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Social origin and academic achievement: What can hierarchical models bring by using PISA data?

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Abstract

This study aims to examine disparities in global school performance. By utilizing data from the 2015 Programme for International Student Assessment (PISA), this research seeks to measure disparities in academic achievement among countries and within each country, relying on multilevel modeling. Consequently, the use of this modeling approach allowed for quantifying estimation biases generated by ordinary least squares estimators. Additionally, considering weightings reveals certain degrees of estimation bias across all participating countries in this international program. Finally, the economic, social, and cultural status of the student (ESCS) positively impacts scientific academic performance in all educational systems, except for the Algerian educational system, where a slightly negative effect was observed.

Keywords: Student achievement **;** Multilevel modeling **;** ESCS **;** PISA 2015

List of abbreviations:

- ESCS: index of economic, social and cultural status
- OCDE: Organisation de coopération et de développement économiques
- OLS: ordinary least squares
- PISA: Programme for International Student Assessment | OECD

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Introduction

The study of empirical literature on the determinants of academic performance allows us to group them into four categories of determinants: (i) determinants related to the student's environment and family background, (ii) determinants related to the student's individual characteristics, (iii) characteristics of educational institutions, and (iv) determinants related to the characteristics of the education system as a whole.

In relation to determinants related to the environment and family background, the majority of empirical studies confirm the close link between the student's family environment and their academic performance. In this regard, Jung-Sook Lee and Natasha K. Bowen (2006) finds that the cultural and educational capital of parents influences students' academic performance. Fuchs and Wöβmann (2004) conclude that the effects of parental education on the success of 15-year-old students in reading are more significant compared to its impact on their success in mathematics and science. Yayan and Berberoglu (2004) indicate that parents' level of education and the number of books at home are positively and significantly correlated with the math performance of 2nd-year college students. The relationship between a child's socioeconomic background and their academic achievement is stronger and more explicit in developed countries compared to developing countries (Coleman et al., 1966; Heyneman and Loxley, 1983). The relationship between children's social background and academic success is unrelated to the level of development of the studied countries (Simmons and Alexander, 1978; Hanushek and Luque, 2003).

Among the first determinants related to individual characteristics is the sense of well-being at school. The concept of well-being refers to school conditions, social relationships, personal development opportunities, and health status (Konu, A., & Rimpelä, M. (2002). According to Hoy and Hannum (1997), well-being has a relatively significant impact on students' behavior in the school environment and on their academic results and performance. Furthermore, school activities and individual effort are among the most important individual characteristics. Student grades improve when they spend more time on homework (Keith et al., 1986, and Postlethwaite and Wiley, 1992). Gender effect is also among the individual characteristics. According to Murphy (2000), girls seem better prepared than boys as they develop interests in line with school activities.

Regarding determinants related to the characteristics of educational institutions, we first note the general characteristics related to the school as a whole. Currently, there is no consensus regarding studies on the relationship between school resources and students' academic performance (Coleman, 1966). Secondly, there are school resource-related characteristics of

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educational institutions. Studies conducted in lower-income countries show that material and human resources play an important role in improving students' performance (Card and Kruger, 1996; Parcel and Dufur, 2001; Fuller and Clarke, 1994). Among the characteristics of educational institutions to mention is class size. Researchers who have examined the issue of class size have arrived at rather contrasting results. Hanushek (1997, 2003, 2006) demonstrates, through a meta-analysis of several articles on the effect of class size, the absence of any consistent, significant, and close relationship between class size and academic performance.

As for determinants related to the characteristics of the education system, it is worth mentioning the impact of preschool education. Caille (2001) concludes that children enrolled in preschool at the age of two are less likely to repeat a grade compared to students who start school later. Another characteristic of the education system is the impact of grade repetition. According to Holmes and Matthews (1984); Seibel (1984); Grisay (1993); Manacorda (2007), grade repetition has a negative impact on student performance. However, Grenne and Winter (2004) assert that the policy of grade repetition has a positive impact on the academic success of students in Florida.

1. Objective and Research Questions

This article aims to study educational performance inequalities based on the scores recorded by 15-year-old students and the Economic, Social, and Cultural Status (ESCS) index for all the educational systems participating in the PISA 2015 survey. Specifically, this study seeks to answer the following research questions:

a) What proportion of the unexplained variance in students' scientific performance exists?
b) What is the percentage of inequality between schools and within schools for each educational system?
c) Is the economic, social, and cultural status of the student a significant factor contributing to the explanation of students' performance in science?
d) What are the bias values generated by an Ordinary Least Squares (OLS) estimation?

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2. Research method

The multilevel model is a highly flexible model that offers several advantages compared to ordinary least squares (OLS) models. It allows us to abandon or modify certain restrictive assumptions of OLS models. The multilevel model can be formalized by first distinguishing, for the sake of presentation, the equations based on the different levels involved in the analysis (Bressoux, 2007).

At Level 1:

$$\mathbf{Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + e_{ij}}$$

Where the indices i and j refer to individuals i (micro-units) and environments j (macro-units). The regression coefficients β_{0j} and β_{1j}can vary from one environment j to another.

At Level 2, it is shown that the coefficients β_{0j} and β_{1j} are random by introducing random error terms u_{0j} et u_{1j}

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

By substituting the values of the coefficients β_{0j} and $\beta_{1j}$from above into equation (1), we obtain the following equation:

$$Y_{ij} = \gamma_{00} + \gamma_{10}X_{ij} + u_{0j} + u_{1J}X_{ij} + e_{ij}$$

Where:

γ_{00} represents the overall mean of Y.

γ_{10} is the average regression slope for all groups.

u_{0j} represents a random error associated with each group j, assumed to be normally distributed with a mean of zero and a variance of ${\sigma_{u0}}^2$.

u_{0j} represents the deviation of each group from the average relationship. It is a random variable with a mean of zero and a variance of ${\sigma_{u1}}^2$.

Due to the presence of two error terms at Level 2, an additional parameter can be estimated: the covariance between the intercepts and slopes, denoted as σ_{u01} .

The following expression succinctly illustrates the design of the random parameter structure to be estimated at Level 2:

$$\begin{bmatrix} u_{0j} \\ u_{1j} \end{bmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} {\sigma_{u0}}^2 & \sigma_{u01} \\ \sigma_{u10} & {\sigma_{u1}}^2 \end{pmatrix}\right]$$

At level 1, $e_{ij} \sim N(0, {\sigma_e}^2)$

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3. Presentation of PISA 2015 Data: Participants, Sampling, and Some Descriptive Analyses

The sampling method of the PISA study is based on a two-stage stratified sampling method in each country (OECD, 2015). In the first stage, schools are systematically sampled with probabilities proportional to the school's size (number of enrolled students aged 15). The sampling of schools is followed by sampling eligible PISA students (aged 15) within each school. It should be noted that the PISA assessment focuses solely on 15-year-olds for the purpose of international comparisons since these students are nearing the end of compulsory education in most countries (OECD, 2013, 2014, 2015).

The following table shows the number of students and the number of schools in the sample for each participating country in the PISA 2015 survey.

Table 1. Participating Countries, Number of Students, and Number of Schools in the Educational System Sample (PISA 2015)

Country	Number of Students	Number of Schools	Country	Number of Students	Number of Schools	Country	Number of Students	Number of Schools
ALB	5215	230	**NOR**	5456	229	**GRC**	5532	211
ARE	14167	473	**NZL**	4520	183	**HKG**	5359	138
AUS	14530	758	**PER**	6971	281	**HRV**	5809	160
AUT	7007	269	**POL**	4478	169	**HUN**	5658	245
BEL	9651	288	**PRT**	7325	246	**IDN**	6513	236
BGR	5928	180	**QAR**	1657	58	**IRL**	5741	167
BRA	23141	841	**QAT**	12083	167	**ISL**	3371	124
CAN	20058	759	**QCH**	9841	268	**ISR**	6598	173

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CHE	5860	227	**QES**	32330	976	**ITA**	11583	474
CHL	7053	227	**ROU**	4876	182	**JOR**	7267	250
COL	11795	372	**RUS**	6036	210	**JPN**	6647	198
CRI	6866	205	**SGP**	6115	177	**KOR**	5581	168
CZE	6894	344	**SVK**	6350	290	**KSV**	4826	224
DEU	6504	256	**SVN**	6406	333	**LBN**	4546	270
DNK	7161	333	**SWE**	5458	202	**LTU**	6525	311
DOM	4740	194	**TAP**	7708	214	**LUX**	5299	44
DZA	5519	161	**THA**	8249	273	**LVA**	4869	250
ESP	6736	201	**TTO**	4692	149	**MAC**	4476	45
EST	5587	206	**TUN**	5375	165	**MDA**	5325	229
FIN	5882	168	**TUR**	5895	187	**MEX**	7568	275
FRA	6108	252	**URY**	6062	220	**MKD**	5324	106
GBR	14157	550	**USA**	5712	177	**MLT**	3634	59
GEO	5316	262	**VNM**	5826	188	**MNE**	5665	64
NLD	5385	187						

Source : author using OECD's PISA data

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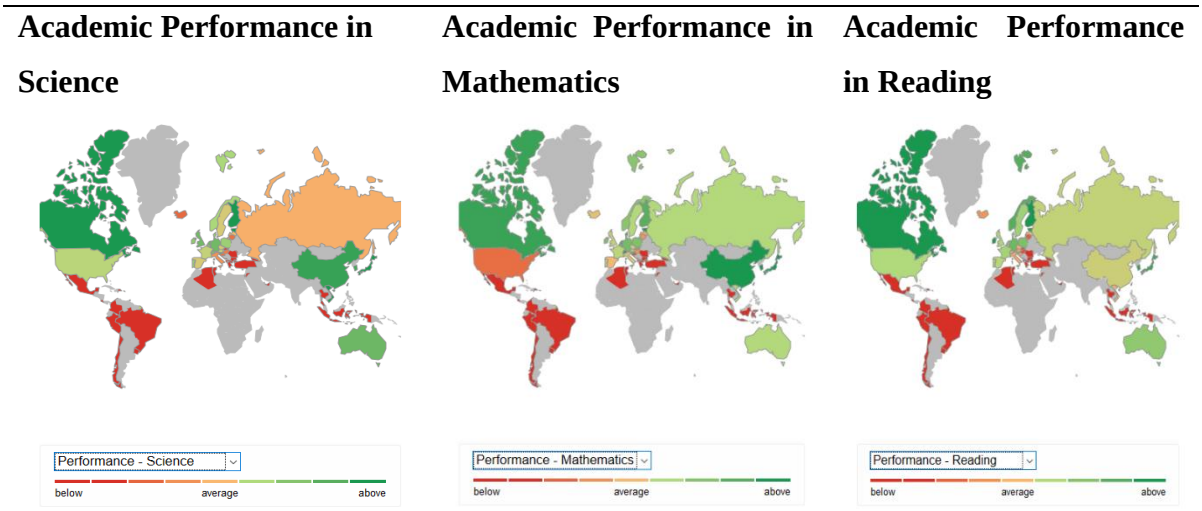
PISA 2015 data is organized into a hierarchical structure with two levels: the first level comprises students, while the second level reflects the school context. This data structure necessitates a multilevel modeling approach because classical OLS estimators do not allow for unbiased estimation of the variance-covariance matrix and, subsequently, can introduce biases in terms of the model's parameter significance (Champ, 2013).

In the present study, the empirical work primarily focuses on estimating an empty model to calculate school performance differences in scientific subjects (intra-class coefficient). Subsequently, a model containing a variable related to student characteristics (ESCS) is estimated to demonstrate that it significantly impacts students' academic performance in scientific subjects across all educational systems. This study uses the final student weights to control for the possibility that some units in the sample may be disproportionately larger than others, which could lead to biased results (Kim, Anderson, Keller, 2014).

Figure 1. Map of Global School Performance



Source : OECD PISA data

The results of the PISA 2015 survey reveal disparities in terms of academic performance in science among the various participating countries. The map above, for example, shows that academic performance in science is very poor in Algeria, moderately average in Russia, while students in Canada exhibit much better performance compared to other countries. Similarly, the map above depicts disparities in academic performance in mathematics across different countries. Likewise, the map above illustrates disparities in academic performance in reading

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among the various countries participating in the PISA 2015 survey. Once again, as an example, Algeria records the lowest reading scores on a global scale.

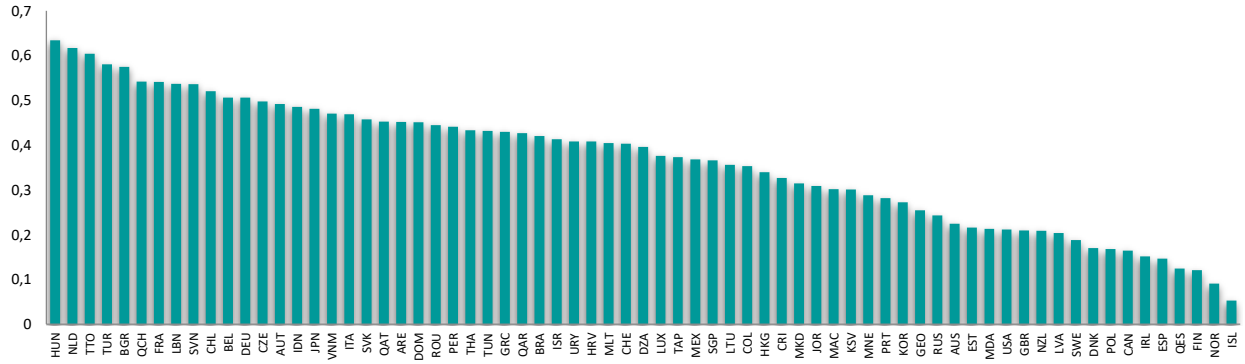
In the following sections, our research focuses on calculating inequalities in academic performance within each educational system to empirically illustrate and demonstrate the effect and magnitude of ESCS on academic performance across countries.

4. Results and discussion

4.1.Results of the Empty Model and Calculation of the Intra-Class Coefficient (ρ)

The results of our estimations demonstrate differences in the coefficients of educational achievement inequality (ρ) calculated for all countries participating in the PISA 2015 survey. Consequently, considering the weighting reveals estimation biases among the different models estimated (see Appendix).

Figure 2. The Intra-Class Coefficient (ρ) Based on Scores Recorded in Scientific Subjects



Source : author using OECD's PISA data

ISL, NOR, FIN, QES, ESP, IRL record the least low intra-class coefficients (ρ). This means that the average scores recorded in schools in these countries do not differ significantly and are nearly zero. Similarly, the educational achievements of students are almost the same for all students in these educational systems. In other words, factors like being in the north, coming from a disadvantaged family, or other such factors do not create differences among students, which is excellent from an educational achievement perspective. These results, of course, conceal many mechanisms and educational policies that have contributed to these performances, as initial inequalities or inputs exist by nature. From these empirical results, a

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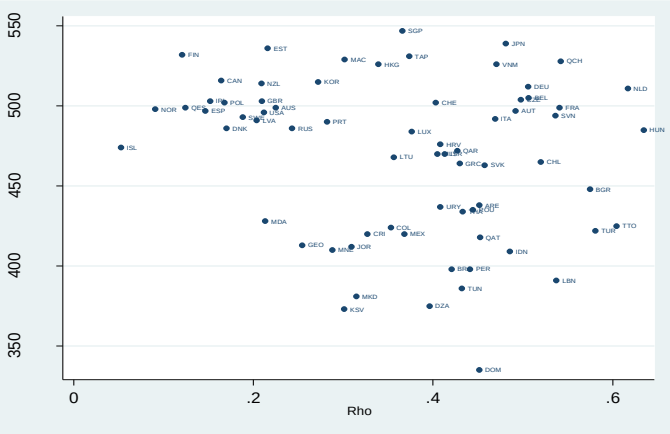
very simple question arises : how can we achieve a less unequal situation among students within an educational system ?

Furthermore, there are educational systems that fail to address input inequalities, and these inequities accumulate to a situation that can be severe, such as school dropout, or a less severe situation characterized by very pronounced inequalities in educational achievements among schools within an educational system. This observation is seen in HUN, NLD, TTO, TUR, BGR.

Figure 3. Academic Performance in Science and Intra-Class Coefficient



Source : author using OECD's PISA data

In the middle of the graph above, we can observe many countries that are both average and unequal in terms of academic performance, such as DZA, LUX, CHE, and many others. From this result, we can conclude that there are countries that are less high-performing but exhibit less pronounced inequalities. On the other hand, there are high-performing educational systems that record relatively high inequality coefficients. Additionally, there are countries with very high scores and very low inequality coefficients, which is the most desirable situation since all students perform well with little variability among them, as seen in the upper-left part of the graph below. This includes NOR, FIN, ISL. Countries in the lower-right part of the graph above are in a critical situation. Countries in the middle share an average performance with moderate inequality.

4.2.Multilevel Model Considering Socioeconomic, Social, and Cultural Status

Socioeconomic, social, and cultural status is one of the most important student-level variables that impact academic performance in most countries participating in the PISA survey (PISA

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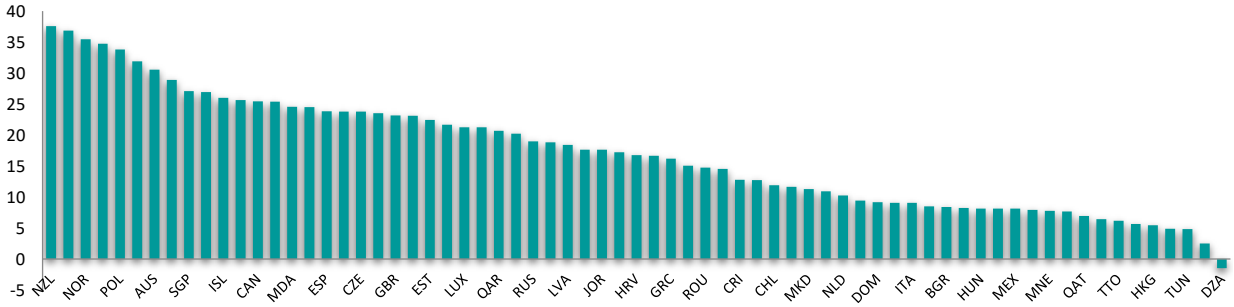
2012). It encompasses data related to the parents' level of education, their occupational status, as well as the various material resources available to students at home for learning. This variable is also at the core of educational policies in these countries, with the primary goal of ensuring equal access to education for all students. ESCS has a positive and statistically significant effect at the 1% level for all countries. However, the magnitude of this variable's effect varies across educational systems.

Figure 4. The Effect of ESCS on Academic Performance in Science Across Countries



Source : author using OECD's PISA data

The hypothesis of the positive effect of ESCS is well confirmed for all educational systems, except for the Algerian educational system, where a slightly negative and significant effect is observed. Furthermore, all estimated ESCS parameters are significant at the 1% level.

An increase of one point in ESCS results in a 38-point increase in science scores in NZL, a 37-point increase in FIN, and a 35-point increase in NOR. The graph above illustrates all estimated effects by country. However, the results show that in Algeria, an increase of one point in ESCS decreases academic performance in science by 2 points, which contradicts our expectations, even though this negative relationship is very weak (a 2-point decrease). This negative relationship certainly requires a detailed investigation for a better understanding of this rather interesting result. TUN, TUR, IDN, HKG, THA are educational systems recording a positive and significant effect ranging from 1 to 5 points, which is classified as a weak positive effect.

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Figure 5. Relationship Between Science Score and ESCS

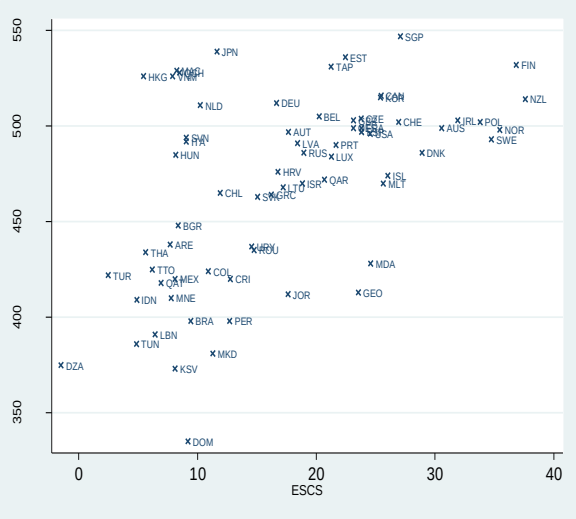
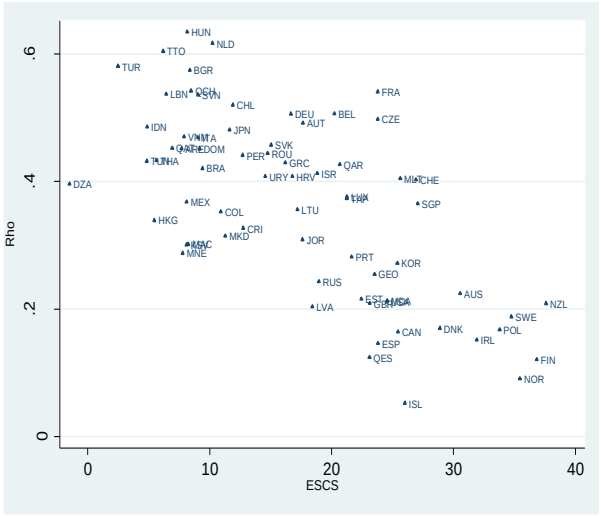


Figure 6. Relationship Between Intra-Class Coefficient and ESCS



Source : author using OECD's PISA data

Based on the results of the multilevel models, it is interesting to note the existence of a negative relationship between the intra-class inequality coefficient (Science Score) and the socioeconomic, social, and cultural status of the student. Conversely, a positive relationship is observed between academic achievements in science and socioeconomic status.

4.3.OLS Model vs. Multilevel Model, Degrees of Estimation Bias by Country

In theory, the multilevel model is the most suitable specification for estimating hierarchical models. The results obtained with the OLS estimator show significant biases in the estimated parameters. For example, in Austria, the effect of an increase of one unit in ESCS improves academic performance in scientific subjects by 45.50 according to OLS. In contrast, estimation by a multilevel model reveals an effect of 17.64. Therefore, the bias between the two models is 27.86. In another example, the estimated effect of this variable in Canada by OLS is 33.65, while the multilevel model shows an effect of 25.44, indicating an estimation bias of 8.21. Similarly, the observed effect in Finland is 40.48 and 36.86 for OLS and the multilevel model, respectively.

Annex Table 6 presents the estimations performed by the OLS estimator. The key conclusion of this section is that estimation biases are observed for all countries in our study. The degree of bias varies from one country to another and is related to their degree of heterogeneity. Thus, the graph above illustrates that the degree of estimation bias varies by country, and this

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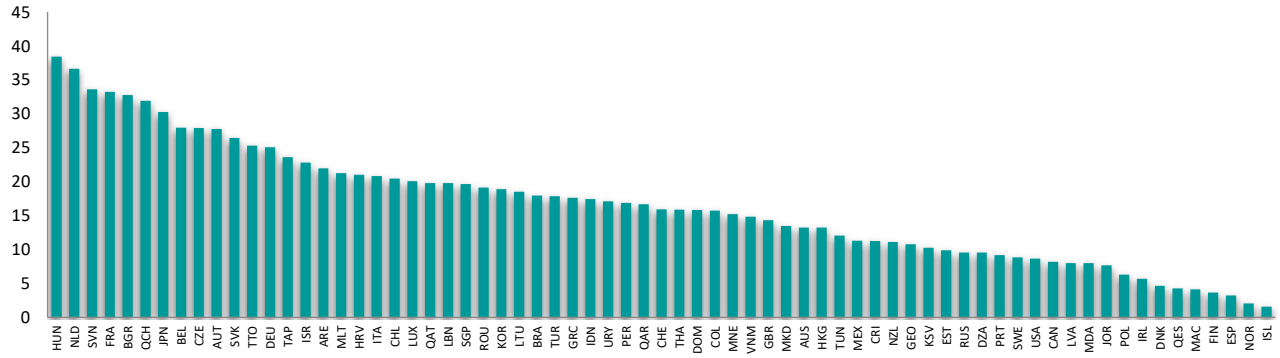
variability is closely related to the degree of the intra-class coefficient estimated by an empty model.

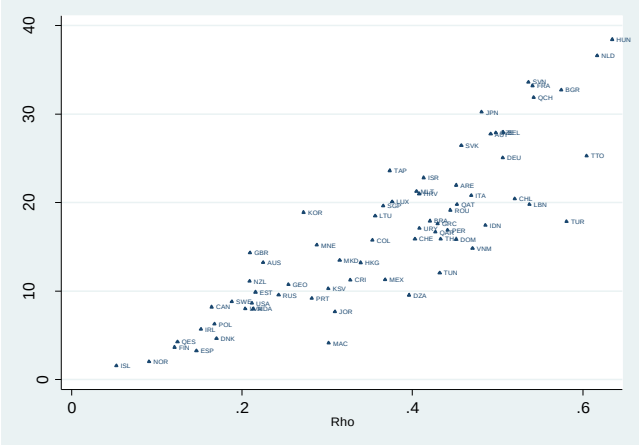
Figure 7. Estimation Bias Values Generated by OLS vs. Multilevel Model



Source : author using OECD's PISA data

This intuitive conclusion reveals that multilevel modeling becomes very interesting when the intra-class coefficient is very large. This result aligns with theoretical research and academic courses on multilevel modeling (Goldstein, 1995).

Figure 8. Relationship Between Intra-Class Coefficient and Estimation Bias Generated by the OLS Estimator



Source : author using OECD's PISA data

The graph above illustrates the increasing relationship between the intra-class coefficient and the degree of bias generated by a misidentification of model parameters. These results demonstrate the value of multilevel modeling for unbiased specification and identification of key parameters. Furthermore, this brief section related to estimation bias underscores the importance of proper econometric identification for the formulation of relevant educational policies and for conducting discussions and reflections in a fair public debate.

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5. Conclusion

Like any study, our work has its own limitations. We can say that our limitations are directly related to the objectives of our research, as we focused in this study exclusively on demonstrating performance disparities in scientific subjects for all countries participating in the PISA 2015 survey, using only the ESCS index proposed by the OECD. In future studies, our modeling will be enriched by more robust econometric models, based on instrumental variable methods to address endogeneity biases generated by the level 2 of the multilevel model. Additionally, a semi-parametric modeling approach within a hierarchical structure will be very useful to provide more simulations and consequently more recommendations. These research perspectives will be conducted for each educational system to provide more policy recommendations in the field of education.

This study has revealed disparities in the academic performance of 15-year-old students in the field of science. The results of the multilevel analysis have shown significant variations in academic performance between schools within each country, as well as among the different educational systems participating in the PISA 2015 survey. Additionally, our study has highlighted estimation biases generated by the violation of modeling assumptions when using the OLS estimator. This underscores the importance of a hierarchical structure for proper model specification. Furthermore, the socioeconomic, social, and cultural status of the student has a positive and significant impact on academic performance in all educational systems, except in Algeria where a negative effect was observed. In conclusion, multilevel modeling, considering weightings, and employing robust econometric methods are all essential elements for conducting an unbiased evaluation study and for proposing relevant educational policies and fair scientific discussions.

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Annex

Table 2. Intra-Class Coefficient (ρ) from Scores Recorded in Scientific Subjects

	Empty Model with Weighting			Empty Model without Weighting				Empty Model with Weighting			Empty Model without Weighting		
CNT	Intercept	Residual	rho	Intercept	Residual	rho	CNT	Intercept	Residual	rho	Intercept	Residual	rho
ARE	4079,83	4958,23	0,45	4179,25	4908,45	0,46	KSV	1200,34	2786,26	0,30	1171,52	2840,79	0,29
AUS	2150,83	7422,41	0,22	2328,82	7664,76	0,23	LBN	3710,20	3196,74	0,54	3701,91	3336,34	0,53
AUT	4420,47	4568,54	0,49	4324,87	4557,62	0,49	LTU	2679,05	4840,85	0,36	2727,90	5009,84	0,35
BEL	4938,45	4813,61	0,51	4980,78	4816,43	0,51	LUX	3585,68	5945,54	0,38	3591,29	5932,04	0,38
BGR	5667,29	4197,24	0,57	5614,30	4242,79	0,57	LVA	1250,48	4886,22	0,20	1076,47	4906,36	0,18
BRA	2885,86	3976,21	0,42	2912,22	3829,35	0,43	MAC	1936,74	4483,17	0,30	1938,54	4480,34	0,30
CAN	1270,42	6463,72	0,16	1329,13	6388,72	0,17	MDA	1353,83	4999,45	0,21	1307,30	5047,00	0,21
CHE	3671,71	5439,16	0,40	3718,68	5169,94	0,42	MEX	1680,56	2887,57	0,37	1610,95	2884,38	0,36
CHL	4145,94	3826,00	0,52	3988,82	3720,84	0,52	MKD	1903,01	4146,95	0,31	1900,86	4148,22	0,31
COL	2014,23	3692,41	0,35	2030,76	3763,26	0,35	MLT	5719,89	8411,78	0,40	5748,75	8417,75	0,41
CRI	1393,58	2868,58	0,33	1374,84	2858,47	0,32	MNE	1875,95	4645,11	0,29	1772,25	4627,45	0,28
CZE	4419,99	4459,21	0,50	4479,79	4204,01	0,52	NLD	5917,80	3676,40	0,62	5939,99	3675,97	0,62
DEU	4843,81	4727,95	0,51	4825,49	4788,51	0,50	NOR	776,40	7771,64	0,09	759,68	7806,50	0,09
DNK	1295,76	6324,73	0,17	1629,94	6727,69	0,20	NZL	2103,57	7969,64	0,21	2113,49	7981,93	0,21
DOM	2051,33	2494,37	0,45	2035,03	2546,45	0,44	PER	2384,93	3020,85	0,44	2344,35	3067,01	0,43
DZA	1505,73	2295,86	0,40	1430,21	2272,55	0,39	POL	1272,56	6321,91	0,17	1144,16	6214,56	0,16
ESP	1043,95	6083,75	0,15	996,60	5898,46	0,14	PRT	2271,58	5789,22	0,28	2647,99	5579,68	0,32
EST	1575,13	5723,36	0,22	1491,73	5767,13	0,21	QAR	2908,99	3905,92	0,43	2861,22	3842,99	0,43
FIN	1054,55	7672,16	0,12	796,04	7736,94	0,09	QAT	4175,71	5055,90	0,45	4167,80	5014,00	0,45
FRA	5311,33	4510,08	0,54	5306,53	4488,06	0,54	QCH	5232,58	4418,99	0,54	4920,69	4182,48	0,54
GBR	1846,95	6978,56	0,21	2133,80	6523,44	0,25	QES	867,50	6114,51	0,12	885,59	6016,64	0,13
GEO	1810,75	5306,47	0,25	1822,08	5361,02	0,25	ROU	2453,26	3067,63	0,44	2421,22	3050,78	0,44
GRC	3518,64	4672,77	0,43	3310,79	4749,05	0,41	RUS	1514,93	4719,38	0,24	1473,17	4801,48	0,23
HKG	1992,88	3883,35	0,34	1994,71	3831,99	0,34	SGP	3643,97	6321,30	0,37	3779,25	6447,93	0,37
HRV	3010,35	4368,16	0,41	2977,19	4317,67	0,41	SVK	4032,01	4783,82	0,46	3977,93	4768,25	0,45
HUN	5879,91	3389,10	0,63	5577,97	3461,21	0,62	SVN	4610,65	3991,08	0,54	4788,25	3889,67	0,55
IDN	1893,87	2005,99	0,49	1918,13	2045,74	0,48	SWE	1820,30	7857,21	0,19	1651,23	7928,86	0,17
IRL	1114,60	6231,28	0,15	1123,58	6219,68	0,15	TAP	3383,28	5678,66	0,37	3378,35	5912,86	0,36
ISL	402,06	7256,93	0,05	367,18	7270,67	0,05	THA	2609,90	3417,80	0,43	3512,14	3305,35	0,52
ISR	4391,90	6241,68	0,41	4328,01	6251,51	0,41	TTO	4811,70	3151,41	0,60	4838,44	3117,52	0,61
ITA	3570,33	4041,09	0,47	3601,51	4028,19	0,47	TUN	1530,33	2012,31	0,43	1529,21	2006,71	0,43
JOR	1889,78	4225,00	0,31	1918,55	4189,09	0,31	TUR	3183,21	2297,39	0,58	3156,02	2312,18	0,58
JPN	3853,17	4156,81	0,48	3861,53	4163,84	0,48	URY	2846,35	4126,95	0,41	2790,40	4168,81	0,40
KOR	2282,00	6104,09	0,27	2266,31	6132,25	0,27	USA	1898,97	7078,28	0,21	1846,62	7063,28	0,21
-	-	-	-	-	-	-	VNM	2483,59	2795,43	0,47	2426,90	2837,99	0,46

Source : author using OECD's PISA data

Tableau 1. Descriptive Statistics

	Science					Mathematics					Reading				
CNT	N	Mean	Sd	Min	Max	N	Mean	Sd	Min	Max	N	Mean	Sd	Min	Max
ALB	5215	427	73	194	664	5215	413	77	150	676	5215	406	87	121	681
ARE	14167	438	95	133	729	14167	428	88	119	733	14167	434	99	71	743
AUS	14530	499	101	215	802	14530	483	88	202	780	14530	492	98	126	784
AUT	7007	497	93	226	773	7007	499	88	183	759	7007	486	94	175	737
BEL	9651	505	96	198	787	9651	510	91	199	793	9651	502	94	134	744
BGR	5928	448	97	190	748	5928	443	90	154	732	5928	435	107	11	760
BRA	23141	398	81	147	719	23141	374	77	113	712	23141	404	89	90	713
CAN	20058	516	87	226	795	20058	505	79	226	793	20058	514	85	203	801
CHE	5860	502	95	184	777	5860	519	88	221	794	5860	489	91	197	782
CHL	7053	465	85	218	705	7053	442	84	182	691	7053	476	84	180	710
COL	11795	424	75	204	703	11795	397	70	175	672	11795	436	82	135	688
CRI	6866	420	65	226	679	6866	400	61	199	639	6866	427	72	185	696
CZE	6894	504	94	219	759	6894	503	87	218	770	6894	498	97	141	739
DEU	6504	512	96	207	793	6504	509	83	239	766	6504	512	93	180	764
DNK	7161	486	91	190	814	7161	498	79	250	730	7161	487	85	195	730
DOM	4740	335	67	156	627	4740	331	62	129	604	4740	362	79	99	630
DZA	5519	375	60	156	612	5519	359	58	173	616	5519	349	63	127	578
ESP	6736	497	83	245	723	6736	491	78	223	775	6736	500	80	217	725
EST	5587	536	85	265	775	5587	521	74	283	748	5587	521	82	230	742
FIN	5882	532	92	234	794	5882	512	76	202	737	5882	528	88	73	750
FRA	6108	499	98	217	750	6108	497	89	163	771	6108	504	105	187	786
GBR	14157	503	93	204	806	14157	492	81	114	754	14157	495	87	174	805
GEO	5316	413	86	180	717	5316	406	87	74	686	5316	404	96	73	693
GRC	5532	464	86	213	716	5532	462	81	164	710	5532	477	88	123	711
HKG	5359	526	76	257	747	5359	551	82	245	795	5359	529	79	237	724
HRV	5809	476	85	238	751	5809	465	82	201	726	5809	488	84	246	731
HUN	5658	485	90	210	754	5658	485	86	212	770	5658	477	90	173	724
IDN	6513	409	63	226	641	6513	393	73	168	676	6513	404	68	182	643
IRL	5741	503	85	213	764	5741	503	74	208	729	5741	521	81	235	752
ISL	3371	474	87	203	726	3371	489	86	219	770	3371	482	93	135	779
ISR	6598	470	102	187	759	6598	472	96	178	771	6598	482	106	116	780
ITA	11583	492	85	193	750	11583	500	84	222	814	11583	493	84	197	743
JOR	7267	412	78	124	635	7267	383	76	50	652	7267	412	85	65	651
JPN	6647	539	90	245	806	6647	533	82	201	758	6647	516	86	191	761
KOR	5581	515	91	232	791	5581	523	93	178	792	5581	517	90	211	784
KSV	4826	373	64	201	616	4826	357	68	136	642	4826	340	70	107	565
LBN	4546	391	85	159	698	4546	402	93	108	739	4546	352	107	75	722
LTU	6525	468	88	167	743	6525	474	81	200	734	6525	466	88	91	726

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LUX	5299	484	97	219	792	5299	486	88	242	760	5299	482	101	186	742
LVA	4869	491	77	261	730	4869	484	70	253	738	4869	489	77	238	721
MAC	4476	529	78	258	783	4476	544	73	184	793	4476	509	77	219	717
MDA	5325	428	81	177	687	5325	420	81	154	691	5325	417	90	112	715
MEX	7568	420	66	218	659	7568	413	67	186	680	7568	429	71	180	672
MKD	5324	381	77	136	663	5324	369	85	105	721	5324	348	88	72	637
MLT	3634	470	112	101	765	3634	484	103	79	761	3634	452	112	58	749
MNE	5665	410	80	149	705	5665	416	78	146	681	5665	424	87	137	669
NLD	5385	511	97	254	810	5385	514	86	233	807	5385	505	96	189	770
NOR	5456	498	93	189	773	5456	501	79	211	749	5456	513	92	54	812
NZL	4520	514	100	216	797	4520	496	86	230	766	4520	510	98	161	760
PER	6971	398	72	172	654	6971	388	75	115	647	6971	399	84	135	664
POL	4478	502	86	168	756	4478	505	81	151	746	4478	507	83	169	735
PRT	7325	490	90	233	758	7325	481	91	162	755	7325	487	88	205	721
QAR	1657	472	80	202	684	1657	454	81	172	691	1657	473	82	209	671
QAT	12083	418	94	178	758	12083	402	92	129	729	12083	402	105	102	750
QCH	9841	528	95	186	790	9841	541	96	159	813	9841	506	98	126	778
QES	32330	499	83	198	746	32330	493	76	222	736	32330	502	80	204	755
QUC	1652	527	93	254	775	1652	499	79	204	713	1652	525	88	196	755
QUD	1398	408	81	218	638	1398	382	71	197	620	1398	416	89	169	676
QUE	1887	502	92	250	741	1887	471	81	216	733	1887	499	90	226	756
ROU	4876	435	74	178	684	4876	444	79	214	691	4876	434	87	145	723
RUS	6036	486	79	258	744	6036	495	75	222	720	6036	495	80	210	749
SGP	6115	547	101	235	836	6115	556	90	263	826	6115	527	94	209	779
SVK	6350	463	95	173	766	6350	477	89	171	765	6350	455	98	134	714
SVN	6406	494	91	231	774	6406	494	82	235	778	6406	486	88	146	728
SWE	5458	493	98	197	796	5458	494	83	202	776	5458	500	95	152	761
TAP	7708	531	96	218	799	7708	540	97	108	817	7708	496	88	127	745
THA	8249	434	84	219	691	8249	429	83	169	719	8249	420	82	167	670
TTO	4692	425	88	157	709	4692	416	90	144	728	4692	427	97	126	712
TUN	5375	386	59	222	624	5375	367	73	143	682	5375	362	73	120	610
TUR	5895	422	73	234	681	5895	416	74	192	676	5895	425	75	139	666
URY	6062	437	83	212	708	6062	420	81	190	712	6062	438	91	172	723
USA	5712	496	94	194	818	5712	469	83	192	723	5712	497	94	185	768
VNM	5826	526	71	311	771	5826	497	75	221	765	5826	489	65	117	697

Source : author using OECD's PISA data

Table 4. Intra-Class Coefficient (ρ) - Inequality in Academic Achievement by Country and Assessed Subjects

	Science			Mathematics			Reading		
CNT	**Intercept**	**Residual**	**Rho**	**Intercept**	**Residual**	**Rho**	**Intercept**	**Residual**	**Rho**
ALB	1375,53	3772,43	0,27	1543,86	4050,14	0,28	2257,37	5182,88	0,30
ARE	4054,44	4942,75	0,45	3659,66	4087,97	0,47	4960,31	4904,62	0,50
AUS	2222,37	7416,67	0,23	1823,93	5505,07	0,25	2185,96	6913,10	0,24
AUT	4488,40	4564,53	0,50	4550,49	3882,63	0,54	5118,52	4303,79	0,54
BEL	4974,76	4821,07	0,51	4931,98	4133,55	0,54	5230,96	4401,44	0,54
BGR	5684,61	4173,09	0,58	4625,02	3698,96	0,56	7345,66	4844,95	0,60
BRA	2817,07	3906,49	0,42	2759,36	3317,18	0,45	3379,70	4775,93	0,41
CAN	1291,22	6433,56	0,17	1310,83	4987,50	0,21	1365,06	5876,00	0,19
CHE	3671,73	5463,15	0,40	3081,28	4938,08	0,38	3512,48	4980,10	0,41
CHL	4139,09	3821,78	0,52	4318,95	3462,81	0,56	4147,05	3806,09	0,52
COL	1991,11	3665,29	0,35	1633,22	3205,44	0,34	2588,53	4310,56	0,38
CRI	1381,22	2853,79	0,33	1343,39	2442,79	0,35	1923,64	3370,31	0,36
CZE	4415,61	4470,88	0,50	4106,86	3700,40	0,53	5135,07	4592,03	0,53
DEU	4911,54	4698,87	0,51	3878,07	3507,58	0,53	5167,81	4155,05	0,55
DNK	1324,44	6308,85	0,17	924,07	4773,50	0,16	1239,55	5477,68	0,18
DOM	2033,91	2488,51	0,45	1865,97	2108,04	0,47	3235,78	3216,14	0,50
DZA	1502,06	2307,81	0,39	1318,03	2087,75	0,39	1690,02	2275,09	0,43
ESP	1042,24	6101,34	0,15	1002,56	5254,04	0,16	1135,39	5535,68	0,17
EST	1580,41	5738,59	0,22	1167,87	4420,67	0,21	1479,09	5272,66	0,22
FIN	1047,73	7655,05	0,12	916,01	5078,10	0,15	1216,13	6777,69	0,15
FRA	5400,79	4524,41	0,54	4648,95	3575,69	0,57	6761,68	4817,05	0,58
GBR	1891,74	7025,08	0,21	1519,71	5658,43	0,21	1596,35	6363,10	0,20
GEO	1816,06	5308,60	0,25	2363,73	4952,19	0,32	2705,10	6293,28	0,30
GRC	3563,23	4671,04	0,43	3126,77	4279,31	0,42	4257,22	4675,37	0,48
HKG	2012,47	3900,59	0,34	2477,86	4431,20	0,36	2323,51	4020,62	0,37
HRV	3010,65	4359,43	0,41	2818,26	3911,83	0,42	3395,07	3903,00	0,47
HUN	5761,10	3410,60	0,63	5166,76	3067,98	0,63	5735,62	3043,09	0,65
IDN	1893,94	2003,26	0,49	2796,35	2264,45	0,55	2167,39	2322,35	0,48
IRL	1125,24	6212,19	0,15	975,23	4609,67	0,17	1035,75	5585,35	0,16
ISL	409,64	7232,18	0,05	515,86	6850,57	0,07	607,13	8047,99	0,07
ISR	4410,87	6302,54	0,41	4560,95	5035,36	0,48	5751,81	5988,00	0,49
ITA	3518,06	4029,30	0,47	3496,55	4159,34	0,46	3545,99	4035,28	0,47
JOR	1913,17	4291,98	0,31	1821,04	4041,52	0,31	2952,58	4453,31	0,40
JPN	3907,79	4184,17	0,48	3700,26	3136,78	0,54	3686,64	3766,45	0,49
KOR	2292,46	6099,16	0,27	2744,64	5915,48	0,32	2547,71	5611,84	0,31
KSV	1202,69	2786,06	0,30	1438,93	2992,20	0,32	1565,75	3091,68	0,34
LBN	3708,11	3180,55	0,54	4678,38	3660,64	0,56	6420,82	4531,18	0,59
LTU	2644,13	4806,61	0,35	2084,09	4315,37	0,33	2990,57	4682,07	0,39

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LUX	3584,13	5981,86	0,37	2890,32	4951,46	0,37	3649,13	6599,77	0,36
LVA	1259,92	4902,72	0,20	1100,98	4136,04	0,21	1438,60	4911,01	0,23
MAC	1949,53	4490,05	0,30	1862,13	4097,92	0,31	2046,07	4174,73	0,33
MDA	1372,03	5005,87	0,22	1561,06	4833,27	0,24	1914,04	6015,97	0,24
MEX	1678,84	2881,21	0,37	1697,68	2963,62	0,36	2205,38	3150,35	0,41
MKD	1900,27	4152,43	0,31	2796,62	4832,54	0,37	2803,94	5040,44	0,36
MLT	5787,85	8417,68	0,41	5084,24	6907,76	0,42	6296,67	7944,43	0,44
MNE	1898,67	4643,78	0,29	2102,97	4243,72	0,33	2504,98	5014,55	0,33
NLD	5936,37	3660,52	0,62	4971,12	2687,03	0,65	6031,71	3314,02	0,65
NOR	808,25	7759,70	0,09	660,11	5535,18	0,11	945,11	7506,86	0,11
NZL	2163,18	8049,52	0,21	1766,74	5704,63	0,24	2233,10	7649,46	0,23
PER	2381,79	3017,24	0,44	2602,10	3312,72	0,44	4050,58	3438,12	0,54
POL	1298,31	6393,89	0,17	1105,23	5716,60	0,16	1159,24	5963,43	0,16
PRT	2265,16	5783,31	0,28	2429,50	5929,94	0,29	2463,12	5274,41	0,32
QAR	2875,67	3910,60	0,42	3354,63	3375,06	0,50	3102,61	4110,95	0,43
QAT	4192,04	5051,65	0,45	4366,43	4415,99	0,50	5950,83	5571,00	0,52
QCH	5231,42	4421,26	0,54	5321,30	4479,00	0,54	5924,92	4511,52	0,57
QES	873,13	6123,63	0,12	805,26	5072,30	0,14	869,59	5706,27	0,13
ROU	2456,15	3068,43	0,44	2942,38	3229,53	0,48	3702,07	3975,64	0,48
RUS	1528,19	4670,21	0,25	1502,46	4135,24	0,27	1638,04	4743,36	0,26
SGP	3653,13	6310,31	0,37	2969,08	4960,39	0,37	3272,76	5333,05	0,38
SVK	4112,24	4777,50	0,46	3596,30	4249,71	0,46	5073,59	4657,38	0,52
SVN	4614,48	4009,29	0,54	3905,71	3337,97	0,54	4769,91	3396,28	0,58
SWE	1882,61	7952,43	0,19	1524,26	5583,45	0,21	1762,99	7404,10	0,19
TAP	3395,99	5673,23	0,37	3602,04	5609,47	0,39	2673,29	4875,73	0,35
THA	2592,14	3410,01	0,43	2432,97	3471,96	0,41	2727,81	3243,81	0,46
TTO	4903,86	3139,20	0,61	5460,44	2894,18	0,65	6390,72	3647,75	0,64
TUN	1496,76	1984,42	0,43	2302,57	3071,15	0,43	2586,32	2882,88	0,47
TUR	3184,58	2298,65	0,58	3073,61	2344,94	0,57	3475,71	2369,29	0,59
URY	2837,31	4110,57	0,41	2922,02	3766,44	0,44	3695,36	4687,64	0,44
USA	1946,24	7109,36	0,21	1601,29	5290,68	0,23	1943,15	6962,67	0,22
VNM	2483,51	2795,45	0,47	3075,51	2954,14	0,51	2705,75	2018,03	0,57

Source : author using OECD's PISA data

Table 5. Multilevel Model Taking ESCS as Level 1 Variable and Science Score as Dependent Variable - Model with Weighting

CNT	Effect	Estimate	Sd	DF	T value	Probt	CNT	Effect	Estimate	Sd	DF	T value	Probt
ARE	**Intercept**	428,040	3,068	469	139,506	0,0000	**KOR**	**ESCS**	25,39	1,70	5379	14,91	0,0000
ARE	**ESCS**	7,689	0,919	13398	8,364	0,0000	**KSV**	**Intercept**	368,73	2,43	223	151,66	0,0000
AUS	**Intercept**	501,400	1,600	753	313,296	0,0000	**KSV**	**ESCS**	8,11	0,95	4540	8,56	0,0000
AUS	**ESCS**	30,550	1,023	13234	29,868	0,0000	**LBN**	**Intercept**	383,51	3,77	269	101,67	0,0000
AUT	**Intercept**	484,479	3,850	268	125,836	0,0000	**LBN**	**ESCS**	6,43	1,00	4233	6,41	0,0000
AUT	**ESCS**	17,647	1,116	6669	15,805	0,0000	**LTU**	**Intercept**	463,42	2,91	310	159,15	0,0000
BEL	**Intercept**	493,069	3,749	287	131,519	0,0000	**LTU**	**ESCS**	17,20	1,16	6022	14,88	0,0000
BEL	**ESCS**	20,227	0,907	9163	22,299	0,0000	**LUX**	**Intercept**	484,21	7,54	43	64,23	0,0000
BGR	**Intercept**	436,232	5,365	179	81,304	0,0000	**LUX**	**ESCS**	21,26	1,10	5138	19,40	0,0000
BGR	**ESCS**	8,376	1,040	5612	8,054	0,0000	**LVA**	**Intercept**	495,38	2,24	249	221,54	0,0000
BRA	**Intercept**	400,706	1,891	827	211,892	0,0000	**LVA**	**ESCS**	18,42	1,22	4566	15,09	0,0000
BRA	**ESCS**	9,409	0,454	20775	20,721	0,0000	**MAC**	**Intercept**	516,60	6,61	44	78,17	0,0000
CAN	**Intercept**	507,772	1,420	755	357,583	0,0000	**MAC**	**ESCS**	8,24	1,40	4416	5,90	0,0000
CAN	**ESCS**	25,446	0,759	18667	33,520	0,0000	**MDA**	**Intercept**	443,70	2,40	228	184,53	0,0000
CHE	**Intercept**	496,582	3,804	226	130,544	0,0000	**MDA**	**ESCS**	24,57	1,22	5058	20,13	0,0000
CHE	**ESCS**	26,914	1,136	5566	23,683	0,0000	**MEX**	**Intercept**	422,84	2,45	274	172,77	0,0000
CHL	**Intercept**	455,670	3,833	226	118,877	0,0000	**MEX**	**ESCS**	8,10	0,65	7231	12,40	0,0000
CHL	**ESCS**	11,905	0,905	6721	13,158	0,0000	**MKD**	**Intercept**	385,85	4,10	105	94,16	0,0000
COL	**Intercept**	428,586	2,316	370	185,092	0,0000	**MKD**	**ESCS**	11,28	1,09	5132	10,34	0,0000
COL	**ESCS**	10,908	0,654	11189	16,681	0,0000	**MLT**	**Intercept**	461,68	8,76	58	52,69	0,0000
CRI	**Intercept**	428,004	2,297	204	186,313	0,0000	**MLT**	**ESCS**	25,63	1,80	3542	14,23	0,0000
CRI	**ESCS**	12,753	0,698	6514	18,274	0,0000	**MNE**	**Intercept**	408,72	5,53	63	73,98	0,0000
CZE	**Intercept**	495,860	3,241	343	153,006	0,0000	**MNE**	**ESCS**	7,78	1,19	5495	6,51	0,0000
CZE	**ESCS**	23,786	1,182	6443	20,120	0,0000	**NLD**	**Intercept**	505,98	5,49	186	92,25	0,0000
DEU	**Intercept**	506,539	4,033	254	125,612	0,0000	**NLD**	**ESCS**	10,23	1,25	5136	8,22	0,0000
DEU	**ESCS**	16,657	1,110	5374	15,008	0,0000	**NOR**	**Intercept**	483,02	2,15	227	224,36	0,0000
DNK	**Intercept**	481,379	2,032	332	236,957	0,0000	**NOR**	**ESCS**	35,45	1,67	5057	21,27	0,0000
DNK	**ESCS**	28,889	1,143	6651	25,266	0,0000	**NZL**	**Intercept**	505,75	2,94	182	171,98	0,0000
DOM	**Intercept**	333,571	3,207	193	104,019	0,0000	**NZL**	**ESCS**	37,59	1,82	4150	20,65	0,0000
DOM	**ESCS**	9,174	0,832	4500	11,023	0,0000	**PER**	**Intercept**	404,45	2,62	280	154,20	0,0000
DZA	**Intercept**	371,143	3,304	160	112,321	0,0000	**PER**	**ESCS**	12,70	0,76	6662	16,68	0,0000
DZA	**ESCS**	-1,497	0,710	5231	-2,109	0,0000	**POL**	**Intercept**	517,13	2,45	168	210,88	0,0000
ESP	**Intercept**	505,418	1,878	200	269,153	0,0000	**POL**	**ESCS**	33,79	1,52	4276	22,28	0,0000
ESP	**ESCS**	23,810	0,886	6476	26,868	0,0000	**PRT**	**Intercept**	501,45	2,77	245	180,86	0,0000
EST	**Intercept**	531,861	2,647	205	200,942	0,0000	**PRT**	**ESCS**	21,65	0,87	6978	24,81	0,0000
EST	**ESCS**	22,441	1,476	5292	15,200	0,0000	**QAR**	**Intercept**	468,85	5,24	56	89,42	0,0000
FIN	**Intercept**	520,922	2,295	167	227,025	0,0000	**QAR**	**ESCS**	20,68	1,83	1556	11,28	0,0000
FIN	**ESCS**	36,830	1,564	5643	23,553	0,0000	**QAT**	**Intercept**	400,77	5,03	166	79,72	0,0000
FRA	**Intercept**	492,552	4,154	250	118,584	0,0000	**QAT**	**ESCS**	6,93	0,94	11762	7,36	0,0000
FRA	**ESCS**	23,792	1,264	5689	18,822	0,0000	**QCH**	**Intercept**	532,01	4,57	268	116,36	0,0000
GBR	**Intercept**	501,500	1,928	547	260,050	0,0000	**QCH**	**ESCS**	8,47	0,80	9529	10,58	0,0000
GBR	**ESCS**	23,138	0,919	12967	25,179	0,0000	**QES**	**Intercept**	507,71	0,89	976	571,13	0,0000
GEO	**Intercept**	417,795	2,490	261	167,799	0,0000	**QES**	**ESCS**	23,11	0,41	31057	56,74	0,0000

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GEO	**ESCS**	23,529	1,307	5004	18,005	0,0000	**ROU**	**Intercept**	439,90	3,49	181	126,22	0,0000
GRC	**Intercept**	452,057	3,796	210	119,079	0,0000	**ROU**	**ESCS**	14,76	1,10	4690	13,38	0,0000
GRC	**ESCS**	16,201	1,095	5280	14,796	0,0000	**RUS**	**Intercept**	484,45	2,62	209	184,86	0,0000
HKG	**Intercept**	528,664	3,818	137	138,453	0,0000	**RUS**	**ESCS**	18,95	1,35	5578	14,07	0,0000
HKG	**ESCS**	5,457	1,046	5105	5,217	0,0000	**SGP**	**Intercept**	546,92	3,95	176	138,34	0,0000
HRV	**Intercept**	477,632	4,053	159	117,850	0,0000	**SGP**	**ESCS**	27,06	1,26	5912	21,48	0,0000
HRV	**ESCS**	16,775	1,184	5567	14,164	0,0000	**SVK**	**Intercept**	454,65	3,53	285	128,68	0,0000
HUN	**Intercept**	463,739	4,712	244	98,419	0,0000	**SVK**	**ESCS**	15,05	1,11	5970	13,52	0,0000
HUN	**ESCS**	8,153	1,056	5324	7,723	0,0000	**SVN**	**Intercept**	480,49	3,76	332	127,69	0,0000
IDN	**Intercept**	414,116	3,019	235	137,192	0,0000	**SVN**	**ESCS**	9,05	1,15	6009	7,89	0,0000
IDN	**ESCS**	4,878	0,677	6265	7,206	0,0000	**SWE**	**Intercept**	484,85	2,75	201	176,38	0,0000
IRL	**Intercept**	497,450	2,185	166	227,673	0,0000	**SWE**	**ESCS**	34,74	1,54	5110	22,54	0,0000
IRL	**ESCS**	31,906	1,299	5499	24,555	0,0000	**TAP**	**Intercept**	533,87	3,61	213	148,05	0,0000
ISL	**Intercept**	455,254	2,678	123	170,007	0,0000	**TAP**	**ESCS**	21,25	1,15	7472	18,43	0,0000
ISL	**ESCS**	26,015	2,070	3158	12,568	0,0000	**THA**	**Intercept**	429,36	3,29	272	130,50	0,0000
ISR	**Intercept**	461,534	4,736	172	97,450	0,0000	**THA**	**ESCS**	5,63	0,75	7822	7,51	0,0000
ISR	**ESCS**	18,822	1,297	6327	14,508	0,0000	**TTO**	**Intercept**	418,51	5,63	147	74,38	0,0000
ITA	**Intercept**	481,220	2,942	470	163,596	0,0000	**TTO**	**ESCS**	6,19	0,99	4365	6,25	0,0000
ITA	**ESCS**	9,045	0,728	10858	12,430	0,0000	**TUN**	**Intercept**	388,59	3,01	164	129,04	0,0000
JOR	**Intercept**	416,166	2,662	249	156,359	0,0000	**TUN**	**ESCS**	4,85	0,65	4984	7,47	0,0000
JOR	**ESCS**	17,611	0,849	6931	20,736	0,0000	**TUR**	**Intercept**	415,28	4,28	186	97,08	0,0000
JPN	**Intercept**	540,137	4,270	197	126,496	0,0000	**TUR**	**ESCS**	2,48	0,64	5671	3,90	0,0000
JPN	**ESCS**	11,630	1,285	6358	9,048	0,0000	**URY**	**Intercept**	442,94	3,26	219	135,70	0,0000
KOR	**Intercept**	519,080	3,393	167	152,999	0,0000	**URY**	**ESCS**	14,56	0,92	5738	15,82	0,0000
VNM	**Intercept**	534,091	3,770	187	141,681	0,0000	**USA**	**Intercept**	493,06	2,91	175	169,37	0,0000
VNM	**ESCS**	7,898	0,776	5636	10,172	0,0000	**USA**	**ESCS**	24,53	1,26	5461	19,45	0,0000

Source : author using OECD's PISA data

Table 6. OLS Model Taking ESCS as Level 1 Variable and Science Score as Dependent Variable - Model with Weighting

CNT	Variable	Estimate	Sd	T value	Probt	CNT	Variable	Estimate	Sd	T value	Probt
ARE	**Intercept**	422,72	0,95	444,86	0,0000	**LBN**	**Intercept**	402,80	1,36	295,31	0,0000
ARE	**ESCS**	29,65	1,07	27,84	0,0000	**LBN**	**ESCS**	26,23	1,11	23,70	0,0000
AUS	**Intercept**	500,40	0,82	612,37	0,0000	**LTU**	**Intercept**	478,37	1,03	463,36	0,0000
AUS	**ESCS**	43,78	0,97	44,94	0,0000	**LTU**	**ESCS**	35,70	1,19	30,10	0,0000
AUT	**Intercept**	491,59	1,03	477,26	0,0000	**LUX**	**Intercept**	480,64	1,19	403,52	0,0000
AUT	**ESCS**	45,40	1,20	37,75	0,0000	**LUX**	**ESCS**	41,34	1,07	38,51	0,0000
BEL	**Intercept**	495,58	0,90	552,49	0,0000	**LVA**	**Intercept**	502,31	1,19	422,78	0,0000
BEL	**ESCS**	48,17	0,97	49,56	0,0000	**LVA**	**ESCS**	26,41	1,17	22,60	0,0000
BGR	**Intercept**	450,48	1,17	385,62	0,0000	**MAC**	**Intercept**	535,37	1,36	392,97	0,0000
BGR	**ESCS**	41,12	1,17	35,21	0,0000	**MAC**	**ESCS**	12,37	1,35	9,20	0,0000
BRA	**Intercept**	428,26	0,69	620,88	0,0000	**MDA**	**Intercept**	450,72	1,29	348,61	0,0000
BRA	**ESCS**	27,34	0,46	59,61	0,0000	**MDA**	**ESCS**	32,56	1,14	28,46	0,0000
CAN	**Intercept**	510,87	0,72	709,15	0,0000	**MEX**	**Intercept**	439,63	1,02	429,33	0,0000
CAN	**ESCS**	33,65	0,74	45,34	0,0000	**MEX**	**ESCS**	19,41	0,59	32,73	0,0000
CHE	**Intercept**	500,23	1,16	429,88	0,0000	**MKD**	**Intercept**	390,04	1,07	364,22	0,0000
CHE	**ESCS**	42,81	1,25	34,14	0,0000	**MKD**	**ESCS**	24,75	1,16	21,41	0,0000
CHL	**Intercept**	463,44	0,98	474,67	0,0000	**MLT**	**Intercept**	468,11	1,73	270,33	0,0000
CHL	**ESCS**	32,35	0,82	39,66	0,0000	**MLT**	**ESCS**	46,90	1,82	25,77	0,0000
COL	**Intercept**	442,09	0,87	505,60	0,0000	**MNE**	**Intercept**	416,00	1,07	387,32	0,0000
COL	**ESCS**	26,65	0,59	45,44	0,0000	**MNE**	**ESCS**	22,97	1,27	18,15	0,0000
CRI	**Intercept**	438,90	0,88	498,17	0,0000	**NLD**	**Intercept**	501,68	1,27	394,27	0,0000
CRI	**ESCS**	24,01	0,63	38,35	0,0000	**NLD**	**ESCS**	46,84	1,63	28,65	0,0000
CZE	**Intercept**	504,56	1,03	491,61	0,0000	**NOR**	**Intercept**	481,94	1,45	332,48	0,0000
CZE	**ESCS**	51,68	1,25	41,48	0,0000	**NOR**	**ESCS**	37,48	1,65	22,71	0,0000
DEU	**Intercept**	511,04	1,17	437,64	0,0000	**NZL**	**Intercept**	508,34	1,43	355,52	0,0000
DEU	**ESCS**	41,71	1,22	34,07	0,0000	**NZL**	**ESCS**	48,71	1,78	27,29	0,0000
DNK	**Intercept**	483,03	1,18	409,56	0,0000	**PER**	**Intercept**	428,69	1,01	422,88	0,0000
DNK	**ESCS**	33,54	1,12	29,85	0,0000	**PER**	**ESCS**	29,59	0,63	47,22	0,0000
DOM	**Intercept**	354,29	1,19	296,52	0,0000	**POL**	**Intercept**	517,92	1,33	388,37	0,0000
DOM	**ESCS**	25,01	0,87	28,90	0,0000	**POL**	**ESCS**	40,06	1,46	27,42	0,0000
DZA	**Intercept**	386,52	1,33	291,40	0,0000	**PRT**	**Intercept**	513,57	1,00	511,10	0,0000
DZA	**ESCS**	8,06	0,81	9,98	0,0000	**PRT**	**ESCS**	30,84	0,83	37,27	0,0000
ESP	**Intercept**	507,12	1,04	488,65	0,0000	**QAR**	**Intercept**	474,67	1,69	281,10	0,0000
ESP	**ESCS**	27,06	0,80	33,80	0,0000	**QAR**	**ESCS**	37,35	1,45	25,81	0,0000
EST	**Intercept**	533,40	1,10	484,63	0,0000	**QAT**	**Intercept**	403,21	1,05	383,30	0,0000
EST	**ESCS**	32,33	1,43	22,63	0,0000	**QAT**	**ESCS**	26,73	1,09	24,56	0,0000
FIN	**Intercept**	520,87	1,21	430,77	0,0000	**QCH**	**Intercept**	561,17	1,27	442,37	0,0000
FIN	**ESCS**	40,48	1,52	26,57	0,0000	**QCH**	**ESCS**	40,37	0,82	48,98	0,0000
FRA	**Intercept**	505,42	1,14	444,56	0,0000	**QES**	**Intercept**	509,50	0,48	1066,68	0,0000
FRA	**ESCS**	57,01	1,40	40,67	0,0000	**QES**	**ESCS**	27,36	0,37	74,20	0,0000
GBR	**Intercept**	503,73	0,80	630,38	0,0000	**QUC**	**Intercept**	523,00	2,15	243,56	0,0000
GBR	**ESCS**	37,45	0,90	41,55	0,0000	**QUC**	**ESCS**	37,20	2,18	17,08	0,0000
GEO	**Intercept**	422,96	1,17	362,21	0,0000	**QUD**	**Intercept**	415,48	2,06	201,87	0,0000
GEO	**ESCS**	34,29	1,24	27,60	0,0000	**QUD**	**ESCS**	40,64	2,17	18,68	0,0000
GRC	**Intercept**	457,94	1,11	412,30	0,0000	**QUE**	**Intercept**	502,29	2,02	248,47	0,0000
GRC	**ESCS**	33,82	1,15	29,38	0,0000	**QUE**	**ESCS**	28,84	2,01	14,34	0,0000
HKG	**Intercept**	534,02	1,18	451,09	0,0000	**ROU**	**Intercept**	454,69	1,17	388,64	0,0000

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HKG	**ESCS**	18,67	1,09	17,17	0,0000	**ROU**	**ESCS**	33,90	1,12	30,29	0,0000
HRV	**Intercept**	484,63	1,10	440,94	0,0000	**RUS**	**Intercept**	486,68	0,99	491,60	0,0000
HRV	**ESCS**	37,77	1,28	29,50	0,0000	**RUS**	**ESCS**	28,51	1,32	21,62	0,0000
HUN	**Intercept**	487,45	1,13	433,12	0,0000	**SGP**	**Intercept**	554,34	1,16	476,33	0,0000
HUN	**ESCS**	46,59	1,14	40,79	0,0000	**SGP**	**ESCS**	46,71	1,28	36,48	0,0000
IDN	**Intercept**	444,91	1,40	318,07	0,0000	**SVK**	**Intercept**	466,51	1,10	424,60	0,0000
IDN	**ESCS**	22,31	0,64	34,76	0,0000	**SVK**	**ESCS**	41,49	1,15	36,12	0,0000
IRL	**Intercept**	496,94	1,07	463,64	0,0000	**SVN**	**Intercept**	512,20	1,07	480,40	0,0000
IRL	**ESCS**	37,59	1,25	30,05	0,0000	**SVN**	**ESCS**	42,66	1,30	32,74	0,0000
ISL	**Intercept**	453,88	2,10	216,47	0,0000	**SWE**	**Intercept**	481,17	1,35	355,87	0,0000
ISL	**ESCS**	27,58	2,02	13,65	0,0000	**SWE**	**ESCS**	43,56	1,53	28,44	0,0000
ISR	**Intercept**	461,45	1,21	381,55	0,0000	**TAP**	**Intercept**	542,04	1,04	519,17	0,0000
ISR	**ESCS**	41,64	1,40	29,75	0,0000	**TAP**	**ESCS**	44,86	1,22	36,90	0,0000
ITA	**Intercept**	483,52	0,78	617,91	0,0000	**THA**	**Intercept**	448,42	1,18	381,41	0,0000
ITA	**ESCS**	29,86	0,82	36,38	0,0000	**THA**	**ESCS**	21,52	0,71	30,11	0,0000
JOR	**Intercept**	420,71	0,95	444,74	0,0000	**TTO**	**Intercept**	434,65	1,27	341,22	0,0000
JOR	**ESCS**	25,29	0,86	29,34	0,0000	**TTO**	**ESCS**	31,48	1,32	23,76	0,0000
JPN	**Intercept**	547,03	1,07	509,95	0,0000	**TUN**	**Intercept**	401,05	0,98	411,22	0,0000
JPN	**ESCS**	41,87	1,47	28,42	0,0000	**TUN**	**ESCS**	16,91	0,68	24,80	0,0000
KOR	**Intercept**	524,91	1,21	435,60	0,0000	**TUR**	**Intercept**	454,84	1,47	309,76	0,0000
KOR	**ESCS**	44,29	1,70	26,13	0,0000	**TUR**	**ESCS**	20,35	0,80	25,60	0,0000
KSV	**Intercept**	381,68	0,93	410,24	0,0000	**URY**	**Intercept**	460,31	1,19	386,73	0,0000
KSV	**ESCS**	18,38	1,05	17,50	0,0000	**URY**	**ESCS**	31,65	0,88	35,78	0,0000
VNM	**Intercept**	567,08	1,73	327,54	0,0000	**USA**	**Intercept**	493,89	1,19	415,44	0,0000
VNM	**ESCS**	22,72	0,80	28,50	0,0000	**USA**	**ESCS**	33,17	1,18	28,12	0,0000

Source : author using OECD's PISA data

Table 7. Countries Participating in PISA 2015

Libelle	Pays	Libelle	Pays	Libelle	Pays	Libelle	Pays
ALB	Albania	**KSV**	Kosovo	**EST**	Estonia	**QAT**	Qatar
ARE	United Arab Emirates	**LBN**	Lebanon	**FIN**	Finland	**QCH**	B-S-J-G (China)
AUS	Australia	**LTU**	Lithuania	**FRA**	France	**QES**	Spain (Regions)
AUT	Austria	**LUX**	Luxembourg	**GBR**	United Kingdom	**ROU**	Romania
BEL	Belgium	**LVA**	Latvia	**GEO**	Georgia	**RUS**	Russian Federation
BGR	Bulgaria	**MAC**	Macao	**GRC**	Greece	**SGP**	Singapore
BRA	Brazil	**MDA**	Moldova	**HKG**	Hong Kong	**SVK**	Slovak Republic
CAN	Canada	**MEX**	Mexico	**HRV**	Croatia	**SVN**	Slovenia
CHE	Switzerland	**MKD**	Macedonia	**HUN**	Hungary	**SWE**	Sweden
CHL	Chile	**MLT**	Malta	**IDN**	Indonesia	**TAP**	Chinese Taipei
COL	Colombia	**MNE**	Montenegro	**IRL**	Ireland	**THA**	Thailand
CRI	Costa Rica	**NLD**	Netherlands	**ISL**	Iceland	**TTO**	Trinidad and Tobago
CZE	Czech Republic	**NOR**	Norway	**ISR**	Israel	**TUN**	Tunisia
DEU	Germany	**NZL**	New Zealand	**ITA**	Italy	**TUR**	Turkey
DNK	Denmark	**PER**	Peru	**JOR**	Jordan	**URY**	Uruguay
DOM	Dominican Republic	**POL**	Poland	**JPN**	Japan	**USA**	United States
DZA	Algeria	**PRT**	Portugal	**KOR**	Korea	**VNM**	Vietnam
ESP	Spain	**QAR**	Argentina (Ciudad Autónoma de Buenos)				

Source : author using OECD's PISA data