INEQUALITY OF EDUCATIONAL OUTCOMES: INTERNATIONAL EVIDENCE FROM PISA

FREEMAN, Richard B.[*]
MACHIN, Stephen J.
VIARENGO, Martina G.

Abstract
This paper examines the relation between measures of the within-country inequality of student scores on international academic tests and the average level of scores across countries, using the PISA mathematics tests over 2000-2009. It finds that average test scores are higher in countries with lower inequality in scores – a virtuous efficiency-equity relation in test performance – and that family background factors are differently associated with student test performance across countries, but display little impact on the country-wide dispersion of test scores.

Keywords: Education, Public Policy, Inequality.
JEL Classification: I20, I3, J68, O15

Introduction and Motivation

Educational outcomes as measured by scores on internationally comparable tests vary widely across countries and among persons within the same country. Some countries regularly record average high scores, while others do poorly. Some countries record wide variation of test scores among students within their country, while others report narrow distributions of scores for their students.

These features invoke a number of interesting, policy relevant questions. In what ways, if any, are the average level and dispersion of test scores related among countries? Do high performing countries have relatively high or low variation of scores compared to low performing countries? Are the test scores of students related to measures of their family background characteristics similar across countries or do countries show different patterns linking test scores to family background? To what extent, if at all, does the variation of background factors of students across countries contribute to the variation of performance within countries?

This paper uses mathematics test scores for 15-year olds from the 2000 and 2009 waves of the Programme for International Student Assessment (PISA) to examine the magnitude

[1*] Richard B. Freeman, Harvard University, NBER, and CEP, London School of Economics
Stephen J. Machin, University College London and CEP, London School of Economics
Martina G. Viarengo, Graduate Institute of Geneva, Harvard Kennedy School and LSE.

and correlates of country differences in levels and dispersion in test scores and to estimate the effects of family background on students' performance within countries, building on the earlier work of Woessmann (2004, 2008) and Schuetz, Ursprung, and Woessmann (2008). Hanushek and Woessmann (2010b) provide an extensive review of the existing studies. Add period recent contributions have also analyzed educational inequalities. For example, Sahn and Younger (2007) use a generalized entropy index to decompose within and between-country inequality in the Trend in International Mathematics and Science Study (TIMSS) math and science test scores. On the other hand, Oppedisano and Turati (2011) examine the evolution of inequality between 2000 and 2006 in nine European countries by focusing on the reading test score in the two waves of the PISA study. Other recent articles that have focused on the PISA study include Baumer et al. (2003), Stanat (2003), Entorf and Minoiu (2004) and Ammermueller (2007). Existing studies analyze instead of have focused on different sets of countries but there is no consistent evidence on how educational opportunities and the effect of family background, schools and institutions vary across countries. Our study contributes to the existing literature by examining the evolution of educational inequality and family background between the first and most recent PISA waves, and by including all the countries that participated in the two surveys. The study also examines various measures of inequality in educational achievement and explores the relation between the estimated coefficients on parental background and the dispersion of test scores. We focus on mathematics test scores given the close relationship that has been found between math test scores and adults' productivity (Bishop 1992; Woessmann 2004), results for the other subjects are available from the authors upon request.

By linking the level and dispersion of test scores among countries, we seek to illuminate the way in which inequality in educational outcomes within a country is associated with better or worse average performance of students in that country. By estimating the relation between measures of backgrounds and performance separately by country, we illuminate the potentially different role that families play in children's development of their human capital across countries and can examine the impact of this variation on the distribution of test scores within countries.

PISA is a particularly good data set for making such comparisons for two reasons. It provides data on a sufficiently large number of students in both developed and developing countries to provide reliable estimates of the first and second moments of the distribution of scores for each country and of country-specific associations between background and educational test scores. In addition, it provides data on enough countries over time to allow researchers to check the stability of empirical findings in different time periods.

1) Our analysis finds: Wide cross-country variation in the level and dispersion of test scores, with countries having higher test scores also having lower inequality in scores. We call this a virtuous equity-efficiency relation since it implies that equity in the form of lower inequality in scores increases with efficiency as measured in average scores.
2) Substantial cross-country variation in the regression coefficients linking tests scores to measures of family background, which implies that families play different roles in the transmission of educational skills in different countries.

However, the differences in the importance of family factors in student performance are largely unrelated to the variation in scores within a country.

Data and Statistical Analysis

The source of data on student achievement and family background used in this paper are from the Programme for the International Student Assessment (PISA), which the Organization for Economic Co-Operation and Development (OECD) has organized beginning in 2000. The PISA test is given to representative random samples of 15-year-old students. Forty-three countries participated in the 2000 and 2003 waves, after which the number increased insteadof the number of increased to 57 in 2006 and to 65 in 2009. The study tested student performance in mathematics, reading and science with a greater emphasis on the subjects in each wave. Both PISA 2009 and PISA 2000 studies had a special focus on the reading literacy of students, whereas the focus of the previous waves was on mathematics in 2003 and on science in 2006. The assessment in PISA relies on literacy rather than just content knowledge (OECD 2002). We analyzed focused on the 42 countries that participated in the 2000 and 2009 waves[1]. For each country and wave, we calculated the median score of students and a measure of the dispersion of the scores within the country – the ratio of the difference between the 95th percentile score and the 5th percentile score divided by the median. We also estimated equations linking test scores and test scores at the 95th percentile and at the 5th percentile to the average books at home and parents' education. Finally the association between the estimated coefficients on family background and the Gini coefficient is examined.

Results

Figure 1 displays our first major finding. This is a striking inverse relation between the within-country dispersion of scores and the average level of scores by country in PISA 2000 and 2009[2]. Panel a of the figure displays the median score in the PISA and the 95th percentile minus the 5th percentile score relative to the median in 2009. Panel b of the figure 1b provides the comparable information for 2000. As shown in the table notes, the negative relation between the two variables is large and statistically significant in both years. This pattern is the opposite of the Okun-style equity-efficiency trade-off, in which inequality and performance are positively related. The virtuous link implies that countries that have high scores do so by raising the scores more from the bottom of the distribution than from the top of the distribution[3].

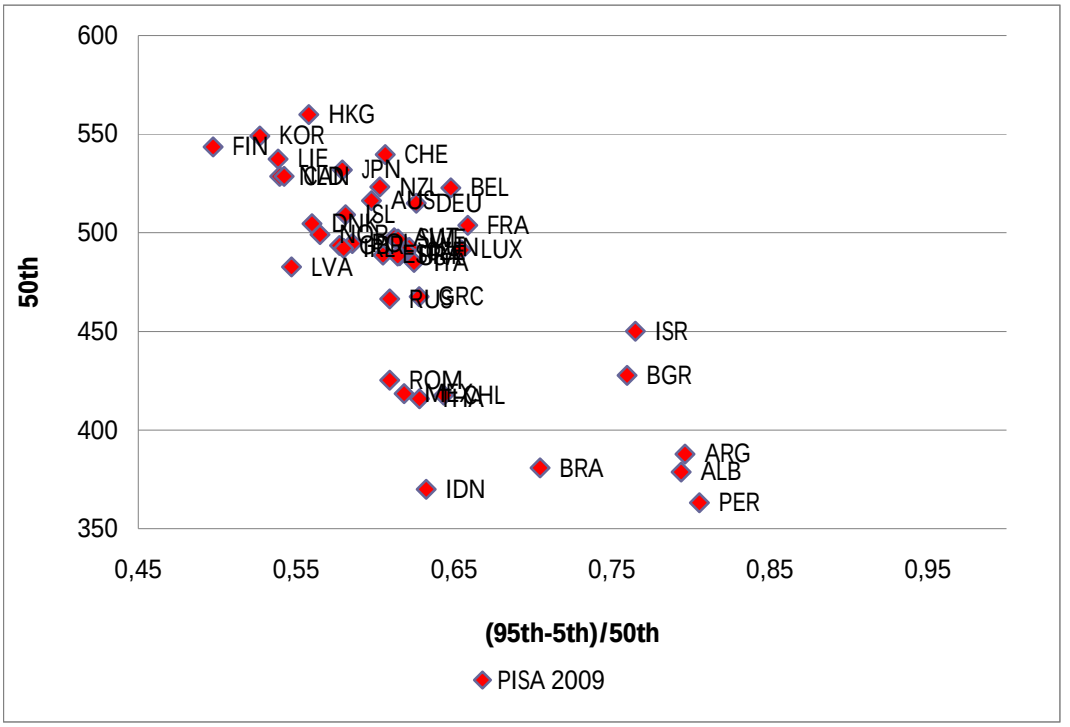
[1] All countries that participated in PISA 2000 also participated in PISA 2009 with the exception of FYR Macedonia.

[2] The table that shows the measures of test score inequality by country is available from the authors upon request.

[3] This result reflects in part the metric that we use to assess tests – the average which weighs all scores as part of the maximand. A metric that valued high scores much more than low scores could

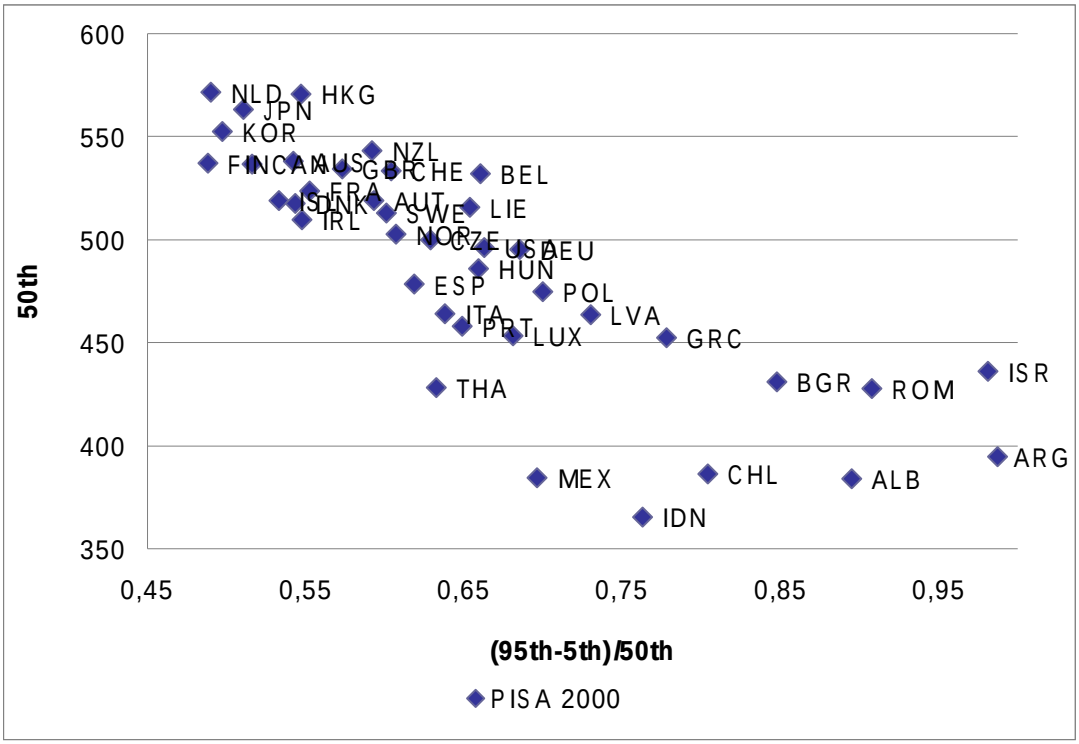
It is important to notice the heterogeneity across countries of the patterns of test scores. Some countries like Brazil, Chile, Germany, Greece, Indonesia, Israel, Italy, Latvia, Lichtenstein, Luxembourg, Mexico, Peru, Poland, Portugal and Spain experienced an increase in test scores and a decrease in the level of inequality. On the other hand, Finland shows that an improvement in test scores has been accompanied by a slight rise in inequality. Other countries experienced both a decrease in test scores and a decrease in the level of inequality (i.e., Albania, Argentina, Belgium, Bulgaria, Czech Republic, Hong Kong, Hungary, Korea, Norway, Romania, Russian Federation and the United States). In Australia, Austria, Canada, Denmark, France, Iceland, Ireland, Japan, the Netherlands, New Zealand and Sweden test decreased whereas inequality went up. Other countries did not experience any change in inequality over the ten years but scores increased in Switzerland and decreased in Thailand and the United Kingdom.

Figure 1a. Country inequality—PISA 2009



yield different results. In this case, an improvement at the bottom of the distribution of test scores could have a lower impact in the improvement of the overall performance. If the sole goal of the country was to produce Math Olympiads, for instance, the only thing that would matter would be the very top scores and the country would weigh at zero improvements at the bottom of the distribution.

Figure 1b. Country inequality—PISA 2000



Note: Correlation (50th, 2000; 50th, 2009) = 0.95
Correlation ((95th − 5th)/50th), 2000=-0.87; ((95th − 5th)/50th), 2009) = -0.75

To determine the effect of background characteristics on test scores, we first estimated the following ordinary least-squares regression model for the two PISA waves[1]:

$$T_{ics} = \alpha + \beta X_{ics} + cG + u_{ics}, \qquad (1)$$

where T_{ics} is the test score of student i, in class c and school s; X_{ics} is a vector of family-background variables; and G is a 0/1 dummy for being female. Our measures of advantaged homes are the following: the presence of books at home, which is positively correlated with the socioeconomic status of the family (Beaton et al. 1996) and which earlier studies have found to be an important predictor of students' performance (Woessmann 2003, 2004); dummy variables for the highest level of schooling by either of

[1] Hanushek (2007) and Hanushek and Woessmann (2010b) provide a review of the education production functions estimated in the literature.

a student's parents[1]; and dummy variables for whether the student was an immigrant or native and whether the student's parent was or was not an immigrant.
To see how background factors affected performance in all of the countries, we estimated equation 1 for the entire PISA population of students using ordinary least squares[2]. Consistent with the findings in previous studies (e.g., Oppedisano and Turati 2001; Woessmann 2004; Schuetz et al. 2008) we observe a significant effect of family background on students' performance.

Columns 1 and 4 in table 1 give the estimated coefficients on the relation of background factors to the test scores for the two years. In 2009 the coefficient on female is significant and negative, and the coefficient on students' immigrant status is not statistically different from zero; that on parents being born in the country is negative and not significant; while the positive coefficients on the measures of books in the household and parental education show substantial advantages to a more privileged background on outcomes[3]. To see whether family background affects students differently at different points in the conditional distribution of achievement, we also estimated equation 1 with quantile regressions. Columns 2 and 5 and columns 3 and 6 give the estimated coefficients for quantile regressions for persons at the 5th and 95th percentiles. If the effects of a variable that improves outcomes are greater at the 95th percentile than at the 5th percentile, that raises inequality, while the converse holds if the effects of a variable are greater at the 5th percentile than at the 95th percentile. In both years, the estimated coefficient on books at home at both 5th and 95th percentiles is larger for students at the 95th percentile than at the 5th percentile. Similarly, in both years the estimated coefficients of parental education are larger at the 95th than at the 5th percentile. This implies that increased books at home and parental education have larger impacts on students at the high end of the distribution. By contrast, immigration status measured by whether the student was born in the country and of whether their parent was born in the country show coefficients of different signs

[1]This dummy variable has been constructed from the variable: "Parents' highest education level" (which takes the following categories: university degree; completed postsecondary education but not university; completed upper-secondary education; completed lower-secondary education; less than lower-secondary education; do not know).

[2] To address missing data and not to exclude observations, we estimated missing values by means of a multiple imputation technique in King et al. (2001): the multivariate imputation by chained equations (Van Buuren and Oudshoorn 1999, "MICE" method in STATA). This imputes missing variables from an iterative multivariable switching-regression technique. We created five imputed data sets and averaged regression coefficients over the five sets to estimate values for the missing independent variables.

[3]Farkas (2010) shows how by middle school students from ethnic minorities and more disadvantaged backgrounds lag behind their higher-income counterparts in both learning and behavioral outcomes.

between the two years, which makes it difficult to make any assessment of its impact on scores. We also run country-level regressions in order to develop a better understanding of the immigration status. It is possible to observe that for most countries the coefficient does not significantly vary between the two waves of the study and that there is an important heterogeneity among countries in the significance and size of the coefficient.[1] This may be revealing something about the composition of immigrants, which we do not have sufficient data to explore.

Table 1. Family background: Regression results, PISA 2009 and 2000

	2009			2000		
Variables	**(1) Test Score**	**(2) Q5**	**(3) Q95**	**(4) Test Score**	**(5) Q5**	**(6) Q95**
Female	-17.879***	-10.163***	-23.659***	-16.963***	-11.497***	-21.229***
	(2.479)	(1.271)	(1.090)	(3.714)	(2.359)	(1.973)
Age	-6.493	-9.792***	-4.631*	20.519**	28.819***	10.070***
	(7.547)	(2.416)	(2.517)	(8.358)	(1.595)	(1.200)
Student is born in the country	-8.290	-6.901	-14.691***	7.604	9.058	12.236**
	(5.162)	(5.656)	(4.509)	(6.185)	(6.192)	(4.934)
Parents born in the country	-0.609	9.133	-0.120	-12.423*	-8.136*	-21.730***
	(3.828)	(6.681)	(5.689)	(6.993)	(4.402)	(4.476)
Parents some secondary school	23.855***	21.457***	30.796***	10.966*	8.047	12.374**
	(4.416)	(2.748)	(2.103)	(5.512)	(6.474)	(5.570)
Parents finished secondary	50.518***	33.961***	68.643***	30.743***	23.730***	45.874***
	(7.759)	(2.471)	(1.856)	(7.310)	(6.663)	(5.542)
Parents some after secondary	60.633***	48.139***	72.694***	52.105***	36.468***	66.906***
	(8.956)	(2.801)	(2.127)	(6.588)	(6.351)	(5.592)
Parents complete university	72.183***	51.901***	88.946***	60.152***	37.740***	79.233***
	(10.439)	(2.701)	(2.030)	(7.575)	(6.834)	(5.982)
Books at home 11–25	10.740*	4.994**	20.756***	33.083***	26.284***	35.523***
	(5.743)	(2.007)	(1.811)	(3.960)	(4.052)	(2.922)
Books at home 26–100	43.731***	32.327***	58.478***	52.451***	33.399***	51.698***
	(6.978)	(2.001)	(1.641)	(4.139)	(4.519)	(3.127)
Books at home 101–200	70.505***	48.317***	85.296***	79.105***	69.881***	74.840***
	(7.004)	(2.488)	(1.898)	(2.753)	(4.549)	(3.342)
Books at home > 200	96.847***	69.022***	106.265***	98.821***	81.593***	94.800***

[1] Results are available from the authors upon request.

	(7.889)	(2.554)	(1.905)	(4.585)	(4.608)	(3.567)
Constant	162.502	101.996***	281.459***	-411.184***	-664.809***	-91.128***
	(101.850)	(38.763)	(42.347)	(116.692)	(27.995)	(21.216)
Number of observations	349121	349121	349121	123924	123924	123924
R-squared	0.345			0.382		

Note: less than some secondary school is the reference category for parents' education; books at home is defined by five categories in the PISA study and here dummies for each category have been used; books at home 0–10 is the reference category; results here are presented for countries that participated in both 2000 and 2009 PISA studies; country dummies not included in this regression. Grade and month of birth have been added as controls.

Robust standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1

The PISA contains enough observations on students in each country to allow us to do something that is rare in analysis of social background effects: to estimate the relationship between background and outcomes for a large sample of countries using the same survey instrument. We divided the sample by country and estimated the equation in table 1 for all of the countries in the PISA study. These calculations show large cross-country variation in the effect of background on test scores. In some countries, background contributes greatly to the variation in scores, whereas in others it has modest effects. The Y axis in figure 2 displays the estimated coefficients for the relation between the average number of books at home and test scores in both 2000 and 2009. What stands out is the large variation in the estimated effects of the books at home on test scores, which range from negligible to huge. The Y axis in figure 3 displays the estimated coefficient on the parent having college education from OLS regression of tests scores in 2000 and 2009. Here too the coefficients range widely among the countries. Based on these calculations we conclude that there is a huge and previously unrecognized cross-country variation in the effect of background on test scores.

Table A1 shows the regression results with school fixed effects. In these estimates, the coefficients remain significant, but in both years for the variables parents' education (defined as parents who finished secondary education and above) and books at home the magnitudes of the coefficients in the fixed-effect regressions are smaller. This suggests the existence of some effects of being in a better school.

Table A1. Family background: Regression results (including school fixed effects), PISA 2009 and 2000

	2009		2000	
Variables	(1) Test Score	(2) Test Score	(3) Test Score	(4) Test Score
Female	-14.416***	-14.827***	-12.666***	-16.729***
	(2.590)	(2.201)	(3.046)	(2.375)
Age	11.152**	10.872***	23.069***	22.213***
	(4.598)	(3.730)	(6.587)	(7.361)
Student is born in the country	-5.060	-5.259	12.282*	10.948**
	(5.865)	(5.704)	(6.776)	(4.077)

Parents born in the country	-4.638	-3.527	-16.013	-10.950*
	(6.105)	(4.835)	(11.189)	(5.963)
Parents some secondary school	27.928***	28.523***	20.608***	16.576***
	(4.955)	(4.795)	(5.150)	(4.007)
Parents finished secondary	63.063***	60.728***	44.544***	36.181***
	(7.142)	(8.547)	(7.303)	(7.481)
Parents some after secondary	71.140***	68.322***	75.591***	51.376***
	(10.064)	(11.597)	(7.803)	(8.527)
Parents complete university	86.112***	82.705***	84.861***	57.270***
	(11.367)	(13.169)	(7.068)	(9.468)
Books at home 11–25	13.906**	12.337**	47.175***	26.566***
	(6.170)	(5.249)	(4.245)	(2.904)
Books at home 26–100	50.465***	47.027***	70.407***	40.557***
	(7.940)	(6.794)	(6.704)	(4.709)
Books at home 101–200	78.883***	74.727***	99.668***	59.664***
	(8.561)	(7.477)	(9.696)	(4.811)
Books at home > 200	105.974***	100.921***	119.920***	73.346***
	(9.714)	(8.192)	(11.745)	(5.050)
Constant	193.969**	202.499***	-26.097	33.695
	(72.625)	(61.714)	(103.346)	(115.991)
Number of observations	349121	349121	123924	123924
R-squared	0.283	0.319	0.327	0.547
Fixed effects		x		x

Note: less than some secondary school is the reference category for parents' education; books at home is defined by five categories in the PISA study and here dummies for each category have been used; books at home 0–10 is the reference category; results here are presented for countries that participated in both 2000 and 2009 PISA studies; country dummies not included in this regression.

Robust standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1

If countries have large or small estimated coefficients on all or most of the background factors that affect test scores, the results could be interpreted as reflecting some general latent factor that one might label as the societal difficulty or ease of transforming background resources into school performance. If, by contrast, countries had similar coefficients on the same background factor in 2009 and 2000 with only a weak correlation with other factors, the natural interpretation would be that each measure reflects stable but different channels by which background factors affect performance. To examine these two possibilities, we computed the correlations among the estimated background coefficients for countries reporting in both the 2000 and 2009 PISA surveys. The results in table 2 show that coefficients on particular background factors are correlated over time. For instance, the correlation across countries of the coefficient on books in the household in 2000 and the coefficient on books in the household in 2009 is 0.60. By contrast, there is a weak, often negligible correlation between the coefficients of the background variables

across countries in the same year. Based on these correlations, the measures seem to reflect independent channels and thus should not be "forced" into a single latent variable model of background.

Table 2. Correlation of the coefficients from the country-level regressions, PISA 2009 and PISA 2000, for countries that were in both years' survey

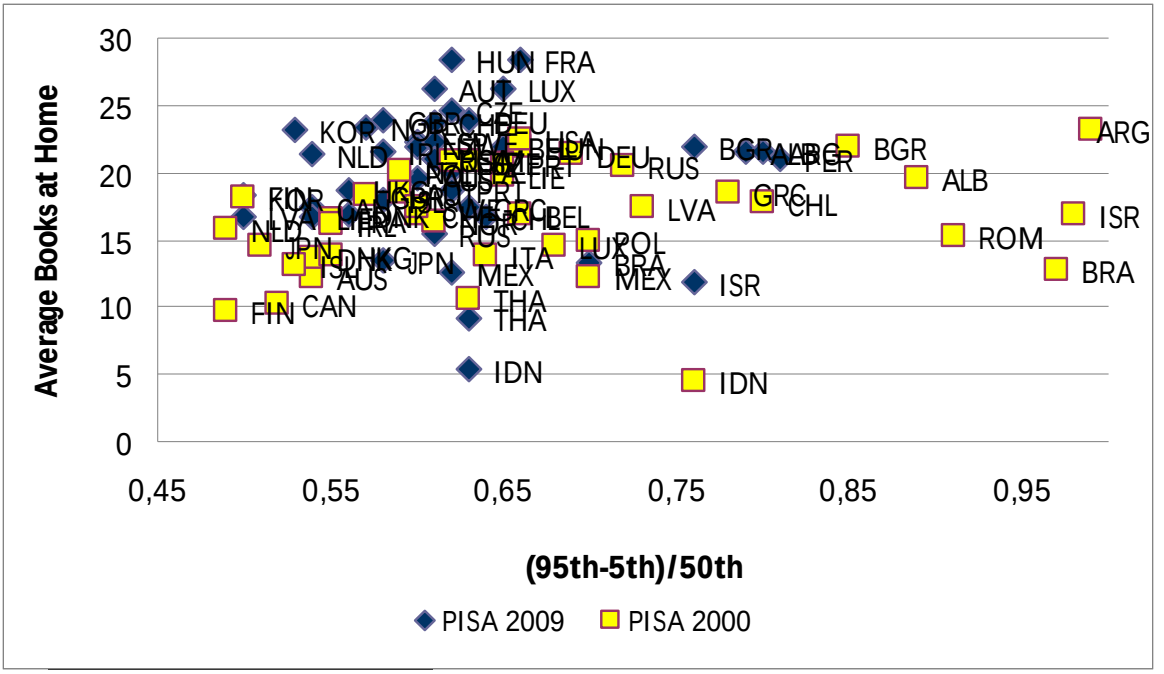
	Books at home, 2009	Parents' education, 2009	Born in country, 2009	Gender, 2009	Books at home, 2000	Parents' education, 2000	Born in country, 2000	Gender, 2000
Books at home, 2009	1.00							
Parents' education, 2009	0.14	1.00						
Born in country, 2009	0.13	-0.22	1.00					
Gender, 2009	-0.42	0.05	-0.03	1.00				
Books at home, 2000	0.60	0.24	-0.18	-0.22	1.00			
Parents' education, 2000	0.16	0.62	-0.03	-0.30	0.21	1.00		
Born in country, 2000	0.01	0.02	0.44	-0.05	-0.16	0.06	1.00	
Gender, 2000	-0.19	-0.16	-0.24	0.54	-0.16	-0.39	-0.19	1.00

Given this finding, we ask next whether countries with larger or smaller coefficients on particular background factors have higher/lower average test scores or greater/lesser within-country inequality in scores. A priori it is not clear how larger background coefficients affect outcomes. On the one side, larger background coefficients might produce greater levels of inequality given the strong relationship between earnings and education and that they reflect the ability of more advantaged homes to pass on their advantages to their children. On the other side, large background coefficients could reflect the openness of society to parental investments in children that could induce parents with fewer resources to invest more heavily in their children. Persons from disadvantaged groups whose parents obtained greater education or who had many books in their household would be more likely to help their children in a society where the coefficients

on those factors are high compared with a society where the coefficients on those factors are low.

To determine whether the estimated impact of having books in the household affects the inequality of test scores across countries, the X axis of figure 2 plots the estimated coefficients on books at home against the measure of dispersion of test score for countries in the 2009 or 2000 samples. We again measure dispersion by the 95th percentile minus the 5th percentile relative to the median. The figure shows a moderate negative relation between the coefficients on having books in the household and the measure of inequality.. Similarly, to determine whether the estimated impact of having a parent with university education affects the level of test scores across countries, the X axis figure 2 plots the estimated coefficients on books at home against the measure of dispersion of test score for countries in the 2009 or 2000 samples. Figure 3 shows a slight positive relation between the estimated impact of parental education on individual student test scores and the inequality of scores[1].

Figure 2. The relation between the estimated coefficients on average books at home[2] and the dispersion of mathematics test score (scores at 95th percentile–5th percentile/median) by country, PISA 2009 and PISA 2000



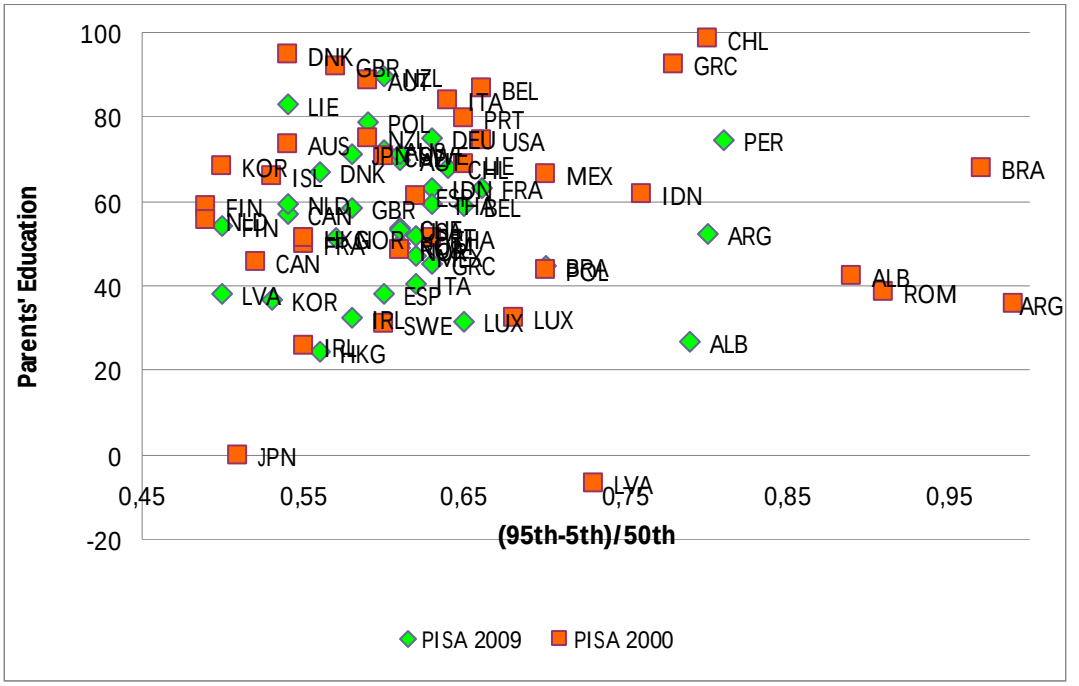
[1] Figures 2b and 3b show the relationship between between the estimated coefficients on parents having college education (and books at home) and the median of mathematics test score

[2] The variable books at home here in the figure and table of this page refers to the average books at home (i.e., the mean of the books at home categories).

	PISA 2000 avg books at home	**PISA 2009 avg books at home**
Correlation C	0.195	0.024
Regression C	0.008	<0.001
	(0.006)	(0.001)

Note: Correlation C between the inequality measure $((95^{th} - 5^{th})/50^{th})$ and average books at home; regression of the inequality measure $((95^{th} - 5^{th})/50^{th})$ on average books at home.

Figure 3. The relation between the estimated coefficients on parents having college education and the dispersion of mathematics test score (scores at 95th percentile minus 5th percentile/median) by country, PISA 2009 and PISA 2000



	PISA 2000 parents' education	**PISA 2009 parents' education**
Correlation D	0.024	0.131
Regression D	<0.001	<0.001
	(0.001)	(<0.001)

Note: Correlation D between the inequality measure $((95^{th}\text{-}5^{th})/50^{th})$ and parents' education (college); regression of the inequality measure $((95^{th} - 5^{th})/50^{th})$ on parents' education (college).

In short, the results on the estimated impacts of books in the household and parental

education show weak associations with the country-level outcomes in opposite directions.

Following some recent studies (e.g., Sahn and Younger 2007; Oppedisano and Turati 2011), the Gini coefficient related to educational achievement for the same sample as the 95-5. The analysis using the Gini coefficient has been carried out and the results presented below. Figures are consistent with results obtained by using the other inequality measures. A similar analysis has been carried out also using the coefficient of variation and is available from the authors.

Table 3. The relation between the estimated coefficients on parents having college education and the dispersion of mathematics test score (GINI coefficient)

	PISA 2000 avg books at home	PISA 2009 avg books at home
Correlation C	0.176	0.052
Regression C	0.001	<0.001
	(0.001)	(<0.001)

Note: Correlation C between the inequality measure (Gini coefficient) and average books at home; regression of the inequality measure (Gini coefficient) on average books at home.

	PISA 2000 parents' education	PISA 2009 parents' education
Correlation D	0.090	0.192
Regression D	<0.001	<0.001
	(<0.001)	(<0.001)

Note: Correlation D between the inequality measure (Gini coefficient) and parents' education **(college); regression of the inequality measure (Gini coefficient) on parents' education (college).**

In this paper we examine the effect of parental background on students' performance. It is important to understand the effect of family's socio-economic status on students' performance from a policy perspective, particularly given the existence of a large literature showing the effects of family background on students' performance and of educational attainment on workers' productivity and ultimately on economic growth and future well-being. Given these relationships we should expect a strong association between education and labor-income across generations (e.g., Woessmann 2004). In this regard, inequality in parental background (e.g., educational attainment, income,…) may reinforce inequalities within society over time. In this study we examine parental background by focusing on two variables that have been extensively used in the existing studies: parents' education and books at home. Using school fixed effects allows us to examine the within inequality and to better understand the effect of parents' background, schools and institutional factors on educational inequality. It is important to notice that the

policy implications related to the effects of the variable books at home need a further explanation. Similarly to parents' education, the variable books at home is closely related to family income and therefore the existing inequality will be transmitted across generations (i.e., more affluent families will be able to transfer more resources to their children whereas poorer families will have fewer resources to transfer more limited resources). On the other hand, if we consider "books at home" as an indicator of cultural capital, there may be specific policies aiming at reducing this inequality.

Conclusión

Cross-country analysis can often be problematic. Data often come from surveys that differ substantially in representativeness and quality. There is a diverse set of potential measures of country characteristics that researchers can use to explain country differences: language, geographic, ethnic composition, history, culture—more variables than countries, indeed. Many of the measures, moreover, are subject to potential misinterpretation without detailed knowledge of the country[1]. This is particularly the case when countries with nominally identical policies implement policies more or less rigorously.

In the area of education, measures of student outcomes across countries suffer from differing nonresponse rates and inclusion or exclusion of special groups of students. Although serious, these problems with international student achievement data do not seem to overturn existing research findings (Hanushek and Woessmann 2010a, 2010b).

There are two main lessons that emerge from our cross-country analysis of student performance on the PISA tests. The first is the negative relation between the wide cross-country variation in the level and dispersion of test scores. That countries with the highest test scores are those with the least inequality in scores suggests a "virtuous" equity-efficiency trade-off in improving educational outcomes. The second is that the large cross-country differences in the impact of family-background factors on educational outcomes suggest the value of detailed studies that model the transmission from parents to children of human capital.

[1]For example, France has a very low unionization rate, which suggests that unions have little impact on labor-market outcomes, when in fact France's labor regulations give unions a large impact through collective bargaining.

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Woessmann, L. 2008. "How Equal Are Educational Opportunities?" Family Background and Student Achievement in Europe and the United States." Zeitschrift für Betriebswirtschaft 78(1): 45–70.Table 1. Family background: Regression results, PISA 2009 and 2000

Note: less than some secondary school is the reference category for parents' education; books at home is defined by five categories in the PISA study and here dummies for each category have been used; books at home 0–10 is the reference category; results here are presented for countries that participated in both 2000 and 2009 PISA studies; country dummies not included in this regression. Grade and month of birth have been added as controls.Robust standard errors in parentheses; ***p < 0.01, **p < 0.05, *p < 0.1

sample Questions from OECDâ€™s PISA Assessments. Programme for International Student Assessment. Programme for International Student Assessment. Take the Test. Sample Questions from OECDâ€™s PISA Assessments. Organisation for economic co-operation and development. The OECD is a unique forum where the governments of 30 democracies work together to address the economic, social and environmental challenges of globalisation.