Immigrant Pupils' Performance in Maths: Does it Matter Where One is From?

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Abstract

Using the newly released PISA data 2012, which measures the cognitive achievement of 15 year olds, we address two questions. First, we ask whether immigrant students have a lower performance in math than their non-immigrant school mates. Second, we ask whether first (or second) generation students coming from (or whose parents come from) countries with higher performance in mathematics fare better than their immigrant peers coming from lower ranked countries. Our sample is composed by around 13,000 immigrant students for whom we know the country of origin and the corresponding PISA average score in Maths. We find that the average immigrant-native score gap in mathematics amounts to -11 score points. Controlling for a wide set of variables, we estimate OLS models where we regress the individual immigrant-native score gaps over the average math scores of the countries of origin. We find that students coming from higher ranked origin countries have a significantly higher score gap, thus being relatively less disadvantaged. Being in the top quintile and having attended school for five years in the origin countries, improves the score gap by a coefficient ranging from 32 to 37 score points. This result is robust across different specifications.

Keywords: Pupils mathematical skills, Immigrant-native score gaps, Immigrants origin countries, PISA 2012

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1. Introduction

This paper lies in the strand of literature on the disadvantages experienced at school by immigrant pupils. We focus on mathematical performance, a less studied aspect than language performance. The questions raised in this paper are whether immigrant pupils experience a disadvantage in learning Maths, and whether this disadvantage is reduced when they come from a highly ranked country in mathematical performance.

These research questions were inspired by the by now consolidated evidence that immigrant pupils experience severe difficulties in subjects that are, too a large extent, indissolubly linked to language skills. PISA 2000 and 2009 evidence in reading skills shows that immigrant pupils perform significantly worse than non-immigrants. The estimated disadvantage is of about one year of school less (around 40 score points) both in PISA 2000 and PISA 2009 (OECD, 2012).

The question here is therefore whether Maths, needing a more universal language and being a more portable human capital asset with respect to other culture-specific subjects, gives rise to a lower degree of learning inequality. Moreover, some countries might have devised more efficient teaching methods that, given the universal nature of mathematical language, might be exported to or integrated in other educational systems.

In this paper we limit ourselves to investigate whether children that come from countries that are more successful in teaching mathematics, benefit from this “asset” also when they are immigrant students.

This question has never been asked so far, and the PISA 2012 survey, with its specific focus on Maths, offers an inviting occasion to investigate this topic.

This paper is structured as follows. Section 2 briefly surveys the literature on immigrant students; Section 3 presents the empirical strategy and Section 4 the data and the variables.

Section 5 presents the results and Section 6 offers some concluding observations and anticipates some planned improvements of the analysis.

2. Review of the Literature

The study of the achievement of immigrant students in different countries and school systems is quite recent but well-established. The topic has been approached with both studies on a specific country and in a comparative perspective, and also from different points of view, i.e. by focusing on some of the individual student characteristics and/or by considering aspects of school system organization. All these studies exploit a growing set of data collected at the individual level in different surveys, and from empirical methodologies that are becoming ever more sophisticated.

Generally speaking, in studies of a specific school system, the weight of individual characteristics of immigrant students (such as family background, the language spoken at home, attitude to study, being a first or second generation immigrant) in their scores is tested together with aspects such as grade retention, public vs. private financing of schools, the socio-economic profile of classes and schools, the segregation of immigrants, or the level of formal comprehensiveness (or differentiation) of the curricula. In this framework, the analysis has the aim of disentangling the role of individual characteristics from the functioning of the school system in the final outcomes of immigrant students. On the contrary, in comparative works the research question frequently focuses on only one of these aspects, which can be related to the individual characteristics of the students (for example, family background) or to the education system (grade retention), with the aim of discovering in which scheme immigrant students achieve better.

A common result of studies on single countries is that one of the main reasons for lower performances of immigrant students with respect to native students is a less favourable family background. This has recently been demonstrated for Germany (Ammermuller 2005) and Denmark (Rangvid 2007). Notice that 'family background' does not necessarily mean the education level of parents or their economic condition, but could also be a favourable home environment for learning, as indicated by the number of books, the language spoken at home, or the academic expectations of parents for their children, etc. After family background, the role of the school is crucial in explaining gaps in test scores, both in terms of school quality and peer composition (Rangvid 2007).

As underlined by Park and Sandefur (2010) 'even if detailed analyses of educational differences between native and immigrant children in specific countries have contributed to our understanding of educational inequality associated with immigrant status in the corresponding country', the question of 'which countries are more successful in facilitating immigrant children's educational integration is better addressed by comparative research across many countries'. In fact, comparative studies confirm the relevance of the education level of parents in reducing the lag of scores of immigrants, even if this may vary strongly across nations. By comparing Europe and the traditional countries of immigration, Entorf and Minoiu (2005) show that the highest impact of family education on score is found for Germany, the UK and US, whereas intergenerational transmission of educational attainment is less likely in Scandinavian countries and in Canada. At the same time, they show that for students with a migration background a key for catching up with their schoolfellows is the language spoken at home. In the same paper the authors prove that immigrant students performances differ also according to the immigrant policies of different countries of destination. By focusing on second-generation immigrants in thirteen European countries, Dronkers and Fleischmann (2010) provide evidence that not only individual student characteristics matter in their academic achievement, but also macro-characteristics of the country of destination, like the average educational level and the naturalisation policy. Again in a comparative framework and looking at the organisation of the education system, Park and Sandefur (2010) study the role of grade retention in reducing the gap between native and immigrant children in ten European countries. They demonstrate that grade retention, where applied, broadens the gap between immigrant children and natives. Alegre and Ferrer-Esteban (2010) compare countries with educational systems controlled publicly, and with more comprehensive curricula, with countries with schools that are more market-oriented and have differentiated curricula. Their conclusion is that segregation is favoured by differentiated curricula and market-oriented systems.

While the main focus of the works illustrated above are the differences among destination countries, closer to this paper there is a batch of recent studies focusing on "which characteristic both of the country of origin and the country of destination promote or hamper the integration of immigrants, taking into account their individual characteristics" (Dronkers and Fleishmann, 2010, pag. 164). Using 2003 PISA data and comparing Math performances Levels et al. (2008) give evidence that both country of origin and destination help explain differences in immigrant children's educational achievement. They analyze students from 35 different origin countries in 13 Western countries of destination and they show that strict immigration laws explain immigrant children's better educational performance in traditional immigrant-receiving countries. Moreover they prove that origin countries' level of economic development can negatively affect immigrant children's educational performance, and that immigrant children from more politically stable countries perform better at school. Finally, socioeconomic differences between immigrant communities and a native population, and relative community size, both shape immigrant children's scholastic achievement. In a companion paper, Dronkers and de Heus (2012) characterize education systems of destination and origin countries by the extent of which they are characterized by the differentiation, the standardization and the resources devoted to teach and learning. As for the first, differentiation of an education system refers not only to early tracking, but also to the use of ability grouping internal to each track. The standardization parameter takes into account the set of standard rules nationally established and to which educational institutions should comply, while resources are expressed mainly in terms of time, i.e. the time devoted to teach and learn assuming that they are positively correlated. Besides the parameters illustrated, Dronkers and de Heus distinguish the 35 countries of origin and the 16 countries of destinations of their analysis in terms of economic development, political context, the religious culture together with the immigrant policies of the country of destination. By using 2006 PISA data, they prove that the degree of teacher shortage has a negative and a longer history of migration has a positive effect on science performance of immigrant students if their destination country is considered. Moreover, comprehensive educational systems have a positive influence on immigrant children's performance, but this is only the case for higher class children. If one looks at the country of origin, the standardization in terms of compulsory period of education has a positive effect on immigrants' science performance. Moreover, whereas immigrants from countries with an Eastern religious affiliation perform better than immigrants from Christian countries, immigrants from Islamic countries perform worse.

A few papers are focused of the country of origin of immigrant students. Levels and Dronkers (2006) show that immigrants from Western Europe, Latin America, Northern Africa and Western Asia perform worse than immigrant students form other regions. In the follow-up paper (Dronkers and Levels, 2007), the research question is if the school segregation, whether ethnic and socioeconomic, may explain the lower performances of immigrant students of the cited areas and the main result is that segregation can't be the explanation of differences verified between regions. Rangvid (2010) focuses on Denmark - as country of destination- and her results are related to the three main Danish groups of immigrants, i.e. the Turkish, immigrants from Lebanon and the Pakistanis. The author proves that second generation of immigrants from Turkey still maintain the disadvantage with the natives performances, while this is not true for the Pakistanis and for whom come from Lebanon. The same author shows that the gap between immigrants and natives is bigger for the language than for the math scores. In a quite different perspective, Dustmann et al. (2012) look at the Turkish immigration and they find that in most host countries, the test score achievement of the children of Turkish immigrants (although being lower than that of their native peers) is higher than that of children of their cohort in the home country, conditionally or not on parental background. Their explanation of this result is that the higher school- and peer- quality relative to that in the home country is a main determinant of the educational advantage of immigrant children.

3. The Empirical Strategy

Our dependent variable is Y_{is}, which is the score gap in mathematics of immigrant child *i* who is attending the school *s*.

Y_{is} is calculated as the difference between the immigrant score and the school native average score as follows:

$$Y_{is} = y_{is} - (\sum_{n=1}^{N_s} y_{n,s})/N_s)$$

where y_{is} is the score in mathematics of immigrant child *i* in school *s*, $y_{n,s}$ is the score of the native child *n* in school *s*, and N_s is the total number of natives in school *s*.

The equation we estimate is:

$$Y_{i,s} = \alpha + \beta MATH_{i,oc} + \mu IMMIG_i + \gamma X_i + \delta_s + \varepsilon_{i,s} \qquad (1)$$

where $MATH_{i,oc}$ is the national average score in mathematics of the origin country of child i, $IMMIG_i$ is the immigration status of the child (whether first or second generation), X_i are other child and family characteristics, δ_s is the school fixed effect, and $\varepsilon_{i,s}$ is a random error normally distributed.

In the latter specification, the school effect is treated as fixed. We also estimate an additional specification which includes the immigrant child's school characteristics as follows:

$$Y_{is} = \alpha + \beta MATH_{i,oc} + \mu IMMIG_i + \gamma X_i + \varphi S_i + \delta_{dc} + \varepsilon_{is} \qquad (2)$$

where S_i is a vector of characteristics of the school of immigrant *i*. In this case, we can introduce the destination country fixed effects δ_{dc}.

We estimate these specifications with OLS. Given the structure of the data, we use the technique for plausible values.[1]

4. Data and variables

We use survey data drawn from the Programme for International Student Assessment (PISA) 2012 which measures the cognitive achievement of 15 year olds. The 2012 round is specifically targeted to mathematical skills, with several sections dedicated to this topic.

Since we conduct our analysis at the micro level of immigrant children, we select only schools where immigrant children are present. For our purpose, we need to know the country of origin of each immigrant child and its PISA average math score. PISA collects information on origin countries only for a subset of the assessed countries, whereas, for the remaining countries, the immigrant origin is simply specified as "another country" with

[1]This amounts to estimate OLS for each plausible value and then compute the average of the estimated coefficients and standard errors.

respect to the country where the assessment is conducted. We focus on the subset of assessed countries where the information on the origin country is available. However, not every origin country is in PISA, so we have to further restrict our analysis to the countries where we can attach a PISA origin country average score to immigrant children. In the end, our sample is formed by around 13000 children.

Our dependent variable is the score gap in mathematics, defined as the difference between each immigrant child score and the average score of natives in the school.

As far as our variable of interest is concerned, $MATH_{i,oc}$, since PISA 2012 results show wide differences between countries in mathematics performance, we take the national mean math score of the immigrant country of origin to proxy the success of a country in teaching mathematics.

In each specification, $MATH_{i,oc}$ enters the equations either in levels or in quantile ranking (i.e. four quintile dummies). For first generation immigrants, the top fourth and fifth quantiles are also interacted with the number of years of school attendance in the country of origin.

As for the child immigration status, our focus is both on first generation and second generation immigrant children. We distinguish among eight categories, one for natives (needed to compute the score gap) and seven for immigrants. We select children with both parents or at least one parent present. Native children are those who are born in the assessed country, as well as their parent/s. Second generation immigrant children are those who are born in the assessed country, and have at least one parent that is born abroad. First generation immigrant children are those who are born abroad and whose parent/s may be born either abroad or in the assessed country.[2] To first generation pupils we impute

[2] The OCSE definition is different in two respects. First, immigrant status is defined only for children whose parents are both present and were born in a country other than the assessed. The others are non-immigrants. Second, second generation immigrants are born in the assessed country, while first generation immigrant are born abroad. Therefore, our definition allows us to consider a wider range of cases with respect to the OCSE definition.

$MATH_{i,oc}$ of the country were they are born, while to second generation student we impute $MATH_{i,oc}$ either of the countries were their mothers are born if their mothers are present, or of the countries were their fathers are born otherwise.

Beside age, sex and immigration status, PISA records the number of years spent in pre-school, and years since migration (for the first generation), that allows us to calculate the number of years of school attendance in the country of origin.

As for the household characteristics, we control for parents' ISCED levels of education and employment status together with the language spoken at home, the number of books and the presence of a computer at home.

As for the school characteristics, some of the are general and some of them are specific for mathematical teaching. The former group includes location (urban or rural) of the school, class size, total school enrolment, proportion of girls in the school, percentage of public funds in the funding of the school. In the latter group are math teacher-student ratio, a dummy recording whether there exist ability grouping for Maths, and another dummy recording whether Maths teachers are monitored by externals.

Since school characteristics are available for only a subset of children in PISA, the number of observations available for estimating (2) is smaller with respect to those available to estimate (1).

Table 1 shows the descriptive statistics of all variables.

5. Results

As shown in Table 1, the average immigrant-native score gap is negative, and has to be interpreted as the average disadvantage in Maths of immigrant pupils. Table 2 shows the OLS estimates of the average Math score of the immigrant country of origin on the immigrant-native score gap. In col. (1) and (2) we control for school fixed effects, while in col. (3) and (4), where we introduce school variables, we can only control for destination countries fixed effects. In order to interpret the value of the coefficients, it is useful to keep in mind that the equivalent one year of schooling is 40.8 score points on the PISA mathematics scale. In col. (1) the specification just controlling for basic child characteristics[3], immigration status and years of school attended in the country of origin, shows that the coefficients of $MATH_{i,oc}$ is positive and significant. Ten score points more in the origin country make the disadvantage to decline by 2.6 score points. In col. (2),where we introduce household and family characteristics, the coefficient stays significant and does not change significantly.

The immigration status reveals that, with respect to natives, the most significantly disadvantaged pupils are those whose parents are both born abroad. In this category, children who are born in the country of the test have a higher disadvantage (-17 score points col. (1) and –11.4, col. (2)) with respect to children who are born abroad (-11.3 and -7.4). This is an interesting result which may point to a "cultural conflict" arising among parents and second generation children that makes these pupils even worse off than those born abroad.

Col (3) and (4) introduce the school variables, and some Maths teaching specific information. Note that the explanatory power of the model decreases sharply, however, (the R2 drops from around 0.55 to 0.15) since we can only have country fixed effects and the number of observations decreases due to missing values. So, the specification presented in col (3) and (4) are not preferred to that presented in col. (2). They simply add evidence on the direction of the influence of some school characteristics, that might well be confirmed also in the other two columns if we had the same number of observations.

To summarize, in Table 2 $MATH_{i,oc}$ remains significant across all specifications. Other variables that are as well robust in decreasing the disadvantage are age, sex (male perfom

[3] We show first specification, col. (1), and then add household characteristics in col. (2) in order to better appreciate the weight of family variables in changing the size and significance of the child characteristics.

better, in line with other PISA evidence), more than two years of pre-school, computer at home (but not the internet connection!), number of books at home, highest level of fathers education, school location un urban areas, higher proportions of girls in the school and higher Maths teacher-student ratios. Instead, variables that are robust in increasing the disadvantage across specifications are speaking the home country language at home, having mothers in full time jobs, and total school enrolment (i.e. number of students in the school).

In order to better disentangle the effects of $MATH_{i,oc}$, we transform it in quintiles. Table 3 shows the OLS estimates of the effect of the Math ranking of the immigrant country of origin on the immigrant-native score gaps. In col. (1) he equivalent of seventy per cent to nearly one year of schooling, 40.8 score points on the PISA mathematics scale, separates the children in the fourth quintiles from children in the lowest quantile. These results remain robust across specification, although with a lower number of point scores.

However, the coefficient of the fifth quintile is lower than the coefficient of the fourth quintile. This result is difficult to interpret, and must be further investigated. One way of explaining it, could be that it is not enough to come from a highly ranked country to have benefits in the host countries, since this benefit may depend on the number of years of school attended in the origin countries. [4] To test this hypothesis, we have introduced the interaction of the top two MATH rank quantiles with the variables recording the number of years attended in the origin country.

Table 4 shows the OLS estimates of the effect of school attendance in top Math ranking countries of origin on the immigrant-native score gaps. This effect is positive and significant in col. (2)-(4) for the top quantile. Being in the fifth quintile and having attended school for five years in the origin countries, decreases the score gap by a coefficient ranging from 32 score points (6.5 due to the interacted term plus 25.5 due to the coefficient of the dummy for

[4] Another reason might be that the ranking of the top countries is less variable. We have built the ranking on the whole data set, and therefore the distribution in our sample is not smooth.

top rank, col. 1) to 37 score points (15 due to the interacted term plus 22 due to the coefficient of the dummy for top rank, col. 4).

6. Concluding remarks

While immigrant students are highly disadvantaged with respect to natives in language skills (more than 40 score points less on both 2000 and 2009 PISA assessments)[5], we find a much more contained disadvantage in mathematics (around 11 score point less). This might be due to two facts. First, language skills are less crucial in learning mathematics and, second, mathematical skills are universal and more portable than language skills.

The main focus of the paper is whether first (or second) generation students coming from (or whose parents come from) countries with higher performance in mathematics fare better than their immigrant peers coming from lower ranked countries. We use the newly released survey data drawn from the Programme for International Student Assessment (PISA) 2012 which measures the cognitive achievement of 15 year olds. Our sample is composed by around 13,000 immigrant students for whom we know the country of origin, that must be assessed in PISA since we need the corresponding PISA average score in Maths. We find that the average immigrant-native score gap in mathematics amounts to -11, a much more contained disadvantaged with respect to language skills (more than 40 score points less on both 2000 and 2009 PISA assessments). We estimate OLS models where we regress the immigrant-native score gap over the average math score of the country of origin, controlling for child, household and school characteristics, together with school and country fixed effects when applicable. We find that indeed students coming from higher ranked origin countries have a significantly higher score gap, thus being relatively less disadvantaged.

[5] OECD, 2012

Being born or having parents that are born in highly ranked countries, can significantly improve immigrant pupils performance in Maths.

Also years of school attendance in the origin countries have a significant role. Being in the top quintile and having attended school for five years in the origin countries, improves the score gap by a coefficient ranging from 32 to 37 score points.

While these results are robust across different specifications, two main concerns about the robustness of these results may be raised. First, a severe constraint of the data is that the average Maths score only varies at the country level. Thus, it might capture the effect of other macro variables, such as GDP per capita, for example. We plan to check if there is a strong correlation among the two variables, and run our regressions substituting GDP per capita to the average math score.

Second, the always challenging problem of how people select into migration. To investigate this problem, we plan to deepen the analysis at the country level, trying to identify the migration corridors in our sample and the sources of potential selection biases.

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Table 1

Summary statistics

	Mean	Max	Min	Std.Dev
Score gap (dependent variable)	-11,9008	307	-338	82,4961
Math Score in the county of origin				
Average Math score in the country of origin	496,4353	613	376	57,1575
Country math ranking 2 (yes=1, no=0)	0,1325	1	0	0,3391
Country math ranking 3 (yes=1, no=0)	0,3038	1	0	0,4599
Country math ranking 4 (yes=1, no=0)	0,2765	1	0	0,4473
Country math ranking 5 (yes=1, no=0)	0,1972	1	0	0,3979
Immigration caracteristics *(ref cat. Immigrant born in the test of country, mother abroad)*				
Immigrant pupil born in the test country, both parents born abroad (yes=1,no=0)	0,2749	1	0	0,4465
Immigrant pupil born in the test country, parents native of the test country (yes=1,no=0)	0,0569	1	0	0,2316
Immigrant pupil born in the test country, father born abroad (yes=1,no=0)	0,0313	1	0	0,1741
Immigrant pupil born in the test country, mother born abroad (yes=1,no=0)	0,0638	1	0	0,2445
Immigrant pupil born abroad, parents born abroad (yes=1,no=0)	0,3704	1	0	0,4829
Years of school attended in the country of orgin	0,9622	11	0	2,2080
Years of school attended in the country of orgin* country ranking 4	0,3536	11	0	1,4839
Years of school attended in the country of orgin* country ranking 5	0,3447	11	0	1,3658
Age of the student	15,7800	16	15	0,2902
Male student (yes=1, no=0)	0,4920	1	0	0,5000
Familiy Characteristics				
Computer at home (yes=1,no=0)	0,9568	1	0	0,2034
Computer connected with internet at home (yes=1,no=0)	0,9521	1	0	0,2136
Number of books at home (6 increasing alternatives between less than 10 and more then 500)	2,9694	6	1	1,4905
The language spoken at home is not that of the test (yes=1,no=0)	0,3076	1	0	0,4615
At least one year of preschool (yes=1,no=0)	0,2180	1	0	0,4129
Two or more years of preschool (yes=1,no=0)	0,6957	1	0	0,4601
Mother in full-time job (yes=1,no=0) *(ref cat unemployed)*	0,4710	1	0	0,4992
Mother in part-time job (yes=1,no=0)	0,1919	1	0	0,3938
Father in full-time job (yes=1,no=0)	0,7348	1	0	0,4415
Father in full-time job (yes=1,no=0)	0,0833	1	0	0,2763
Mother education ISCED 2 (yes=1,no=0) *(ref cat no education)*	0,1716	1	0	0,3770
Mother education ISCED 3B (yes=1,no=0)	0,0918	1	0	0,2888
Mother education ISCED 3A (yes=1,no=0)	0,1935	1	0	0,3951
Mother education ISCED 5B (yes=1,no=0)	0,1288	1	0	0,3350
Mother education ISCED 5A (yes=1,no=0)	0,2127	1	0	0,4092
Father education ISCED 2 (yes=1,no=0)	0,1594	1	0	0,3661
Father education ISCED 2B (yes=1,no=0)	0,0997	1	0	0,2996
Father education ISCED 3A (yes=1,no=0)	0,1770	1	0	0,3817
Father education ISCED 5B(yes=1,no=0)	0,1200	1	0	0,3250
Father education ISCED 5A (yes=1,no=0)	0,2261	1	0	0,4183
School characteristics				
Location of the school: small town (yes=1,no=0) *(ref cat village)*	0,2173	1	0	0,4124
Location of the school: town (yes=1,no=0)	0,3393	1	0	0,4735
Location of the school: city (yes=1,no=0)	0,2402	1	0	0,4272
Location of the school: large city (yes=1,no=0)	0,1677	1	0	0,3736
Class size	26,3050	53	13	8,1022
Total school enrolment	897,6116	4925	23	589,8732
Proportion of girls at school	0,4865	1	0	0,1886
Percentage of public funds in the funding of the school	88,1438	100	0	22,4866
Math teacher-student ratio	102,0712	1581	2595	84,4664
No ability grouping for Maths (yes=1,no=0)	0,2058	1	0	0,4043
Teachers monitoring by externals (yes=1,no=0)	0,2873	1	0	0,4525

Table 2

OLS estimates of the effect of the average Math score of the immigrant country of origin on the immigrant-native score gaps

Dependent variable: immigrant-native Math score gaps

	(1)	(2)	(3)	(4)
Age of student	10.950***	13.690***	10.521***	12.728***
	(2.496)	(2.467)	(2.284)	(2.363)
Math score of the student country of origin	0.256***	0.210***	0.085***	0.083***
	(0.030)	(0.030)	(0.023)	(0.024)
Male pupil(yes=1, no=0)	19.692***	21.860***	21.851***	21.646***
	(1.422)	(1.415)	(1.377)	(1.427)
Immigrant pupil born in the test country, both parents born abroad (yes=1,no=0)	-17.438***	-11.456***	-0.292	-1.816
	(2.190)	(2.205)	(1.949)	(2.016)
Immigrant pupil born abroad, parents native of the test country (yes=1,no=0)	7.750*	11.674***	1.716	0.401
	(4.534)	(4.493)	(3.283)	(3.399)
Immigrant pupil born abroad, father born abroad (yes=1,no=0)	3.179	7.383	3.953	-1.817
	(5.059)	(5.018)	(4.606)	(4.788)
Immigrant pupil born abroad, mother born abroad(yes=1,no=0)	7.343**	5.908	8.977***	8.531**
	(3.712)	(3.653)	(3.383)	(3.446)
Immigrant pupil born abroad, parents born abroad(yes=1,no=0)	-11.298***	-7.437***	1.793	2.104
	(2.462)	(2.479)	(2.269)	(2.334)
Years of school attended in the country of origin	-0.064	0.601	0.216	0.123
	(0.425)	(0.418)	(0.374)	(0.382)
At least one year of pre-school (yes=1, no=0)	12.488***	9.836***	5.228**	3.863
	(2.811)	(2.803)	(2.512)	(2.595)
Two or more years of pre-school (yes=1, no=0)	23.661***	21.338***	14.495***	14.034***
	(2.603)	(2.605)	(2.384)	(2.471)
Computer at home (yes=1, no=0)		22.308***	17.855***	15.926***
		(4.756)	(3.864)	(3.969)
Computer connected with internet at home (yes=1, no=0)		-11.093**	-24.214***	-20.944***
		(4.497)	(3.542)	(3.639)
Number of books at home		10.255***	7.508***	8.040***
		(0.582)	(0.530)	(0.556)
Language spoken at home is not that of the test (yes=1, no=0)		-9.818***	-5.651***	-5.232***
		(1.731)	(1.680)	(1.732)
Mother in full-time job(yes=1, no=0)		-7.236***	-6.353***	-6.065***
		(1.621)	(1.553)	(1.606)
Mother in a part-time job(yes=1, no=0)		-1.988	3.558*	4.304**
		(1.913)	(1.873)	(1.934)
Father in full-time job (yes=1, no=0)		-2.358	1.673	2.619
		(1.992)	(1.839)	(1.885)
Father in part-time job(yes=1, no=0)		-5.086*	-1.395	-0.628
		(2.882)	(2.645)	(2.756)
Mother education: ISCED 2 (yes=1, no=0)		7.331***	1.071	-0.985
		(2.251)	(2.104)	(2.177)
Mother education: ISCED 3B for the mother(yes=1, no=0)		3.092	1.457	-0.468
		(3.193)	(3.305)	(3.372)
Mother education: ISCED 3A for the mother(yes=1, no=0)		10.123***	1.807	-1.459
		(2.431)	(2.252)	(2.326)
Mother education: ISCED 5B for the mother(yes=1, no=0)		9.191***	4.412	2.990
		(2.927)	(2.709)	(2.833)
Mother education: ISCED 5A for the mother(yes=1, no=0)		4.905*	-0.119	-4.478*
		(2.760)	(2.567)	(2.650)
Father education: ISCED 2 (yes=1, no=0)		-8.033***	0.888	-0.321
		(2.350)	(2.135)	(2.214)
Father education: ISCED 3B (yes=1, no=0)		4.779	8.768***	8.765***
		(3.273)	(3.277)	(3.379)
Father education: ISCED 3A (yes=1, no=0)		-7.231***	-0.767	-0.269
		(2.365)	(2.213)	(2.293)
Father education: ISCED 5B (yes=1, no=0)		-4.820*	-2.174	-2.232
		(2.744)	(2.581)	(2.680)
Father education: ISCED 5A (yes=1, no=0)		11.532***	7.974***	8.351***

		(2.727)	(2.486)	(2.584)
Location of the school: small town (yes=1, no=0)			11.159***	10.016**
			(3.910)	(3.987)
Location of the school: town (yes=1, no=0)			12.135***	11.995***
			(3.862)	(3.935)
Location of the school: city (yes=1, no=0)			9.072**	10.960***
			(3.953)	(4.028)
Location of the school: large city (yes=1, no=0)			17.326***	19.865***
			(4.177)	(4.272)
Total school enrolment			-0.007***	-0.009***
			(0.002)	(0.002)
Proportion of girls at school			19.156***	19.825***
			(4.238)	(4.398)
Class size			-0.027	-0.019
			(0.098)	(0.105)
Percentage of public funds in the funding of the school			0.279***	0.288***
			(0.033)	(0.034)
Maths Teacher-student ratio				0.034***
				(0.008)
No ability grouping for maths (no=1, yes=0)				-1.537
				(1.874)
Dummy for teachers monitoring by externals (yes=1, no=1)				0.216
				(1.643)
Constant	-331.577***	-391.381***	-297.865***	-335.400***
	(41.829)	(41.430)	(38.790)	(40.180)
R2	0.53	0.56	0.14	0.15
N	13,046	12,762	11,453	10,751

* p<0.1; ** p<0.05; *** p<0.01

Table 3
OLS estimates of the effect of the Math ranking of the immigrant country of origin on the immigrant-native score gaps
Dependent variable: immigrant-native Math score gaps

	(1)	(2)	(3)	(4)
Age of student	10.994***	13.567***	10.421***	12.720***
	(2.487)	(2.460)	(2.277)	(2.357)
Dummy variable for country math ranking 2	4.192	4.777	14.224***	15.541***
	(6.153)	(6.172)	(4.343)	(4.869)
Dummy variable for country math ranking 3	28.074***	28.285***	33.873***	35.175***
	(6.095)	(6.112)	(4.597)	(5.049)
Dummy variable for country math ranking 4	39.705***	32.270***	29.945***	30.737***
	(6.391)	(6.434)	(4.813)	(5.264)
Dummy variable for country math ranking 5	29.524***	26.016***	21.832***	24.030***
	(6.453)	(6.493)	(4.817)	(5.291)
Male pupil(yes=1,no=0)	19.942***	22.105***	22.170***	21.859***
	(1.417)	(1.411)	(1.375)	(1.424)
Immigrant pupil born in the test country, both parents born abroad (yes=1,no=0)	-12.861***	-7.990***	2.746	1.141
	(2.247)	(2.254)	(1.999)	(2.074)
Immigrant pupil born abroad, parents native of the test country (yes=1,no=0)	6.942	10.853**	0.747	-0.380
	(4.524)	(4.488)	(3.281)	(3.396)
Immigrant pupil born abroad, father born abroad (yes=1,no=0)	2.648	6.922	2.139	-3.432
	(5.040)	(5.005)	(4.599)	(4.782)
Immigrant pupil born abroad, mother born abroad(yes=1,no=0)	9.265**	7.640**	8.512**	8.139**
	(3.690)	(3.633)	(3.377)	(3.439)
Immigrant pupil born abroad, parents born abroad(yes=1,no=0)	-9.539***	-6.535***	1.107	1.562
	(2.480)	(2.492)	(2.284)	(2.346)
Years of school in the pupil country of origin	0.060	0.722*	0.419	0.323
	(0.425)	(0.419)	(0.377)	(0.385)
At least one year of pre-school (yes=1,no=0)	12.882***	10.727***	6.380**	5.320**
	(2.804)	(2.799)	(2.509)	(2.592)
Two or more years of pre-school (yes=1,no=0)	23.894***	22.181***	15.581***	15.462***
	(2.601)	(2.606)	(2.380)	(2.468)
Computer at home (yes=1,no=0)		21.871***	17.573***	15.646***
		(4.745)	(3.855)	(3.958)
Computer connected with internet at home (yes=1,no=0)		-11.446**	-24.270***	-21.101***
		(4.485)	(3.531)	(3.628)
Number of books at home		10.162***	7.268***	7.824***
		(0.581)	(0.530)	(0.557)
Language spoken at home is not that of the test (yes=1,no=0)		-8.344***	-4.701***	-4.404**
		(1.747)	(1.690)	(1.742)
Mother in full-time job(yes=1,no=0)		-8.202***	-7.149***	-6.830***
		(1.622)	(1.553)	(1.606)
Mother in a part-time job(yes=1,no=0)		-2.637	2.580	3.321*
		(1.910)	(1.874)	(1.934)
Father in full-time job(yes=1,no=0)		-3.101	1.132	2.110
		(1.992)	(1.834)	(1.881)
Father in part-time job(yes=1,no=0)		-5.586*	-1.867	-0.914
		(2.875)	(2.637)	(2.749)
Mother education: ISCED 2 (yes=1, no=0)		6.873***	0.885	-1.049
		(2.246)	(2.099)	(2.174)
Mother education: ISCED 3B for the mother(yes=1, no=0)		2.699	0.856	-1.098
		(3.189)	(3.298)	(3.365)
Mother education: ISCED 3A for the mother(yes=1, no=0)		8.983***	1.161	-2.108
		(2.431)	(2.253)	(2.329)
Mother education: ISCED 5B for the mother(yes=1, no=0)		7.668***	2.919	1.143
		(2.929)	(2.708)	(2.833)
Mother education: ISCED 5A for the mother(yes=1, no=0)		3.876	-0.826	-5.297**
		(2.760)	(2.565)	(2.649)
Father education: ISCED 2 (yes=1, no=0)		-7.087***	2.238	1.023
		(2.349)	(2.135)	(2.214)

Father education: ISCED 3B (yes=1, no=0)		5.113	10.034***	10.027***
		(3.266)	(3.271)	(3.373)
Father education: ISCED 3A (yes=1, no=0)		-6.694***	0.848	1.090
		(2.363)	(2.217)	(2.296)
Father education: ISCED 5B (yes=1, no=0)		-4.796*	-0.485	-0.486
		(2.741)	(2.585)	(2.684)
Father education: ISCED 5A (yes=1, no=0)		12.560***	9.739***	9.785***
		(2.726)	(2.488)	(2.583)
Location of the school: small town (yes=1, no=0)			9.958**	9.173**
			(3.888)	(3.964)
Location of the school: town (yes=1, no=0)			11.514***	11.424***
			(3.839)	(3.912)
Location of the school: city (yes=1, no=0)			8.828**	10.963***
			(3.931)	(4.004)
Location of the school: large city (yes=1, no=0)			17.654***	20.323***
			(4.154)	(4.246)
Total school enrolment			-0.006***	-0.009***
			(0.002)	(0.002)
Proportion of girls at school			20.226***	20.628***
			(4.227)	(4.387)
Class size			-0.024	-0.027
			(0.098)	(0.105)
Percentage of public funds in the funding of the school			0.273***	0.280***
			(0.033)	(0.034)
Maths Teacher-student ratio				0.034***
				(0.008)
No ability grouping for maths (no=1, yes=0)				-1.904
				(1.871)
Teachers monitoring by externals, (yes=1, no=0)				0.642
				(1.640)
Constant	-232.947***	-308.391***	-278.671***	-319.615***
	(39.846)	(39.482)	(36.933)	(38.348)
R2	0.53	0.57	0.15	0.15
N	13,046	12,762	11,453	10,751

* *p*<0.1; ** *p*<0.05; *** *p*<0.01

Table 4
OLS estimates of the effect of school attendance in top Math ranking countries of origin on the immigrant-native score gaps
Dependent variable: immigrant-native Math score gaps

	(1)	(2)	(3)	(4)
Age of student	11.023***	13.624***	10.601***	12.611***
	(4.43)	(2.461)	(2.280)	(2.353)
Dummy variabile for country math ranking 2	3.655	4.711	14.328***	15.077***
	(0.59)	(6.169)	(4.340)	(4.861)
Dummy variabile for country math ranking 3	27.902***	28.406***	34.104***	35.198***
	(4.58)	(6.108)	(4.595)	(5.045)
Dummy variabile for country math ranking 4	39.064***	32.306***	30.613***	31.319***
	(6.08)	(6.463)	(4.832)	(5.283)
Dummy variabile for country math ranking 5	28.652***	25.471***	19.954***	21.813***
	(4.43)	(6.508)	(4.834)	(5.309)
Male pupil(yes=1,no=0)	19.996***	22.133***	22.151***	21.898***
	(14.11)	(1.411)	(1.374)	(1.423)
Immigrant pupil born in the test country, both parents born abroad (yes=1,no=0)	-12.966***	-7.988***	2.763	1.260
	(5.77)	(2.255)	(2.000)	(2.075)
Immigrant pupil born abroad, parents native of the test country (yes=1,no=0)	6.674	11.453**	1.840	-0.387
	(1.49)	(4.454)	(3.304)	(3.363)
Immigrant pupil born abroad, father born abroad (yes=1,no=0)	2.401	7.505	3.562	-3.397
	(0.48)	(4.983)	(4.617)	(4.758)
Immigrant pupil born abroad, mother born abroad(yes=1,no=0)	8.953**	7.893**	9.274***	8.512**
	(2.43)	(3.635)	(3.382)	(3.439)
Immigrant pupil born abroad, parents born abroad(yes=1,no=0)	-10.443***	-6.443***	1.368	1.011
	(4.26)	(2.471)	(2.300)	(2.342)
Inter. years of school in the country of origin and the fifth ranking, first gen	0.839	1.289*	3.793***	2.998***
	(1.19)	(0.689)	(0.934)	(0.688)
Inter. years of school in the country of origin and the fourth ranking, first gen	0.603	0.693	1.059	0.052
	(1.04)	(0.572)	(0.834)	(0.543)
At least one year of pre-school (yes=1,no=0)	13.043***	10.712***	6.124**	5.715**
	(4.65)	(2.799)	(2.518)	(2.581)
Two or more years of pre-school (yes=1,no=0)	24.036***	22.219***	15.589***	16.033***
	(9.22)	(2.613)	(2.393)	(2.466)
Computer at home (yes=1,no=0)		21.709***	17.304***	15.513***
		(4.745)	(3.853)	(3.956)
Computer connected with internet at home (yes=1,no=0)		-11.491**	-24.415***	-21.110***
		(4.485)	(3.531)	(3.627)
Numebr of books at home		10.150***	7.229***	7.845***
		(0.580)	(0.530)	(0.555)
Language spoken at home is not that of the test (yes=1,no=0)		-8.311***	-5.274***	-5.156***
		(1.752)	(1.705)	(1.756)
Mother in full-time job(yes=1,no=0)		-8.182***	-7.108***	-6.904***
		(1.622)	(1.552)	(1.604)
Mother in a part-time job(yes=1,no=0)		-2.634	2.540	3.214*
		(1.910)	(1.873)	(1.932)
Father in full-time job(yes=1,no=0)		-3.130	1.132	2.126
		(1.992)	(1.834)	(1.880)
Father in part-time job(yes=1,no=0)		-5.702**	-1.797	-0.898
		(2.875)	(2.635)	(2.746)
Mother education: ISCED 2 (yes=1, no=0)		6.846***	0.749	-1.168
		(2.246)	(2.098)	(2.172)
Mother education: ISCED 3B for the mother(yes=1, no=0)		2.773	1.264	-0.648
		(3.189)	(3.298)	(3.365)
Mother education: ISCED 3A for the mother(yes=1, no=0)		9.021***	1.395	-2.036
		(2.431)	(2.253)	(2.326)
Mother education: ISCED 5B for the mother(yes=1, no=0)		7.632***	3.029	1.082
		(2.930)	(2.709)	(2.832)
Mother education: ISCED 5A for the mother(yes=1, no=0)		3.897	-0.653	-5.204**
		(2.760)	(2.564)	(2.647)
Father education: ISCED 2 (yes=1, no=0)		-7.013***	2.578	1.185
		(2.349)	(2.135)	(2.211)

Father education: ISCED 3B (yes=1, no=0)		5.115	10.169***	10.014***
		(3.266)	(3.269)	(3.370)
Father education: ISCED 3A (yes=1, no=0)		-6.674***	0.994	1.124
		(2.363)	(2.216)	(2.294)
Father education: ISCED 5B (yes=1, no=0)		-4.707*	-0.350	-0.543
		(2.741)	(2.584)	(2.680)
Father education: ISCED 5A (yes=1, no=0)		12.597***	9.772***	9.754***
		(2.725)	(2.486)	(2.580)
Years of school in the pupil country of origin			-1.070	
			(0.670)	
Location of the school: small town (yes=1, no=0)			9.632**	8.738**
			(3.889)	(3.964)
Location of the school: town (yes=1, no=0)			11.415***	11.265***
			(3.839)	(3.911)
Location of the school: city (yes=1, no=0)			8.714**	10.789***
			(3.929)	(4.001)
Location of the school: large city (yes=1, no=0)			17.570***	20.075***
			(4.156)	(4.247)
Total school enrolment			-0.006***	-0.008***
			(0.002)	(0.002)
Proportion of girls at school			20.461***	20.802***
			(4.225)	(4.384)
Class size			-0.022	-0.024
			(0.098)	(0.105)
Percentage of public funds in the funding of the school			0.273***	0.283***
			(0.033)	(0.034)
Maths Teacher-student ratio				0.034***
				(0.008)
No ability grouping for maths (no=1, yes=0)				-1.887
				(1.869)
Teachers monitoring by externals, (yes=1, no=0)				0.624
				(1.639)
Constant	-233.060***	-309.086***	-281.410***	-318.292***
	(5.85)	(39.482)	(36.954)	(38.302)
R2	0.53	0.57	0.15	0.15
N	13,046	12,762	11,453	10,751

* p<0.1; ** p<0.05; *** p<0.01