourg	85.52	14.48	98.28	1.72	4 580	39
Macao-China	2.92	97.08	86.46	13.54	4 415	45
Malaysia	95.83	4.17	97.86	2.14	4 992	152
Malta	58.16	41.84	90.10	9.90	3 246	52
Mauritius	53.89	46.11	94.20	5.80	4 190	182
Mexico	88.99	11.01	59.82	40.18	36 007	1 530
Moldova			99.15	0.85	5 176	176
Montenegro	99.19	0.81	96.41	3.59	4 825	52
Netherlands	38.59	61.41			4 553	185
New Zealand	94.79	5.21	93.89	6.11	4 641	163
Norway	98.78	1.22			4 578	197
Panama	71.56	28.44	65.61	34.39	3 281	188
Peru	79.04	20.96	58.61	41.39	5 291	237
Poland	93.14	6.86	95.49	4.51	4 882	185
Portugal	88.64	11.36	94.82	5.18	5 204	214
Qatar	71.01	28.99	59.81	40.19	8 012	151

Romania	99.37	0.63	99.37	0.63	4 776	159
Russian Federation	99.77	0.23	99.77	0.23	5 217	213
Serbia	98.99	1.01	99.96	0.04	5 439	190
Singapore	97.6	2.4	98.12	1.88	5 081	171
Slovak Republic	92.31	7.69			4 411	188
Slovenia	97.9	2.1			6 154	341
Spain	58.96	41.04	92.86	7.14	23 130	886
Sweden	88.12	11.88			4 563	189
Switzerland	96.83	3.17	98.16	1.84	11 548	426
Thailand	87.02	12.98	93.85	6.15	6 181	230
Trinidad and Tobago	84.57	15.43	91.38	8.62	4 025	149
Dubai (UAE)	42.49	57.51	30.10	69.90	10 114	369
Tunisia	98.23	1.77	96.82	3.18	3 900	164
Turkey	99.3	0.7	91.93	8.07	4 847	150
United Kingdom	96.1	3.9	95.76	4.24	11 545	482
United States	93.42	6.58	93.84	6.16	5 224	164
Uruguay	79.17	20.83	80.04	19.96	4 926	225
Miranda-Venezuela	9.77	90.23	15.84	84.16	2 631	121
India Himachal Pradesh	83.03	16.97	73.22	26.78	1 355	66
India Tamil Nadu	62.38	37.62	74.05	25.95	2 900	147
Total	81.33	18.67	86.89	13.11	482 156	18 205

Note: Only students in the modal grade ± 1 year.
France is excluded because they do not report the information needed to classify schools into the private group.

Table 2 – Median test scores and alternative measures for talent, including differences of medians between private and public schools, by country – PISA 2009

	public	private	private-public		public	private	private-public
Albania	378.55	451.73	73.18	Macao-China	529.15	532.33	3.18
	0.75	31.07	30.32		2.58	-7.48	-10.06
	375.42	446.86	71.44		500.58	514.20	13.62
Azerbaijan	385.46	452.24	66.78	Malaysia	413.97	403.94	-10.03
	-5.03	22.35	27.38		-1.47	-27.27	-25.80
	390.38	469.12	78.74		413.68	409.62	-4.06
Argentina	411.38	439.94	28.56	Malta	456.41	528.71	72.30
	-0.67	13.11	13.78		-7.11	25.62	32.73
	408.44	446.18	37.74		459.43	538.50	79.07
Australia	514.15	575.94	61.79	Mauritius	428.63	451.96	23.33
	1.48	35.00	33.52		2.99	7.66	4.67
	518.84	586.17	67.33		425.91	460.40	34.49
Belgium	526.07	588.35	62.28	Mexico	426.44	432.09	5.65
	0.92	28.69	27.77		2.89	0.82	-2.07
	530.17	580.48	50.31		409.87	420.29	10.42
Brazil	387.31	511.96	124.65	Moldova	400.83	399.76	-1.07
	-3.34	52.30	55.64		0.69	-25.31	-26.00
	371.18	507.62	136.44		403.92	419.20	15.28
Bulgaria	434.22	503.46	69.24	Montenegro	404.17	359.62	-44.55
	3.00	33.43	30.43		5.19	-37.16	-42.35
	440.61	524.78	84.17		411.47	360.55	-50.92
Canada	533.22	573.52	40.30	New Zealand	528.74	573.92	45.18
	14.14	27.11	12.97		1.17	24.88	23.71
	536.63	584.64	48.01		531.30	582.40	51.10
Chile	438.83	498.28	59.45	Panama	357.86	454.36	96.50
	-5.62	24.68	30.30		-14.20	31.90	46.10
	433.32	503.79	70.47		358.34	462.17	103.83
Shanghai-China	588.38	596.71	8.33	Peru	363.51	418.70	55.19
	3.42	13.93	10.51		-5.52	13.38	18.90
	566.99	582.85	15.86		358.90	423.12	64.22
Chinese Taipei	548.21	494.69	-53.52	Poland	502.12	564.20	62.08
	22.98	-26.82	-49.80		-0.78	23.88	24.66
	539.34	488.42	-50.92		494.33	575.12	80.79
Colombia	401.54	446.92	45.38	Portugal	510.15	566.20	56.05
	-7.43	10.31	17.74		3.58	11.00	7.42
	391.33	445.67	54.34		494.49	576.22	81.73
Costa Rica	433.49	503.83	70.34	Qatar	335.14	464.85	129.71
	-2.44	15.04	17.48		-28.41	67.50	95.91
	418.19	505.88	87.69		353.92	478.72	124.80
Croatia	476.92	501.23	24.31	Romania	426.69	356.51	-70.18
	3.87	-31.66	-35.53		2.28	-66.02	-68.30
	471.37	507.61	36.24		429.76	368.34	-61.42
Denmark	502.82	508.72	5.90	Russian Federation	469.60	492.01	22.41
	7.95	8.97	1.02		0.95	29.89	28.94
	505.21	516.60	11.39		477.88	502.46	24.58
Estonia	516.84	595.51	78.67	Singapore	553.74	503.27	-50.47
	-0.47	57.60	58.07		10.19	-30.67	-40.86
	519.94	601.03	81.09		542.24	484.37	-57.87
Georgia	379.30	463.14	83.84	Spain	500.39	530.49	30.10
	0.01	38.10	38.09		-0.09	6.18	6.27
	403.64	477.59	73.95		499.62	541.02	41.40
Greece	473.21	527.77	54.56	Switzerland	527.22	511.89	-15.33
	-0.20	19.71	19.91		7.91	-32.09	-40.00
	473.21	550.94	77.73		524.99	516.10	-8.89
Hong Kong-China	561.58	525.71	-35.87	Thailand	417.36	421.01	3.65
	5.43	-51.19	-56.62		-2.47	-10.01	-7.54
	534.73	528.99	-5.74		401.69	413.32	11.63

Indonesia	376.71	400.19	23.48	Trinidad and Tobago	431.11	451.78	20.67
	3.19	-2.05	-5.24		0.92	13.55	12.63
	363.82	394.55	30.73		441.30	462.48	21.18
Ireland	500.18	551.01	50.83	Dubai (UAE)	407.27	466.38	59.11
	2.94	11.57	8.63		-20.27	12.45	32.72
	500.04	564.63	64.59		408.45	474.78	66.33
Israel	463.14	459.95	-3.19	Tunisia	412.41	350.41	-62.00
	0.90	5.93	5.03		-0.44	-1.57	-1.13
	472.49	466.03	-6.46		397.09	338.10	-58.99
Italy	494.60	490.90	-3.70	Turkey	452.39	492.07	39.68
	0.95	-23.62	-24.57		-2.28	11.67	13.95
	489.78	500.12	10.34		433.96	477.86	43.90
Japan	533.42	565.40	31.98	United Kingdom	499.29	564.05	64.76
	-2.15	40.07	42.22		1.36	32.79	31.43
	532.80	568.00	35.20		502.98	572.96	69.98
Kazakhstan	392.75	419.50	26.75	United States	489.08	563.10	74.02
	-5.25	18.74	23.99		-1.71	33.71	35.42
	404.55	428.18	23.63		485.87	570.31	84.44
Jordan	402.33	439.75	37.42	Uruguay	431.93	508.14	76.21
	-3.90	5.15	9.05		-4.93	19.44	24.37
	404.99	453.19	48.20		417.57	510.63	93.06
Korea	527.83	565.39	37.56	Miranda-Venezuela	344.45	432.09	87.64
	-4.18	10.07	14.25		-31.65	3.17	34.82
	529.34	568.11	38.77		341.72	442.57	100.85
Kyrgyzstan	317.13	386.86	69.73	India Himachal Pradesh	327.97	359.82	31.85
	-7.28	30.34	37.62		-3.56	9.48	13.04
	330.09	403.46	73.37		326.97	364.52	37.55
Liechtenstein	509.73	517.93	8.20	India Tamil Nadu	339.75	375.69	35.94
	2.54	-26.94	-29.48		4.94	15.41	10.47
	512.15	534.59	22.44		329.25	374.36	45.11
Luxembourg	483.72	575.09	91.37				
	2.90	14.85	11.95				
	492.25	584.41	92.16				

Note: In grey we indicate countries/state/regions where the public sector dominates the private one. Median values are obtained using individual student weights. Test score reports the mean of literacy, numeracy and scientific knowledge, each in turn taken as mean of five plausible values. Residual ability (our preferred proxy for talent) is obtained as the residual of a regression of PISA test scores (numeracy, obtained as mean of the five plausible values) on gender, age (months), having attended preprimary education (variable *st05q01*=2 or =3), number of years repeated in the same grade (constructed from variables *st07q01*, *st07q02* and *st07q03*), whether attending vocational education (variable *iscedo*=2 or =3), attending the modal grade (variable *grade*), parental education (dummies obtained from variable *hisced*), parental occupational category (white/blue collar – variable *hsecateg*) and occupational status (variable *hisei*), number of books (variable *st22q01*) and educational resources (variable *hedres*) at home, single parent (variable *famstruc*=1), speaking dialect at home (variable *st19q01*), non native (variable *immig*=2 or=3) and country fixed effects. The R^2 of the regression is 0.50. The principal component variable is the first factor extracted from factor analysis (principal component method) applied to reading, mathematics and science scores, highest parental education and number of books at home; it explains 63% of total variance. Since by construction principal component has zero mean and unitary standard deviation, it has been rescaled in order to match the mean and standard deviation of the average test score.

Table 3 Private-public heterogeneity with respect to features that may influence the strength of talent selection effects

	private-public (mean)							
country	Δ selectivity	Δ accountability	Δ competition	Δ streaming	Δindividualized evaluation	Δ repeaters	Δ autonomy	Δ disciplinary climate
Albania	-1.05	0.16	-0.11	0.36	1.25	0.02	-0.29	0.53
Azerbaijan	-2.37	-0.26	1.25	0.64	-0.41	-0.17	-0.12	0.46
Argentina	-2.42	-0.04	-0.01	0.41	0.42	-0.02	-0.33	0.36
Australia	-0.26	0.04	0.08	1.10	0.25	-0.04	-0.17	-0.16
Belgium	-9.25	0.44	0.32	0.76	0.06	0.01	-0.32	-0.06
Brazil	-5.72	0.18	-0.09	1.25	1.42	0.00	-0.16	0.47
Bulgaria	-0.36	0.26	1.02	1.51	0.19	0.26	-0.09	0.06
Canada	-3.19	-0.28	-0.52	1.22	1.33	0.05	-0.23	0.9
Chile	-2.03	-0.23	0.33	0.52	-0.07	0.13	-0.17	0.25
Shanghai-China	-0.39	-0.14	-0.11	-0.05	0.49	0.19	-0.02	0.48
Chinese Taipei	-0.29	0.25	-0.25	0.76	0.47	0.11	-0.17	0.3
Colombia	-0.91	0.19	0.24	0.81	0.62	0.01	-0.03	0.48
Costa Rica	-6.47	0.19	-0.26	1.45	1.07	-0.09	-0.21	0.26
Croatia	-2.69	0.79	0.73	1.30	1.45	-0.17	-0.15	-0.31
Denmark	-0.29	0.07	0.87	0.63	0.66	-0.38	0.13	-0.04
Estonia	-0.11	0.28	-0.86	-0.59	-0.47	0.28	0.89	0.13
Georgia	0.08	-0.09	-0.03	0.6	0.43	0.35	-0.2	0.15
Greece	-0.89	0.46	0.71	-0.07	0.35	0.04	-0.15	1.09
Hong Kong-China	-3.61	0.09	-0.05	1.51	0.42	0.08	0.35	0.19
Indonesia	2.31	-0.08	0.36	0.26	0.34	0.11	-0.06	-0.13
Ireland	-1.46	-0.14	-0.29	0.75	-0.3	0.05	-0.39	-0.37
Israel	0.62	-0.39	-0.01	-1.08	-0.44	-0.26	0	-1.36
Italy	-3.41	-0.19	-0.22	0.17	0.02	0	0.18	-0.02
Japan	0	0.12	-0.14	0.03	0.19	0.03	-0.41	-0.1
Kazakhstan	-0.07	0.59	-0.24	-0.61	0.55	0.44	0.01	0.77
Jordan	-0.32	-0.03	0.28	0.09	0.89	0.07	-0.17	0.68
Korea	0	-0.05	0.62	-0.2	0.1	0.06	-0.13	-0.42
Kyrgyzstan	-0.97	-0.03	-0.32	1.05	-0.13	0.09	-0.08	-0.22
Liechtenstein	0.5	-0.7	1.2	1.17	2.03	-0.6	0	-0.8
Luxembourg	-11.67	-0.62	-1.1	0.8	2.17	0.09	0.19	0.04
Macao-China	-3.03	0.38	0.16	0.55	0.43	0.03	0.03	0.16
Malaysia	0	0.45	0.14	0.18	0.55	-0.33	-0.11	0.42
Malta	0	-0.97	-0.01	0.2	2.07	-0.13	-0.09	0.43
Mauritius	9.31	0.4	0.71	0.81	0.96	-0.05	-0.06	-0.07
Mexico	-2.22	0.08	-0.21	0.13	0.14	-0.01	-0.08	0.25
Moldova	-0.01	0.34	0.02	0.03	-0.14	-0.56	-0.48	0.02
Montenegro	5.79	-0.06	-0.5	0.35	-0.22	0.18	0.16	-0.2
New Zealand	-2.12	-0.03	0.21	1.19	0.28	0.25	0.25	0.4
Panama	-5.92	-0.01	-0.59	0.83	0.21	0.08	0.14	0.42
Peru	-2.59	-0.11	0.05	0.36	0.71	0.02	-0.11	0.15
Poland	-0.17	0.37	-0.29	0.57	0.39	-0.22	0.01	0.3
Portugal	-6.89	-0.32	-0.2	1.51	0.99	0.11	-0.28	0.16
Qatar	-3.33	-0.28	-0.27	0.38	0.9	0.01	-0.02	0.87
Romania	-0.46	1.1	-3.01	-1.47	-0.23	0.44	0.59	-1.14
Russian Federati	-0.17	-1.06	-0.02	0.09	-0.65	-0.45	-0.16	0.32
Singapore	0.49	-0.03	-0.19	0.05	1.17	-0.68	-0.1	0.04
Spain	-2.68	0.03	-0.08	1.11	0.62	0.04	-0.1	0.47
Switzerland	-0.99	0.1	0.14	0.95	1.69	-0.61	0.13	-0.38
Thailand	1.26	0.25	-0.29	0.11	0.58	-0.08	-0.07	0.03
Trinidad and Tob	6.14	0.38	0.53	0.96	0.21	-0.19	-0.02	0.21
Dubai (UAE)	-5.97	-0.23	-0.33	1.05	1.51	0.2	-0.21	0.73
Tunisia	-4.38	0.58	0.27	0.23	0.16	0.36	0.17	0.76
Turkey	0.79	0.57	-0.31	0.93	0	-0.06	-0.18	0.41
United Kingdom	0.32	-0.09	-0.15	1.53	0.59	0.05	-0.01	1.24
United States	-4.59	-0.2	-0.17	0.66	0.3	0.48	0.43	1.19
Uruguay	-17.87	0.06	0.08	1.47	0.56	0	-0.17	0.72
Miranda-Venezuel	-1.97	0	0.13	0.25	0.06	-0.14	-0.12	0.34

India Himachal P	-4.26	0.22	-0.08	0.81	-0.15	0.2	-0.17	0.3
India Tamil Nadu	-18.35	0.26	0.32	0.16	-0.12	0.33	-0.04	0.3
Total	-0.73	0.02	-0.11	0.64	0.26	0.08	0.09	0.27
factor analysis (principal component method) applied to schools – factor loadings								
factor 1 (var.expl.0.19)	-0.6157	0.3864	-0.1067	0.4339	0.3987	-0.3313	-0.5275	0.5537
factor 2 (var.expl.0.14)	-0.0719	-0.3309	0.2686	0.4084	0.6026	0.6137	0.0268	-0.1585
factor 3 (var.expl.0.13)	0.1074	0.3982	0.8589	-0.1834	0.0863	-0.1483	-0.182	-0.1736
uniqueness	0.6042	0.5826	0.1787	0.6113	0.4705	0.4916	0.6879	0.6382

Note: School-weighed mean differences between private and public schools along 8 dimensions of teaching organization:

1) **Selectivity** in admission = PISA variable *selsch* ranging between 1 and 3 (computed by assigning schools to four different categories: (1) schools where neither of two factors (students' academic record (including placement tests) and the recommendation of feeder schools) is considered for student admittance, (2) schools considering at least one of these two factors, (3) schools where at least one of these two factors is a prerequisite for student admittance.)
2) **Accountability** = PISA dummy variable *sc21q03* (Does your school provide information to parents on the academic performance of students as a group relative to students in the same grade in other schools?) coded 1 if selected
3) **Competition** = PISA dummy variable *sc13q07* (This academic year, which of the following activities does your school offer to students? School club or school competition for foreign language, math or science) coded 1 if selected
4) **Streaming** or ability grouping = PISA variable *abgroup* ranging between 1 and 3 (derived from the two items by assigning schools to three categories: (1) schools with no ability grouping for any subjects, (2) schools with one of these forms of ability grouping between classes for some subjects and (3) schools with one of these forms of ability grouping for all subjects.)
5) **Individualized evaluation** based on teacher judgment = PISA variable *sc15q03* (Generally, in your school, how often are students assessed using teachers' judgmental ratings?) ranging between 1 (never, selected by 8.7% of schools, and 5 (more than once a month, the modal reply at 39.1% of schools).
6) **Repeaters**: fraction of repeating students = PISA variable *sc07q02* ("The approximate percentage of students repeating a grade at ISCED 3 in this school last year was …"). Missing information for Iceland, Japan, Korea, Malaysia, Norway, Poland (only private) was set equal to zero.
7) **Autonomy**: school responsibility in curriculum assessment = PISA variable *respcurr* (computed from four items measuring the school principal's report concerning who had responsibility for curriculum and assessment ("Establishing student assessment policies", "Choosing which textbooks are used", "Determining course content", and "Deciding which courses are offered"). Higher values indicate relatively higher levels of school responsibility in this area. Range between -1.36 and +1.36, with unitary standard deviation
8) **Disciplinary climate** = PISA variable *studbeha* (index on the student-related aspects of school climate, with higher WLEs representing good behavior as regards: Student absenteeism; Disruption of classes by students; Students skipping classes; Students lacking respect for teachers; Student use of alcohol or illegal drugs; Students intimidating or bullying other students.). Range between -3.41 and +2.36, with unitary standard deviation

Table 4 – Cross-country regressions of talent-slope estimates from $y_{is} = \alpha_s + \beta_s \theta_{is} + \mathbf{X}_{is}\gamma + \varepsilon_i$

	larger definition	stricter definition
	$\hat{\beta}$	$\hat{\beta}$
Δ selectivity	0.025	0.227*
	[0.000]	[0.000]
Δ accountability	0.531**	0.211
	[0.000]	[0.000]
Δ competition	-0.801***	-0.553**
	[0.000]	[0.000]
Δ streaming	-0.295*	-0.027
	[0.000]	[0.000]
Δ individualized evaluation	-0.145*	-0.063
	[0.000]	[0.000]
Δ repeaters	-0.040***	-0.028**
	[0.000]	[0.000]
Δ autonomy	0.103	-0.084
	[0.000]	[0.000]
Δ disciplinary climate	0.138	0.126
	[0.000]	[0.000]
Observations	72	58
R^2	0.327	0257

Note: See the note to Figure 2, which shows the left-hand side of these regressions, for details of how country-specific slopes are estimated. This table reports coefficients from regressions on the eight indicators listed in Table 3. Observations are weighted by the inverse of the estimated coefficient's standard error. Robust standard errors in brackets; statistical significance: *** p<0.01, ** p<0.05, * p<0.1. The coefficients of the last column are multiplied by 1000 for readability.

Table 5 – Selection into private schools – PISA 2009

	1	2	3	4	5	6	7
VARIABLES	probit (marginal effects)	linear probability model	linear probability model	linear probability model	linear probability model	linear probability model	linear probability model
residual ability	0.217***	0.302***	0.300***	0.194**	0.180**	0.033	-0.102
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δ repeaters × residual ability				-0.107***	-0.114***	-0.097***	-0.075***
				[0.000]	[0.000]	[0.000]	[0.000]
Δ individualized evaluation × residual ability					-0.016	-0.273**	-0.377***
					[0.000]	[0.000]	[0.000]
Δ streaming × residual ability						0.054	-0.14
						[0.000]	[0.000]
Δ selectivity × residual ability				-0.258*	-0.201	-0.15	-0.344*
				[0.000]	[0.000]	[0.000]	[0.000]
Δ accountability × residual ability					-0.263	0.083	0.107
					[0.000]	[0.000]	[0.000]
Δ competition × residual ability						-2.579***	-2.208***
						[0.000]	[0.001]
Δ autonomy × residual ability							0.154
							[0.000]
Δ disciplinary climate × residual ability							0.398***
							[0.000]
number of books at home	0.011080***	0.010914***	0.010989***	0.010897***	0.010874***	0.010739***	0.010839***
	[0.002]	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]
highest parental occupational status (*hisei*)	0.001536***	0.002017***	0.001985***	0.001965***	0.001966***	0.001950***	0.001922***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
wealth	0.025573***	0.038631***	-0.02684	-0.02441	-0.02473	-0.02328	-0.02204
	[0.003]	[0.004]	[0.019]	[0.019]	[0.019]	[0.019]	[0.019]
wealth × Δ school cost covered by tuition fees (*sc03q02*)			0.000886***	0.000846***	0.000850***	0.000829***	0.000812***
			[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δ school cost covered by tuition fees (*sc03q02*)			0.003909***	0.004445***	0.004447***	0.004369***	0.004371***
			[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
attending vocational education	0.046672**	0.072824***	0.071488***	0.071791***	0.071912***	0.069173***	0.070294***
	[0.021]	[0.027]	[0.027]	[0.027]	[0.027]	[0.027]	[0.027]
number of years repeated in the same grade	0.003047	0.002045	0.002956	0.001948	0.001997	0.002884	0.001262
	[0.004]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]	[0.007]
Observations	310255	310255	310255	305415	305415	305415	305415
Number of countries	58	58	58	58	58	58	58
R^2	0.275	0.222	0.223	0.225	0.225	0.228	0.229

Note: Δ indicates (private-public) mean difference at country level. All regressions also include a constant, gender, age, single parent, parental education, parental occupational category, speaking dialect at home, non native, city size and country fixed effects. Standard errors in brackets allow errors to be clustered at the school level. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1. The estimated coefficients of residual ability and its interactions in the first nine rows are multiplied by 1000 for readability.