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Do the Average Level and Dispersion of Socio-Economic Background Measures Explain France's Gap in PISA Scores?

Hervé Boulhol,

Patrizio Sicari

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By Hervé Boulhol and Patrizio Sicari

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ABSTRACT/RESUME

Do the average level and dispersion of socio-economic background measures explain France's gap in PISA scores?

OECD's PISA publications highlight the impact of economic, social and cultural status (ESCS) on students' results within countries. The focus here is to investigate whether ESCS measures could contribute to differences in aggregate educational outcomes between countries. There is some evidence that, after controlling for education spending and the overall level of economic development, differences in ESCS might account for a substantial amount of France's gap in average PISA scores with respect to best performing OECD countries, albeit by no means all of it.

JEL classification codes: H52; I21; I24; I25
Keywords: France; education; PISA; socio-economic background; inequality

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Le niveau global et la dispersion des mesures du statut socio-économique expliquent-ils l'écart observé pour la France dans les résultats aux tests PISA ?

Les publications de l'OCDE sur les résultats PISA soulignent l'impact du milieu socio-économique des élèves sur leurs résultats à l'intérieur de chaque pays. L'objet est ici d'analyser dans quelle mesure les indicateurs de milieu socio-économique peuvent contribuer aux différences de résultats scolaires entre pays. En contrôlant pour le niveau de dépenses d'éducation et de développement économique global, les différences de milieu socio-économique semblent rendre compte d'une part importante de l'écart de résultat moyen aux épreuves PISA entre la France et les pays enregistrant les meilleures performances, mais pas, loin s'en faut, de la totalité de cet écart.

Classification JEL : H52; I21; I24; I25
Mots clefs : France ; éducation ; PISA ; contexte socio-économique ; inégalités

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Do the average level and dispersion of socio-economic background measures explain France's gaps in PISA scores?

By

Hervé Boulhol and Patrizio Sicari[1]

The purpose of this short paper is to investigate whether differences in students' socio-economic background among OECD countries influence education outcomes. More specifically, the impact of the country average and dispersion of the PISA index of the economic, social and cultural status (ESCS) on PISA scores is analysed, with a focus on France's relative performance. OECD's PISA publications regularly include the impact of ESCS on students' results within countries. The focus is here on highlighting the effect of differences in ESCS among countries.

For the average student, France's results in the 2009 PISA are close to the OECD country average (Figure 1). However, inequality in terms of the education level of 15 year-old students is at a disturbing level. The score of the top 5% of students (95th percentile) was more than twice that of the bottom 5% (5th percentile), with only Israel and Luxembourg showing a greater level of inequality (Figure 2, Panel A). Since 2000, France (along with Japan, which started from a moderate level of inequality) has seen inequality increase most sharply; this situation is made even worse because it stems from a pronounced decline in the results of the worst performing students (Panels B and C). Consequently, their level is among the lowest anywhere in the OECD (Figure 3).

The ESCS index is computed for each student from a principal component analysis based on the following measures: the home possessions index based on family wealth possessions, cultural possessions, home educational resources and the number of books; the higher occupational status of the two parents; and the higher education of the two parents, expressed in terms of years of schooling (see OECD, 2012, for details). The ESCS score is obtained as the score of the first principal component, normalised such that zero is the score of the average OECD student and one is the standard deviation across equally weighed

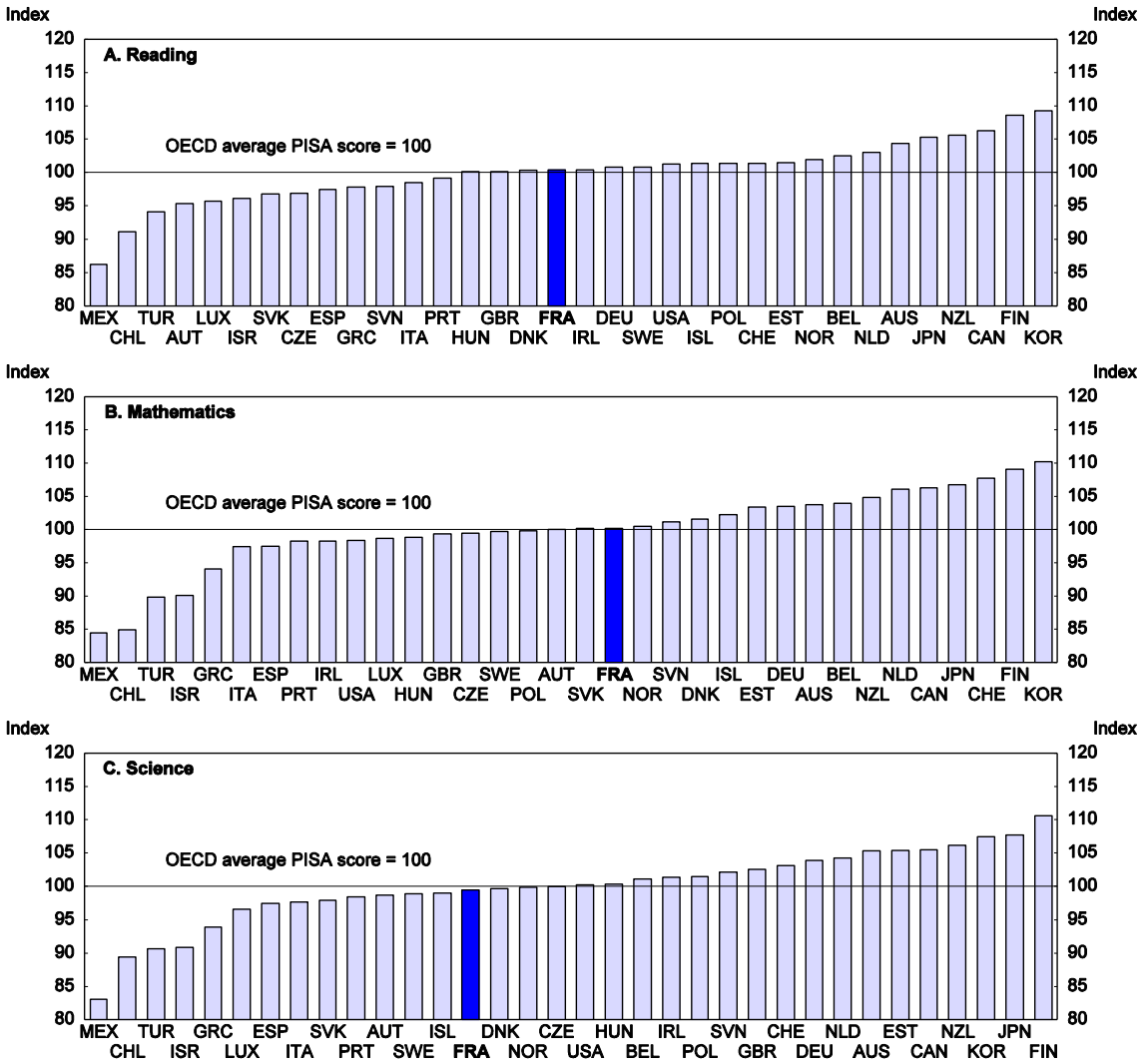
1. This paper was originally produced as a background document for the 2013 *Economic Survey of France*. Hervé Boulhol is senior Economist and Head of the France Desk in the OECD Economics Department; e-mail: herve.boulhol@oecd.org. Patrizio Sicari is Research Assistant in the OECD Economics Department; e-mail: patrizio.sicari@oecd.org. The authors would like to thank Peter Jarrett for comments and Mee-Lan Frank for valuable technical preparation. This paper contains the views of the authors, and not necessarily those of the OECD or its member governments.

OECD countries. The individual ESCS score is then used to compute the aggregate ESCS index at the country or school level.

France is below the OECD average in terms of the average ESCS index (Figure 4). Northern European countries, Canada and Australia have the highest average ESCS, while Turkey, Mexico and, to a lesser extent, Chile record the lowest levels. Students' heterogeneity is measured by the dispersion of the ESCS index across individuals. It is the greatest in Mexico, Turkey and Portugal, and the lowest in the Czech Republic, Japan, Norway and Australia (Figure 5). France is below the OECD average based on this measure of heterogeneity.

Figure 1. **Average PISA scores for students' proficiency in reading, mathematics and science, 2009**

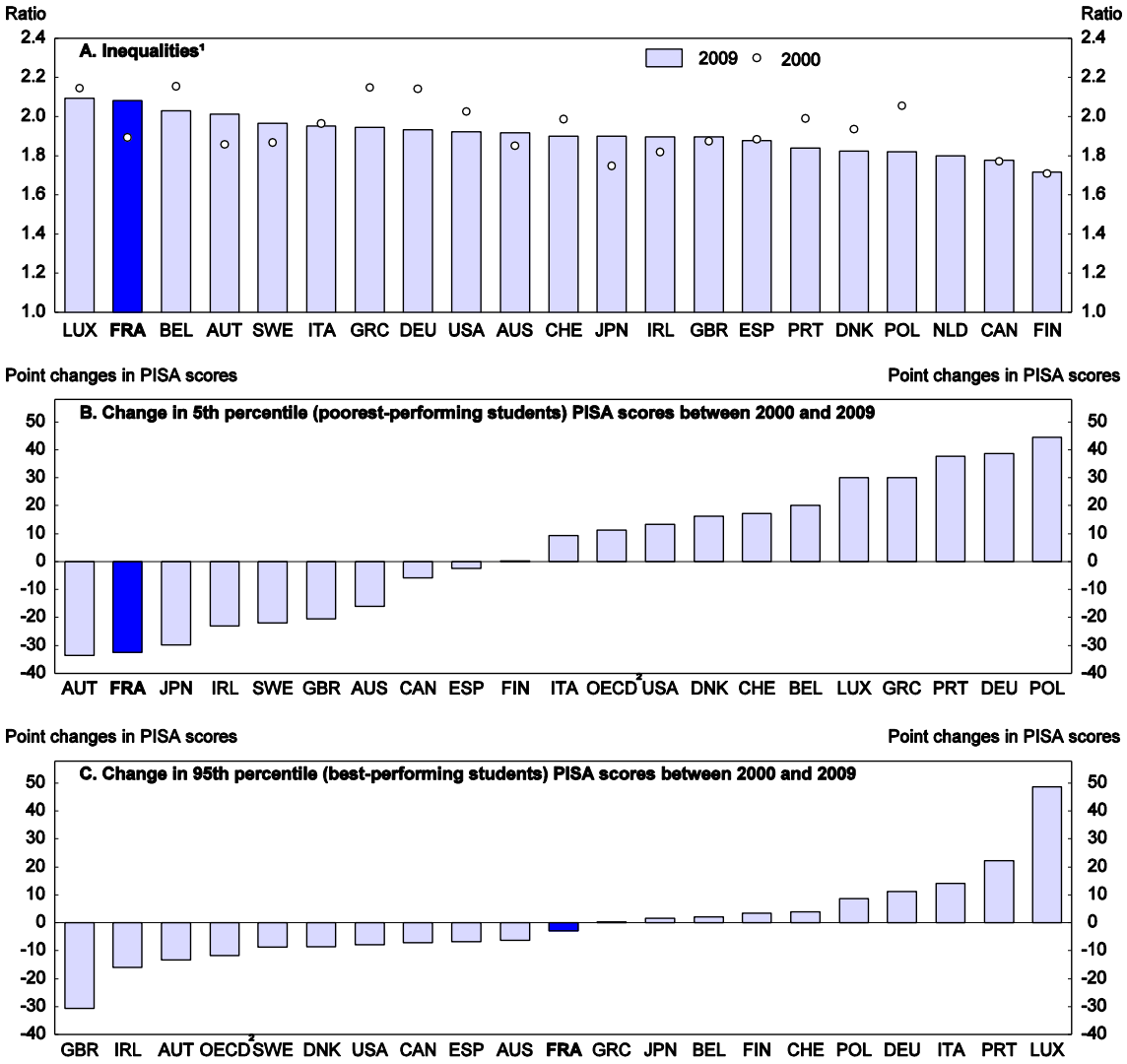
Index, OECD average = 100



Source: OECD, PISA 2009 Results database.

Figure 2. **Inequality of levels of education between students**

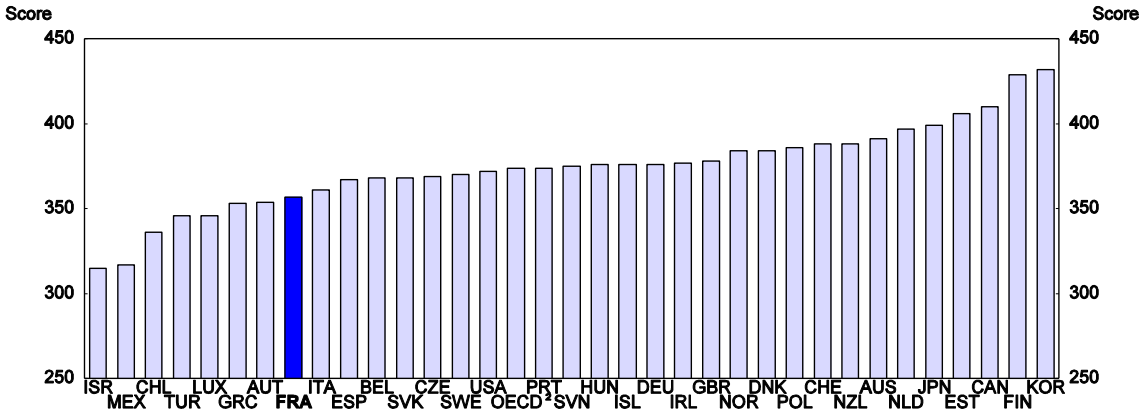
Average scores of proficiency in reading, mathematics and science



1. Ratio of the average score of the top 95% of students to the average score of the bottom 5%.
2. Unweighted average.

Source: OECD, PISA 2009 Results database.

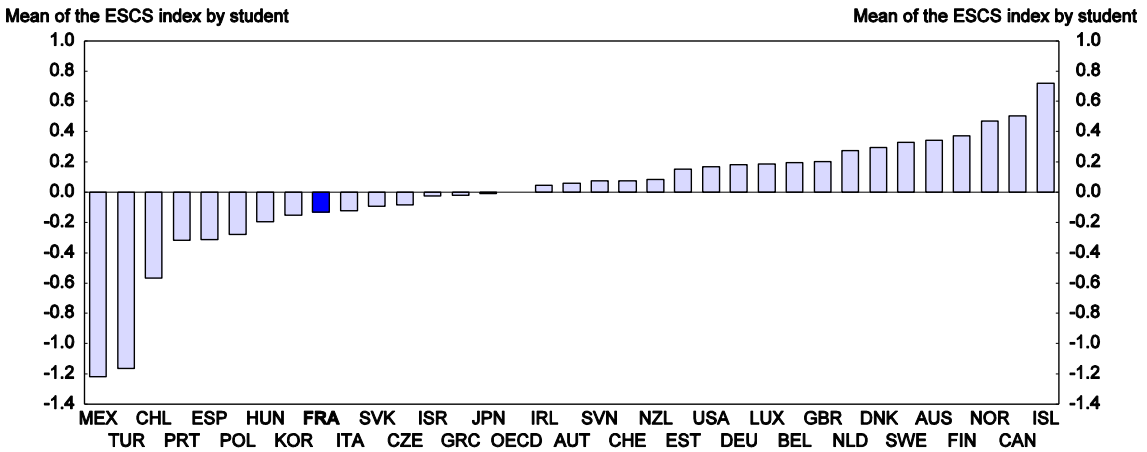
Figure 3. **PISA scores of the poorest-performing students (10th percentile)[1], 2009**



1. Average of scores obtained for proficiency in reading, mathematics and science.
2. Unweighted average.

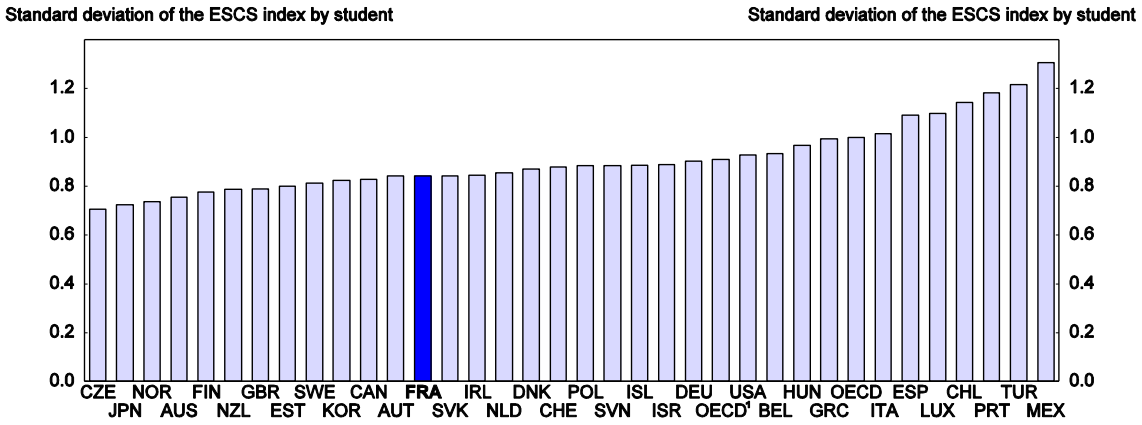
Source: OECD, PISA 2009 Results database.

Figure 4. **Mean of the PISA index of Economic, Social and Cultural Status (ESCS) across individuals in OECD countries, 2009**



Source: OECD, PISA 2009 Results database.

Figure 5. **Dispersion of the PISA index of Economic, Social and Cultural Status (ESCS) across individuals in OECD countries, 2009**



1. Unweighted average.

Source: OECD, PISA 2009 Results database.

PISA results have shown that the influence of socio-economic background on individual scores is one of the highest in France (Figure 6). This is driven by both school segregation (measured by the share of between-school variance in total ESCS variance) and, even more so, by the ESCS gradient between schools (Willms, 2010).

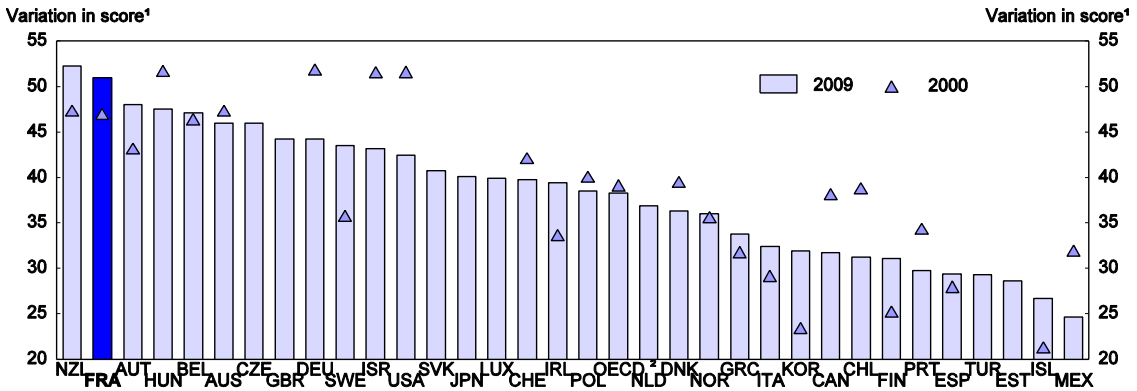
The effect of ESCS average and dispersion on relative performance across countries is estimated following the specification:

$$Y_i = a * AVG_ESCS_i + b * STD_ESCS_i + c * Z_i + u_i \qquad (1)$$

where Y_i is the dependent variable related to PISA scores of country i, AVG_ESCS is the country average of the individuals' ESCS index, STD_ESCS is the standard deviation, Z are control variables and u stands for the residual. Control variables include the country's aggregate economic development level measured by GDP per capita in PPP terms, and education spending, measured either by total spending as a share of GDP (*EDUSPEND1*) or average spending per pupil in primary and secondary education as a percentage of GDP per capita (*EDUSPEND2*). The dependent variables that are considered are the average PISA score, the 5th percentile of scores (P5), the 95th percentile (P95), and the ratio of P95 over P5 as a measure of inequality. All variables except the two ESCS measures are in logs.

Figure 6. **Relationship between student performance and socio-economic background**

Estimated slope of the relationship between student performance on the reading literacy scale and the PISA index of economic, social and cultural status (ESCS)



1. Variation in score associated with a one-point increase in the PISA index of economic, social and cultural status; no data in 2000 for Czech Republic, Estonia, Great Britain, Japan, Luxembourg, the Netherlands, Slovak Republic and Turkey.

2. Unweighted average of 26 OECD countries.

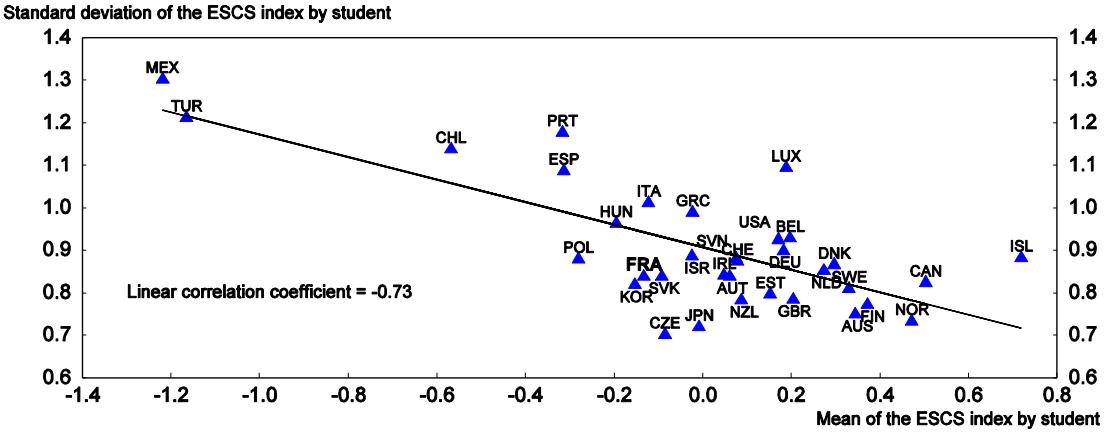
Source: OECD, PISA 2000 Results and PISA 2009 Results databases.

The starting point is the impact of economic development and education spending on PISA scores. ESCS variables are introduced in a second stage. Results, presented in Table 1, indicate that GDP per capita is positively associated with PISA scores but not with the performance of the least-performing students. The influence of education spending is not significant based on *EDUSPEND1* but positive and very significant for *EDUSPEND2*. For the latter measure, the point estimate is greater for the lowest performing students, but the impact on inequality is only weakly significant. A general point in this paper is that, even more than is usually recommended, results here should be interpreted with great care, given the small size of the sample and obvious endogeneity issues: for example, past educational achievements tend to boost economic development, which in addition might allow more spending on education.

The ESCS variables are then introduced alone, with results reported in Table 2. The ESCS variables explain together about 60% of the variance of average (for example) PISA scores across countries. The average level of ESCS is positively related to PISA scores, but significance is weak unless the dispersion variable is excluded from the specification. In contrast, the coefficient of ESCS dispersion is highly significant. While the corresponding point estimate is greater for the poorest-performing students, it is not significantly different than that for the average or the best-performing ones, such that dispersion does not seem to explain education inequality. However, disentangling the effect of dispersion from that of the average of ESCS might be blurred by the relatively high correlation between the two variables (Figure 7). Controlling for economic development level and education spending does not change the results (Table 3).

Figure 7. **The dispersion and the mean of the ESCS index are negatively correlated across countries**

2009



Source: OECD, PISA 2009 Results database.

Table 1. **Impact of economic development and education spending on PISA scores**

2009

	Average PISA score	PISA score 5th percentile	PISA score 95th percentile	Ratio of the 95th to the 5th percentile	Average PISA score	PISA score 5th percentile	PISA score 95th percentile	Ratio of the 95th to the 5th percentile
GDP per capita, PPPs	0.063***	0.030	0.066***	0.037	0.045*	0.004	0.054***	0.050*
	(0.022)	(0.036)	(0.017)	(0.027)	(0.022)	(0.037)	(0.017)	(0.029)
EDUSPEND1[1]	0.054	0.082	0.030	-0.052				
	(0.038)	(0.063)	(0.029)	(0.047)				
EDUSPEND2[2]					0.161***	0.244***	0.112***	-0.132*
					(0.052)	(0.087)	(0.040)	(0.069)
Constant	5.463***	5.375***	5.738***	0.362	5.231***	4.994***	5.554***	0.559*
	5.463***	5.375***	5.738***	0.362	5.231***	4.994***	5.554***	0.559*
F ratio	6.112	1.434	9.295	1.313	9.04	4.278	11.771	2.652
R-squared	0.283	0.085	0.375	0.078	0.384	0.228	0.448	0.155
N	34	34	34	34	32	32	32	32

Note: C* p<0.10, ** p<0.05, *** p<0.01; estimated standard errors are reported in parenthesis; GDP per capita, EDUSPEND1 and EDUSPEND2 are taken in logs.

1. Total spending on education as a share of GDP.
2. Average spending per pupil in primary and secondary education, as a percentage of GDP per capita.

Source: Authors' calculations based on data from the OECD PISA 2009 Results, Health and National Accounts databases.

Table 2. **Impact of ESCS measures on PISA scores**

2009

	Average PISA score	Average PISA score	Average PISA score	PISA score: 5th percentile	PISA score: 95th percentile	Ratio of the 95th to the 5th percentile
AVG_ESCS$_i$[1]	0.094***		0.045*	0.026	0.042**	0.016
	(0.017)		(0.022)	(0.042)	(0.016)	(0.037)
STD_ESCS$_i$[3]		-0.277***	-0.188***	-0.243**	-0.157***	0.087
		(0.044)	(0.061)	(0.116)	(0.043)	(0.103)
Constant	6.206***	6.457***	6.377***	6.043***	6.607***	0.565***
	(0.007)	(0.040)	(0.055)	(0.106)	(0.040)	(0.094)
F ratio	30.336	40.189	24.042	7.113	35.995	0.394
R-squared	0.487	0.557	0.608	0.315	0.699	0.025
N	34	34	34	34	34	34

Note: * p<0.10, ** p<0.05, *** p<0.01; estimated standard errors are reported in parenthesis.

1. Country average of individual ESCS.
2. Standard deviation of the ESCS index by individual at the country level.

Source: Authors' calculations based on data from the OECD PISA 2009 Results databases.

Table 3. **Full specification**

2009

	Average PISA score	Average PISA score	Average PISA score	PISA score: 5th percentile	PISA score: 95th percentile	Ratio of the 95th to the 5th percentile
GDP per capita, PPPs	-0.019	-0.023	-0.001	-0.071	0.020	0.091**
	(0.026)	(0.035)	(0.024)	(0.047)	(0.017)	(0.042)
EDUSPEND2[1]	0.123**	0.181**	0.106**	0.172**	0.064**	-0.108
	(0.045)	(0.081)	(0.042)	(0.080)	(0.029)	(0.072)
AVG_ESCS$_i$[2]	0.096***		0.045	0.091	0.028	-0.062
	(0.027)		(0.032)	(0.061)	(0.022)	(0.055)
STD_ESCS$_i$[3]		-0.259***	-0.157**	-0.150	-0.151***	-0.002
		(0.093)	(0.061)	(0.117)	(0.043)	(0.105)
Constant	6.002***	5.707***	6.020***	6.130***	6.194***	0.064
	(0.299)	(0.449)	(0.273)	(0.524)	(0.192)	(0.470)
F ratio	12.693	6.134	13.112	5.349	20.198	1.863
R-squared	0.576	0.397	0.660	0.442	0.750	0.216
N	32	32	32	32	32	32

Note: * p<0.10, ** p<0.05, *** p<0.01; estimated standard errors are reported in parenthesis; GDP per capita and EDUSPEND2 are taken in logs.

1. Average spending per pupil in primary and secondary education, as a percentage of GDP per capita.
2. Country average of individual ESCS.
3. Standard deviation of the ESCS index by individual at the country level.

Source: Authors' calculations based on data from the OECD PISA 2009 Results, Health and National Accounts databases.

One can also compare the performance of countries before and after adjusting for the effect of ESCS variables. Using the estimation of the full specification (column 3 in Table 3), the adjusted average PISA score is:

$$PISA_AVG_ADJ_i = PISA_AVG_i * \exp\left[-0.045 * \left(AVG_ESCS_i - \overline{AVG_ESCS}\right) + 0.157 * \left(STD_ESCS_i - \overline{STD_ESCS}\right)\right] \quad (2)$$

where $\overline{AVG_ESCS}$ and $\overline{STD_ESCS}$ stand for the ESCS average level and standard deviation across OECD countries, respectively. Table 4 shows that adjusting by differences in ESCS (average level and standard deviation) reduces the dispersion of average PISA scores across OECD countries by about one third. Likewise, while France lags between 6 and 9% behind best performing countries in terms of average PISA score (*i.e.* Finland, Korea, Japan and Canada), that gap is reduced by about 50% when differences in ESCS across countries are taken into account, except with respect to Korea where the decline is only 7%. Hence, differences in ESCS might account for a substantial amount of France's PISA gap, albeit by no means all of it.

Table 4. **PISA scores adjusted by level and dispersion of ESCS measures.**

2009

Country	Average PISA score[1]	Adjusted average PISA score[2]	Average PISA score[1] : OECD average = 100	Adjusted average PISA score[2] : OECD average = 100
Australia	519	499	104.5	100.5
Austria	487	481	98.0	96.9
Belgium	509	507	102.5	102.1
Canada	527	509	106.0	102.5
Chile	439	468	88.4	94.2
Czech Republic	490	478	98.8	96.2
Denmark	499	490	100.5	98.7
Estonia	514	502	103.4	101.1
Finland	543	524	109.4	105.5
France	**497**	**495**	**100.0**	**99.7**
Germany	510	506	102.7	101.9
Greece	473	480	95.2	96.7
Hungary	496	505	99.8	101.7
Iceland	501	484	100.8	97.4
Ireland	497	492	100.1	99.0
Israel	459	458	92.3	92.3
Italy	486	497	97.8	100.2
Japan	529	515	106.6	103.7
Korea	541	538	109.0	108.4
Luxembourg	482	493	97.0	99.2
Mexico	420	473	84.5	95.2
Netherlands	519	509	104.5	102.5
New Zealand	524	513	105.5	103.2
Norway	500	477	100.7	96.1
Poland	501	506	100.9	101.9
Portugal	490	519	98.6	104.5
Slovak Republic	488	486	98.3	97.8
Slovenia	499	496	100.4	99.8
Spain	484	506	97.5	101.9
Sweden	496	482	99.8	97.0
Switzerland	517	513	104.1	103.4
Turkey	455	503	91.5	101.3
United Kingdom	500	487	100.7	98.0
United States	496	495	99.9	99.6

1. Average of PISA scores on the reading, mathematics and science scales.
2. OECD average equal to 100.
3. Computed based on equation 5, using the estimation of column 3 in Table 3, in order to adjust the average PISA scores by differences in the ESCS index (average level and standard deviation) across OECD countries.

Source: Authors' calculations based on data from the OECD PISA 2009 Results database.

Bibliography

OECD (2012), *Pisa 2009 Technical Report*, OECD Publishing.

Willms, J.D. (2010), "School Composition and Contextual Effects on Student Outcomes", *Teachers College Record*, Vol. 112, No. 4, 1008-37.

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