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Immigrant Students and Educational Systems. Cross-Country Evidence from 2006

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Immigrant students and educational systems. Cross-country evidence from PISA 2006

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Abstract. Using data from PISA 2006 on 29 countries, this paper analyses immigrant school gaps (difference in scores between immigrants and natives) and focuses on tracking and comprehensive educational systems. Results show that the wider negative gaps are present where tracking is sharp and less frequently in countries with comprehensive schooling. In both cases, negative gaps are concentrated in continental Western Europe, where they are also often related to immigrants and natives attending different schools, or are significant within schools.

Keywords: Immigrant students, educational systems, PISA.

JEL: F22, I21

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I. Introduction

The existence of an immigrant gap in education (difference in scores between immigrants and natives) is widely acknowledged, but its causes remain unclear. While several studies have analysed the performance of immigrant students in individual countries and in groups of countries in relation to family background (Schneeweiss, 2009; Ammermueller, 2007b; Entorf, and Minoiu, 2005; Entorf and Tatsi, 2009; OECD, 2006), the possible links between the immigrant school gaps and the structural features of countries' educational institutions have received less attention (Entorf and Lauk, 2006; Schnepf, 2007). The implications of a gap in education are, however, well understood: they mainly consist of opportunity disparities for the individuals in their adult lives, especially in labour markets (Dustmann, 2004).

Some features of the educational institutions of countries differ, but in most cases they are based on one of two main models: tracking or comprehensive. In the former, students are channelled into schools with different programmes, academic and vocational, with vocational schools ranked below academic ones in terms of quality, programme content and students' prospects of pursuing further studies at the tertiary level. In the comprehensive model, all students follow the same programme throughout the compulsory schooling cycle.

The relationships between individual performances and schooling models have been more extensively investigated in studies concerning the overall population of students. Several authors find a lower dispersion of scores where schooling is comprehensive, and interpret this finding as an indication that this model of education is fairer than tracking (Schuetz et al., 2008; Brunello and Checchi, 2007; Wömann, 2004; Ammermueller, 2007a; Hanushek and Wömann, 2006; Bauer and Riphahn, 2006; Raitano and Vona, 2010). A further implication is that the school performance of minorities is perhaps not independent of the educational models of countries and, more specifically, that the immigrant school gaps (negative and positive) can be expected to be narrower where schooling is comprehensive.

The aim of this paper is to investigate the relationships between the school gap of immigrant students and the educational models of receiving countries. It is based on data from PISA 2006, which focuses on science. Of the 57 countries or jurisdictions that participated to PISA 2006, it takes into account the 29 countries with a highest proportions of immigrant students. Similarly to previous investigations on this issue, we consider the educational systems of countries together with several indicators of individual characteristics and background (Entorf and Lauk, 2006; Schnepf, 2007). Contrary to previous papers, however, we take into account a large number of countries, we measure the relationship between scores and school types at the individual rather than at the aggregate – country – level and, also, we separately analyse the impact on immigrant gaps of educational systems and of the individual schools attended by students.

Partially confirming prior expectations, we find that the structural features of educational systems matter: – controlling for individual characteristics and family background - negative gaps are wider in countries with sharp tracking and narrower – with some exceptions - where schools are comprehensive. Where tracking is sharp, the poorer performance of immigrants compared to that of natives tends to be strongly related to the types of school attended. Our results only partially confirm expectations because gaps are negative and significant also in a reduced number countries with comprehensive schools. These countries, together with those characterized by sharp tracking, are located in continental Western Europe. Hence, among the countries considered in this paper, those with the most negative and significant school gaps are concentrated in this area.

A further finding is that in several countries of continental Western Europe the poorer performance of immigrant students relatively to that of natives is related not only to school tracking, where present in its sharpest form, but also to the specific schools attended by each group – which could signal residential segregation – and in some cases remains significant within schools – which in turn may be a symptom of discrimination.

A different possible explanation for this concentration of negative gaps is that they might depend on characteristics of the immigrant communities residing in Western Europe. For example,

the importance attached to education may vary between ethnic groups, and immigrant groups in Europe might assign a lower value to schooling than immigrant populations in other areas of the world. To control for this possibility, we add the countries or world areas of origin of immigrant students and their parents to the base regressions. We do not find, however, a significant concentration of negative coefficients of the 'country of origin' variable in European countries and, hence, an empirical support for this possibility.

One more disaggregated indicator of assimilation in education concerns the performance of different generations of immigrant students. As second generation immigrants attend the entire school cycle in the country of residence and their families have been living there for a longer time, it is generally expected that, controlling for relevant factors, they will perform more similarly to natives than first generation ones (Schneeweiss, 2009; Schnepf, 2007). This paper measures the performance of first and second generation immigrant students separately.

One variable of special interest for our investigation is the speaking of a foreign language at home. Some authors find that a negative correlation between speaking a foreign language at home and scores at school is especially present in English-speaking countries (Schnepf, 2007; Fertig and Schmidt, 2002; Entorf and Lauk, 2006). Our findings only partially confirm these results.

This paper is structured as follows: Section 2 presents some basic traits of the educational models; Section 3 presents the data and empirical strategy; Section 4 analyses the results and Section 5 presents the conclusions.

2. Educational systems

While the two main schooling models are tracking and comprehensive, their effective implementation differs across countries. The age at which the type of school is selected varies from ten years old in some cases to sixteen in others. We include in our definition of tracking those countries where school selection takes place before sixteen years old. Among these, the number of tracks may be two or more, and, more importantly, the differentiation between them may be mild or

sharp. Tracking is particularly sharp in some continental Western European countries, where the quality of academic and vocational schools differs substantially and the choice of school takes place at an early age (Wömann, 2009).

Similarly, comprehensive systems differ in the degree of uniformity with which the common school programme is taught within schools. In some countries, especially European ones, courses are taught to all students at the same level of difficulty, while in others, mostly English-speaking, core courses are taught at different levels, which can be either chosen by students or accessed through examination. This type of schooling is often denominated comprehensive with "streaming".

The proportion of students in grades below the average for their age is of interest for our investigation because it can relate in particular to immigrants. For the sake of brevity, students in below average grades will be defined as "repeaters", even though not all of them are actually repeating a school year. Grade repetition is related to educational customs rather than institutional rules and varies significantly across countries. Table 1 depicts the countries included in this study (selected as explained in Section 3) and shows that, with a few exceptions, grade repetition is common in continental Europe, especially where tracking is sharp but also in some countries with comprehensive schools, such as Spain, Denmark, Estonia and Latvia. On the other hand, it is less common elsewhere; it is rare especially among English-speaking countries (which all have comprehensive systems, except for Ireland, where school selection takes place at fifteen).

3. Data and econometric specification

3.1. Data

The distribution of the educational attainments of the adult population of immigrants and overall in the set of countries considered is summarized in Table 2. Columns (1) and (3) show the proportions

of people aged 25 and over with primary education and who have completed at least one year of tertiary studies (secondary education being the difference between the two).[1]

The figures in the Table clearly show that immigrants tend to be concentrated in the lower and higher tails of the distribution for educational level. Immigrants with tertiary education are more frequent in English-speaking countries and those with primary education in Central and Southern Western Europe, but the differences in education between them and the countries' overall populations, which interest us more because of their possible relationship with students' gaps at school, are more substantial outside continental Europe. In Canada these differences are wider for both primary and tertiary levels, in USA and Australia for the primary level, and in Great Britain for the tertiary level (columns 5 and 6 of Table 2).

In this paper we use the data provided by the Programme for International Student Assessment (PISA), an internationally standardized evaluation conducted every three years in a large number of countries. Its main purpose is to collect data on the competencies of 15-year-old students in reading, mathematics and science. The data were collected during the third PISA survey, in 2006, which includes 57 countries or jurisdictions and focuses on science. The 29 countries selected for this study are those where immigrant students account for at least 3% of the student population. The same criterion was adopted in OECD (2006), based on PISA 2003.[2]

The PISA student questionnaire includes an indicator (*ISCEDO*) of general, pre-vocational and vocational schools, but figures are missing or unreliable for several countries. We therefore used the UNESCO (2006) classification of educational systems to build a proxy of the "school type" variable. More precisely, we divided the schools of each country into three main categories,

[1] Data on the educational attainment of the adult population in countries, not available for all the countries considered, are from Barro-Lee (2000) updated to 2007, and on the educational attainment of adult immigrants are from Docquier and Marfouk (2006).

[2] The 3% condition holds only for the second-generation student population in Estonia, Latvia and Slovenia, and for first generation ones in Greece, Ireland, Montenegro, and Italy. First-generation students: born outside the country of assessment, with parents born in a different country; second-generation students: born in the country of assessment, with parents born in a different country.

i.e., type 1: academic, type 2: intermediate, and type 3: vocational.[3] We then linked this classification to the variable *(PROGN)* of the student database indicating the school attended by each student, and obtained, as a result, a proxy of school types at the micro level (details from the authors upon request). This differs from previous studies of educational systems, where school models are considered at the aggregate country level (Schuetz et al., 2008; Brunello and Checchi, 2007; Wömann, 2004; Ammermueller, 2007a; Hanushek and Wömann, 2006; Bauer and Riphahn, 2006).

Table 3 contains the values of an index of "specialization" of immigrants with respect to natives in each school type and grade. Index numbers are the ratio between the proportion of immigrant students in a given school type or grade and the proportion of native students in that school type or grade. Values above unity denote the relative specialization of immigrant students. The last column indicates the average grade for fifteen-year-olds in each country. Indices for Switzerland are biased in favour of type-1 schools because substantial numbers of students move to the country just for educational purposes, and mainly attend schools of type 1.

Several numbers above unity in Table 3 concern countries - such as the Netherlands, Belgium, Austria, Germany, Luxembourg and Switzerland, Italy and France - where tracking is sharp and repeaters are frequent even among the overall student population. Among countries with comprehensive schools, there is a relative specialization of immigrants in the lower grades in Denmark, Spain, Hong Kong and Macao. It is also worth noting that index numbers are often, but not always, higher for first-generation immigrants.

3.2 Econometric specification

First, we consider a regression model for each country, where the only regressor is the immigrant status of students and the dependent variable is students' scores . The regression equation is:

[3] "Special schools" – schools for children with special needs – were included in type 3; within our sample, they are present only in countries with tracking.

$$Y_{is} = \beta_0 + \beta_I I_{is} + \varepsilon_{is} \quad (1)$$

where Y are the scores of student i in school s; I_{is} is a categorical variable denoting whether the student is native or first or second generation immigrant. The native status is in the intercept, and β_I, the difference in performance between immigrants and natives, is the immigrant student gap, the coefficient of interest to us.[4] Usual assumptions on ε_{is} apply.

This first step is useful in providing a preliminary picture of the distribution of raw gaps across countries. At a glance it can show whether the resulting distribution is similar to that for the differences between the educational attainments of countries' immigrant and overall adult populations, seen in Table 2, or, also, whether it relates to the differences in educational systems (Table 1).

While this first group of regressions measures the unconditional coefficients, the other groups of variables are added in subsequent steps. This procedure helps to make the influence of the different factors on the immigrant gap, i.e. on the coefficient β_I, clear.

Next, we consider an augmented regression model by adding the factors concerning schooling: grades and school types. The purpose of this second model is to see whether schooling affects the immigrant gaps in countries. The regression equation is now

$$Y_{is} = \beta_0 + \beta_I I_{is} + \beta s\, S_{is} + \beta_G G_{is} + \varepsilon_{is} \quad (2)$$

type of school and grade are, respectively, S_{is} and G_{is}, and β_S and β_G are their coefficients.

Gaps are expected to shrink more where immigrants are present above all in the lower grades (Table 3) and, within the group of countries with tracking, where the differentiation between

[4] First-generation students: born outside the country of assessment, parents also born in a different country; second-generation students: born in the country of assessment, parents born in a different country.

curricula is sharp (Table 1). The results of this second group of regressions are still only indicative because important variables – concerning background and students' characteristics - are missing and could be correlated with the regressors, grades and school types. If they are, the school types and grades coefficients will capture both the direct correlation between the schooling and scores and the indirect ones concerning background. This will presumably lead to an upward bias in absolute value of the immigrant gap, which should be corrected in the subsequent, more complete, models.[5]

The third step leads to a more complete specification, which includes the gender of students, the parents' levels of education and employment status and the language spoken at home:

$$Y_{is} = \beta_0 + \beta_I I_{is} + \beta s\, S_{is} + \beta_G G_{is} + \boldsymbol{\beta}_X \boldsymbol{X}_{is} + \varepsilon_{is}\,, \qquad (3)$$

where $\boldsymbol{X}_{is}$ is a vector of background variables and $\boldsymbol{\beta}_X$ is the vector of coefficients (A list of variables is Table A).

In countries where the schooling coefficients already capture a high proportion of background factors, the further inclusion of the $\boldsymbol{X}_{is}$ variables is not expected to substantially affect the immigrant gaps and the R^2 of the regressions. Conversely, where background is related to scores directly rather than through school types or grades, gaps should shrink and R^2 should increase substantially.

There is also expected to be a group of countries where both schooling and family background are weakly correlated with students' scores. This type of result has been interpreted as indicating a fairer educational system, because performance might, in fact, be linked more to unmeasurable factors, such as innate talent (Wömann, 2004). For the topic under investigation in this paper, it is interesting to see whether the weak correlations and system fairness concern all students, including immigrants, or especially natives.

[5] The β_I would be negatively biased if, for example, students of the poorer families were overrepresented in vocational and technical schools and immigrants have, on average, a poorer background than natives.

More generally, the gaps that remain after controlling for schooling and background are informative. They signal that other factors, not explicitly considered in the model, may help to explain the different performance of the two groups of students. For example, the performance of the two can systematically differ between schools, or within them. To assess the importance of these forces, a different specification of the model, with added school fixed effects (and school types excluded), is regressed. The equations now are:

$$Y_{is} = \beta_I I_{is} + \beta_G G_{is} + \boldsymbol{\beta}_X \boldsymbol{X}_{is} + \gamma_s + \varepsilon_{is} \qquad (4)$$

where γ_s are the school fixed effects. A contraction of the gaps with respect to equation (3) suggests a differentiation between the schools taken individually (not the school types) attended by the two groups, while gaps that remain wide and significant signal a differentiation in scores within schools.

Equations (3) and (4) control for family background, but scores may also depend on cultural patterns related to ethnicity and the country of origin of students and their families. The possible influence of these factors is controlled for in a further set of regressions: the countries or world areas of origin of the student and their mother and father are added to equation (3). For reasons of brevity, the results of these regressions are not presented in this paper, but are available from the authors upon request.

Regarding the assimilation of students into education, it is generally expected that, taking into account the main differences between immigrant cohorts, second generation immigrant students will perform more similarly to natives than first generation ones. In the regressions of this paper, most differences between cohorts should be accounted for by the variables concerning student and family characteristics (and country of origin). Hence, we expect the scores of second generation immigrants to be more similar to those of natives than the scores of first generation ones both for countries with negative and positive gaps, and for countries with tracking and comprehensive schools.

The level of R^2 in each set of regressions and its variability between countries is also of interest. The value resulting from the first set of regressions, based on the specification of equation (1), will reveal the proportion of the total variability explained by students' immigrant status alone in each country. Compared to this value, the R^2 of the second specification, of equation (2), can be expected to increase more for countries with a marked stratification of the educational system, due either to sharp tracking or, also, to a high frequency of grade repetition. Higher values of R^2 in equation (3) indicate that scores are substantially related to the factors measured, such as schooling and background. A further increase with the specification of equation (4) shows that the specific school attended helps to explain the gap.

In general, if the values of a coefficient in regressions resulting from different specifications of a base model are to be compared, all the regressions should be run with the same, or a very similar, number of observations. In our case, the comparisons concern our coefficient of interest, β_I. Tables 4a and 4b (columns 8 and 16) below, show that the number of missing observations is very similar or equal for Models I and II and for Models III and IV (based, respectively, on equations 1-2 and 3-4). Also, except in the case of Germany, missing entries are low in Models I and II, and higher in Models III and IV.

In this analysis, we avoid imputing missing values and choose to eliminate observations with missing entries. We avoid imputation for two main reasons. One is that standard estimators, such as OLS, applied to imputed data may have substantial biases (Rubin, 2008) and even more sophisticated, likelihood-based, computational approaches, such as the EM algorithm with nontrivial assumptions about the process generating the missing data, may lead to biased estimators. The other is that, as stated, for the majority of countries the number of missing observations, especially in Models I and II, is low.

Regressions have been run by using weighted OLS. To be more specific, balanced repeated replications (BRRs) (e.g. see Särndal et al., 1992), based on the weights provided in the PISA dataset, have been used for computing model parameter estimates and their standard errors OECD

(2009). BRR is a method of estimating the sampling variability of a statistic that takes the properties of the sampling design into account. Like the Jacknife and Bootstrap methods, it uses re-sampling principles and provides unbiased estimates of the sampling error arising from complex sample selection procedures. For our data, BBR accounts for the two-stage sample design for selection of schools and students within schools (see OECD, 2009). In particular, PISA provides a set of 80 alternative weights that have to be assigned to each student to form alternative samples at the country level. The confidence intervals for the inferences reported in Tables 4 are standard (1-α)% confidence intervals (α<0.05) based on the asymptotic normality assumption of the coefficient estimates. We performed diagnostic analysis on the BBR coefficient estimate replicates to confirm that this assumption is trustworthy for all the reported results.

4. Results

Tables 4a and 4b depict the immigrant student gaps of the countries considered. Model I provides the results of unconditional gaps, of equation (1) of Section 3.2 above. As expected, the findings are that immigrants perform significantly below natives in the majority of countries, and above natives only in a small number of cases. The extent of the gaps becomes clear if we consider that PISA scores across OECD countries are standardized to an average of 500 with an international standard deviation of 100, and that a school year has been found to correspond to about a third of the standard deviation (Schuetz et al., 2008). Hence, in countries such as Austria, Germany, the Netherlands, Denmark or Sweden, immigrants lag behind natives by as much as two or three school years, while in others, such as Australia, Canada, Ireland or Qatar, the difference is small or even positive.

At a glance, in Model I of Tables 4a and 4b, the distribution of the unconditional gaps across countries seems to be unrelated to either the two main school systems (Table 1), comprehensive and tracking, or the differences between the educational attainments of the adult populations of immigrants and overall in the countries of residence (Table 2). What the figures do clearly show is

that negative school gaps are wider in continental Western Europe, where both educational systems are present, and where differences in educational attainments are not wider than elsewhere. In particular, immigrants perform substantially below natives in countries where education is based on tracking (for first generation immigrants, in Austria: - 92.3, Belgium: - 93.2, Switzerland: -94.8, Germany -92.8, Luxembourg: -66.9, France: -66.9, Italy: 61.1 and Portugal: 66.9) as well as where it is comprehensive (Denmark: -88.6, Norway: -59.6, Sweden: -78.1 and Spain: -65.7).

However, these gaps are unconditional, and the educational attainments in Table 2 refer to adult populations. A clearer picture emerges from the consideration of the gaps in Model II of Tables 4a and 4b (equation 2 above), where the educational variables concerning grades and school types are added to the initial regression model.

The prior expectation was that school types and grades would have a stronger impact in countries with tracking, both because the school types regressor is present only for these countries and because it can be correlated with the missing variables concerning family background. It was hypothesised in Section 3.2 that this might lead to an upward bias in absolute value. The results in Tables 4a and 4 partially confirm the expectation that negative and significant gaps are wider in countries with sharp tracking, and – with some exceptions - narrower in those with comprehensive schools. They also show that for both educational models the most negative gaps are of countries located – except for Estonia - in continental Western Europe.

Therefore there is also a significant heterogeneity within each group of countries. The # sign in column 7 of Tables 4a and 4b indicates that the difference between the coefficients of Models I and II is significant at the 1% level (of either first or second generation immigrants) in eight of the fifteen countries with tracking, but also in three of the fourteen countries with comprehensive schools.[6] Among the latter, the gap is affected by the introduction of the *grades* regressor.

Among countries with tracking, the impact of *school types* and *grades* on the immigrant gaps is, as expected, higher where the differentiation between school types is sharper and the

[6] Difference between coefficients are measured following Allison (1995).

immigrants repeat grades more frequently than natives (Model II of Table 4a). Gaps shrink by about two school years in Belgium (from -93.2 to -36.6), by one and a half in Italy (from -61.1 to - 12.9), and by about one in Germany (from -76.7 to -46), France (from -66.8 to -35.4) and the Netherlands (from -67.5 to - 30.3). In the other countries with tracking, either the impact of the school variables is low or gaps were already narrow in Model I.

Among countries with comprehensive schools, the *grades* variable 'explains' a significant part of the immigrant gap where the rates of grades repetition are high and immigrants are overrepresented in the lower grades (Tables 1 and 3 above). The coefficient of first generation immigrants shrinks by amounts corresponding to about one school year, from -65.7 to -37.7 in Spain, from -88.6 to -75.8 in Denmark, and, atypically, increases in absolute value in Estonia, from -31.9 to -38.3, suggesting a lower performance of immigrants within grades.

Hence, Model II shows that the negative gaps of immigrants are significantly related to schooling especially in a 'core' group of countries, located in continental Western Europe and characterized by sharp tracking or frequent grade repetition. Outside this area, the school performance of immigrants is more similar to that of natives or, where gaps are wider, as in Great Britain or the United States, they are related to other factors.

What are the effects of introducing background into this picture? Model III show that the consideration of the parents' level of education and occupation and the language spoken at home brings differentiated findings. On the one hand, relatively to Model II, the proportion of explained variation of the regressions tends to increase relatively more in comprehensive countries. This could be expected, given that the R^2 of comprehensive countries in Model II were generally lower. On the other hand, gaps shrink further with respect to Model II in some countries with tracking but especially in those with comprehensive schools.

In countries with tracking, the introduction of the background variables affects the gap, especially where it remained wide and significant in Model II: Austria, Switzerland, Luxembourg, Germany, the Netherlands and Slovenia. One country where, in contrast, schooling variables appear

to capture most of the factors underlying the different performance of natives and immigrants is Italy: here the gap already shrinks by about one and a half school years in Model II and no further substantial effect is registered in the more complete Model III. [7]

Gaps also shrink where schools are comprehensive. One interesting finding is that gaps in English-speaking countries (which are all comprehensive, except for Ireland, where choice is at fifteen) are low or nil even unconditional, with the exception of the USA and Great Britain, where negative coefficients in Models I and II correspond to approximately one school year. In Model III all countries in this group are characterised by similar school performances of immigrant and native students. This implies that gaps, where present, are due mostly to different family backgrounds.

This more complete specification, however, does still not entirely explain the different performance of native and immigrant students everywhere. Some negative and significant differences remain, with coefficients corresponding to one or almost one school year, in several countries of continental Europe, both with the tracking and the comprehensive school models: among the former, Belgium, Switzerland, the Netherlands, Luxembourg, Germany and France (Table 4a, Model III), among the latter, Denmark, Sweden, Estonia and Spain (Table 4b, Model III).

These remaining gaps suggest that forces not considered in the model may be at work. For example, the difference in performance could be due to immigrants and natives mainly attending different schools, or it could take place within schools. To distinguish between these possibilities, Model IV includes school fixed effects in the full model, and excludes the school type variable.

Results of Model IV show that the coefficients of second generation immigrant students in Germany, Switzerland, France and Luxembourg become non-significant, which indicates a variation between schools, i.e. second generation immigrants in these countries tend to attend

[7] Coefficients of Models II and III cannot be strictly compared for this country, as the number of observations differs substantially in the two specifications. However, the shrinking of the immigrant coefficient is already considerable in Model II, where the proportion of missing observations is just 2%. Regressions on the interactions between background and schooling variables (available from the authors upon request) show that the performance of students in this country is significantly related to background through the indirect school type and grades channels. On Italy and Germany see also Checchi and Flabbi (2007).

schools with a lower quality of education than those attended by natives. The finding refers to schools taken individually, but considered together with the significant coefficients in Model III, it shows that, for given background factors, the poorer performance of these students is correlated both with the types of school– vocational and technical rather than academic – and with the specific schools attended. This result may be due to factors such as residential segregation. The variation between schools finding also applies to Estonia, where, in contrast with the above countries, the school system is comprehensive. There educational quality only differs between schools taken individually, and not also between school types.

Conversely, gaps remain negative and significant even with the school fixed effect in countries of Northern Europe: Sweden (-40.3 first generation, -18.1 second), the Netherlands (-14.6 first, -25.7 second), Denmark (-28, first), Austria (-31.3, first), and in Spain (-32.9). The result concerns both school systems and denotes differences within schools that may be due to discrimination. Outside Europe, negative gaps remain significant only in Israel (and there only for second generation immigrant students, while for first generation ones they are positive).

We are also interested in the performance of first and second generation immigrants. The prior expectation is that, controlling for other factors, the latter should perform more similarly to natives than first generation students because they have been brought up in their country of residence. However, for the group of European countries with tracking especially, the results of our regressions show a different picture. In Model I, the unconditional gaps of second generation immigrants are as negative as those of the first generation cohort in Austria, Belgium, Germany (corresponding to almost three school years), the Netherlands, Switzerland and Luxembourg (corresponding to two or more school years). In comprehensive countries, a similar result applies to Denmark and Sweden (with gaps corresponding to more than one school year).

More generally, the performance of second generation immigrants is not as expected in several countries of Northern and central Western Europe. In this area, after controlling for family background and hence for variables that can account for differences between cohorts, second

generation immigrant students do not perform better than first generation ones. Depending on each country, the poor performance is related to the school types or to the specific schools attended, to differences within schools or to all these factors.

Does the language spoken at home matter? Our results show that it affects scores in some countries, but, contrasting with the findings from previous work (Schnepf, 2007; Fertig and Schmidt, 2002; Entorf and Lauk, 2006), not especially in English-speaking ones. As shown in column 17 of Tables 4a and 4b, speaking a foreign language at home is significantly correlated with scores in the full regressions (not reported in this paper, but available from the authors upon request), with a negative sign in Australia, Canada and Ireland (where gaps are narrow), but also in the Netherlands, Norway, Luxembourg, Russia, and Hong Kong.

Interestingly, the R^2 of the regressions for countries with tracking and for those with comprehensive education tend to differ. Even in Models I and IV, where the specifications are identical for the two groups, the R^2 values are generally higher in the group of countries with tracking (Tables 4a and 4b). In Model I, immigrant status alone explains about the 10% of the total variation in regressions for countries with tracking, such as Austria, Belgium, Switzerland, Germany and Luxembourg and about 5% in the Netherlands (Table 4a), while its value is nil or near to zero in most countries with comprehensive schools, with the exception of Denmark and Sweden, where the value of R^2 is about 0.05 (Table 4b). In the more complete Model IV, the values of the R^2 of several countries with tracking, such as Austria, Belgium, Germany, France, Italy, Luxembourg, the Netherlands, Portugal and Slovenia, are above 0.5 (in some cases, this already occurs in Model II), while the R^2 values of countries with comprehensive schools, with the sole exception of Qatar (where immigrant school gaps are positive), are well below that level.

As already stated, lower values of R^2 have been interpreted as evidence of a stronger relationship between performance and unmeasurable factors like innate talent and hence of fairer educational systems. Our results concerning Sweden, Denmark and Estonia, in Northern Europe, show a more complete picture, where R^2 values are low but negative immigrant school gaps are

wide and significant, which suggests a fairness of educational institutions that concerns the majority of students, but not immigrants, or at least not to the same extent. Conversely English-speaking countries are characterized by both low R^2 and narrow immigrant student gaps (for the USA and UK, the latter result applies after controlling for background).

Further studies can make clear whether this difference between the two groups of countries with comprehensive schooling arises mainly because of the way the model is effectively implemented in each case or because of other factors, which may concern the integration of immigrant communities into society in more general terms. Regarding the first point, the comprehensive model with streaming, more characteristic of English speaking countries, provides students with the possibility of taking courses at different levels of difficulty, which can be important for those with some disadvantages in specific disciplines, but not in others. Especially when the disadvantage in some disciplines is due to cultural reasons, or to a dissimilarity in study programmes compared to the country of origin, the immigrant student can compensate with other disciplines, and, with time, aim to achieve convergence with average scores in all subjects. This convergence is more difficult in countries where the programme of study is the same for all students, and an initial disadvantage in one subject can simply grow with the passage of time.

The higher concentration of negative scores in the European area, however, could be related to characteristics of the immigrant populations not captured by the variables of our models. As already stated, students' performance may be influenced not just by family factors but also by the culture and beliefs of the ethnic communities they belong to, and immigrant communities in Europe might not put much value on education. Although Table 2 shows that the difference between the educational attainments of the immigrant and overall populations of the host countries is not wider in Europe than elsewhere, we have run a further set of regressions with the countries of origin, when available, or with the areas of origin, of the student, mother and father added to Model III to control for these factors.

Results (not reported in this paper) show that there does not seem to be a 'country of origin' problem specific to Europe. More precisely, there is no concentration of negative coefficients in this area, and, there is no group of origin countries or areas to which a lower performance at school is systematically related. The same origin countries may have negative or positive coefficients, depending on the destination economy. This may indicate that rather than the culture (for example, religion) of the ethnic groups, what matters is parents' level of education, a factor our regressions control for. The correlation between country of origin and scores is significant and negative in the regressions concerning Belgium (with origin countries located in East Asia and Sub-Saharan Africa), Estonia (origin: Eastern Europe), France, the Netherlands and Norway (non-Western European countries), but negative coefficients are also significant in regressions concerning non-European host countries, such as New Zealand (countries of origin: in South Asia, North Africa, and non-Western Europe), Qatar (Middle East) and Hong Kong (non-Western Europe).

As shown in Models I and II of Tables 4a and 4b, the percentage of missing observations is low (with the exception of Germany). The coefficients of these two models can be compared because the change in the number of observations from one to the other is nil or negligible. The same applies to Models III and IV, which have the same number of observations, although there are more missing observations than in the previous models. This may introduce a bias in coefficients, which should be downwards for negative coefficients and upwards for positive ones if students with a poorer background tend to respond less completely to the PISA Students Questionnaire. Where immigrants have on average a poorer background than natives, negative gaps can be expected to be underestimated and vice versa when immigrant students have a better background than natives.

The variable with the most frequent missing values in our data is 'language'. To check whether the results on gaps change significantly without this variable, the regressions of Models III and IV were rerun without it. Negative gaps widen slightly in countries where the language variable had a significant coefficient in Models III and IV, but general results do not change significantly.

Overall, this paper shows that, controlling for factors related to family background, there is a concentration of negative performances at school of immigrants compared to natives in the central area of continental Western Europe. These differences appear to be related to tracking where it is sharp, and to be affected that factors that are not directly related to educational institutions where education is comprehensive. In both cases, more than elsewhere, the performance of immigrant students compared to natives presents a variability between individual schools and in some cases within schools.

5. Conclusion

This paper shows that the school performance of immigrant students is significantly lower than that of natives in several countries. Partially confirming prior expectations on the relations between the immigrant gaps and the two main models of education, tracking and comprehensive, we find that gaps are more negative where tracking is marked and – with some relevant exceptions – that they are narrow or nil where education is comprehensive or tracking is mild. These few exceptions refer to countries with comprehensive schools and wide and significant negative gaps. Together with those characterized by sharp tracking, they are located in continental Western Europe.

The geographical concentration could be due to specific cultural traits of the immigrant communities, but using the available data on the home countries of immigrant students and of their parents, we find no relation between countries of origin and the location of negative gaps. The available evidence on this issue is, however, still incomplete and further data and research may be needed to qualify results.

Rather, we find that in some countries of Western Europe the immigrant school gaps remain negative and significant even after having controlled for family background and tracking (which are generally both significant), and that these remaining gaps are explained by immigrants and natives attending different schools and (or) are significant within schools. Also in this case, further studies

are needed to make clear whether these findings are linked, respectively, to residential segregation and to discrimination at school.

In the group of countries characterized by the more negative and significant gaps, second generation immigrant students often do not perform much better than first generation ones, even controlling for individual and family characteristics.

Outside continental Western Europe, tracking is implemented in a milder form or schools are comprehensive and, in general, negative gaps are narrow or nil. Particularly in the group of English-speaking countries, the immigrant school gaps are either non-significant or are linked to family background. There, differently from the European version of the comprehensive model, courses are taught at different levels of difficulty. This may represent an opportunity for students disadvantaged in some disciplines but not in others, often the case among immigrants, because it may lead to a process of assimilation in education with patterns differentiated for each discipline. This mechanism of adaptation is absent both in countries with sharp tracking – where the educational level of courses in vocational and technical schools is lower than in academic ones - and in the European countries with a completely homogenous comprehensive system – where all courses are taught at the same level.

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***Table 1. School systems*.**

First age of selection and frequency of repeaters

		Tracking		Comprehensive	
				streaming	homogenous
Frequency of repeaters	high	AUT	[10]		
		DEU	[10]		SWE
		BEL	[12]		DNK
		CHE	[12]		NOR
		NDL	[12]		EST
		LUX	[13]		LVA
		FRA	[14]		ESP
		ITA	[14]	HKG	
		RUS	[14.5]	MAC	
		PRT	[15]	QAT	
	low	GRC	[15]	AUS	
		IRL	[15]	CAN	
		ISR	[15]	GBR	
		MNE	[14]	NZL	
		SVN	[14]	USA	

Sources: UNESCO (2006); share of repeaters: PISA 2006.

First age of selection in square brackets.

Table 2. Educational attainment of overall and immigrant population aged 25+.
Percentages

	Immigrants		Population		(% Immigrants)/(%Population)	
	primary	tertiary	primary	tertiary	primary	tertiary
	(1)	(2)	(3)	(4)	(5)	(6)
AUS	35	40	3	28	13.6	1.5
AUT	47	13	23	12	2.1	1.1
BEL	62	20	17	23	3.6	0.9
CAN	30	59	4	27	7.4	2.2
CHE	55	19	18	19	3.1	1.0
DEU	66	22	16	20	4.2	1.1
DNK	45	17	32	17	1.4	1.0
ESP°	29	19	23	18	1.2	1.0
EST						
FRA	74	16	14	17	5.3	1.0
GBR	34	35	27	15	1.3	2.4
GRC°	45	15	31	15	1.4	1.0
HKG						
IRL°	14	41	17	25	0.8	1.6
ISR						
ITA°	53	15	26	9	2.1	1.6
LUX	45	22	24	16	1.9	1.3
LVA						
MAC						
MNE						
NLD	50	22	10	22	5.2	1.0
NOR	22	29	22	25	1.0	1.2
NZL	33	41	24	42	1.4	1.0
PRT	60	19	45	10	1.3	1.9
QTA						
RUS						
SVN						
SWE	34	26	13	23	2.6	1.1
USA	38	43	2	52	18.1	0.8

Notes: Percentages of Immigrants and of overall population, aged 25+, in primary and in tertiary education. Columns (5) and (6), respectively, are: column (1) divided by column (3) and column (2) divided by column (4). Data on overall population from Barro-Lee (2000), updated to 2006 and on Immigrants by educational attainment from Docquier and Marfouk (2006).

Table 3. Grades and School types.

Index: (% immigrant students) / (%native students)

Countries	School 1		School 2		School 3		Grade 9		Grade ≤ 8		grade at 15
Tracking	**2nd gen**	**1st gen**	**2nd gen**	**1st gen**	**2nd gen**	**1st gen**	**2nd gen**	**1st gen**	**2nd gen**	**1st gen**	
AUT	0.92	0.78	0.82	**1.08**	**1.31**	**1.05**	**1.17**	**1.22**	**1.84**	**3.09**	10
BEL	0.98	0.7	0.93	1.02	**2.52**	**6.03**	**1.78**	**1.86**	**3.38**	**7.85**	10
CHE	*1.11*	*1.09*	*1.02*	*1.01*	*0.78*	*0.84*	0.95	0.81	**1.33**	**1.9**	9
DEU	0.5	0.52	**1.21**	**1.17**	**1.27**	**1.26**	0.99	1.05	**1.91**	**2.34**	9
FRA	0.91	0.63	**1.09**	**1.4**	**1.46**	**1.48**	**1.15**	**1.32**	**1.58**	**4.09**	10
GRC		0.5		**3.35**				9.28		7.66	10
IRL		**1.45**		0.94				0.92		**3.39**	9
ISR	0.94	0.69	**1.16**	**1.77**			**1.45**	**2.63**			10
ITA		0.4		**1.58**		**1.3**		**4.09**		**13.21**	10
LUX	0.69	0.77	0.83	0.7	**1.18**	**1.15**	**1.12**	**1.17**	**1.65**	**1.83**	10
MNE		1.08		0.91		0.87		1.01			9
NLD	0.59	0.63	0.91	0.79	**1.89**	**2.26**	**1.34**	**1.46**	**1.97**	**5.35**	10
PRT	0.73	0.42	**1.19**	**1.43**	0.93		0.84	0.99	**1.99**	**2.77**	10
RUS	0.85	0.91	**1.11**	**1.16**	**1.55**	0.43	1.08	1.09	**1.63**	**1.98**	10
SVN	0.69		**1.24**		**1.32**						10
Comprehensive											
AUS							0.45	1.32			10
CAN							0.57	1.09	0.33	1.06	10
DNK							0.95	0.75	**1.3**	**2.91**	9
ESP							**1.17**	**1.76**	**1.08**	**1.83**	10
EST									0.56		9
GBR											11
HKG							1.02	1.62	0.86	**9.99**	10
LVA									0.92		9
MAC							0.97	1.01	0.87	**1.97**	10
NOR											10
NZL											11
QAT							1.37	0.92	0.51	0.48	10
SWE									1.98	5.57	9
USA							1.3	1.59	0.52	0.81	10

Notes: Indices are calculated by taking the proportion of immigrants in each school type and grade, the proportion of natives in each school type and grade and then dividing one by the other. School 1: academic; School 2: intermediate; School 3: vocational. Switzerland (CHE): international students with immigrant students. Hong Kong and Macao: no significant share of students in schools of types 2 and 3

Table 4a: immigrant performance gaps, schooling and background. Tracking

Dependent variable: student scores in Science

Countries	**Model I** - Unconditional gap			**Model II** - Gap conditional to school type and grade			Coefficients variation	*% missing obs erv.*	**Model III** - Gap conditional to grade, school type and background			**Model IV** - Gap conditional to background. School fixed effects			Coefficients variation	*% missing obs erv.*	*foreign lang at home*
	2nd gen	1st gen	*Ad. R2*	2nd gen	1st gen	*Ad. R2*			2nd gen	1st gen	*Ad. R2*	2nd gen	1st gen	*Ad. R2*			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
AUT	**-92.3**	**-88.7**	*0.10*	**-75.9**	**-68.0**	*0.37*		1	-39.4	-31.5	*0.36*	-40.0	**-31.3**	*0.57*		4	
	(13.40)	(6.66)		(5.05)	(2.43)				(21.25)	(16.53)		(26.43)	(8.94)				
BEL	**-80.3**	**-93.2**	*0.09*	**-55.8**	**-36.6**	*0.49*	#	1	-32.8	**-22.8**	*0.49*	-16.7	**-17.6**	*0.58*		12	
	(2.53)	(1.41)		(2.42)	(4.82)				(47.64)	(10.53)		(53.29)	(8.25)				
CHE	**-69.3**	**-94.8**	*0.12*	**-67.33**	**-87.6**	*0.28*		1	**-34.2**	-50.3	*0.28*	-23.3	-39.0	*0.47*		8	
	(10.36)	(7.93)		(10.54)	(4.92)				(15.11)	(42.09)		(13.41)	(41.73)				
DEU	**-92.8**	**-76.7**	*0.09*	**-67**	**-46**	*0.45*	#	17	**-32.7**	-17.9	*0.47*	-29.4	-11.5	*0.62*		19	
	(1.88)	(5.42)		(1.64)	(3.88)				(10.08)	(67.04)		(14.42)	(60.35)				
FRA	**-48.3**	**-66.8**	*0.03*	**-39.8**	**-35.4**	*0.47*	#	3	**-29.0**	**-30.8**	*0.48*	-11.5	**-30.2**	*0.59*		9	
	(2.53)	(2.72)		(4.28)	(2.70)				(11.13)	(7.49)		(60.35)	(7.41)				
GRC°		-49.5	*0.02*		10.9	*0.28*		2		**20.2**	*0.33*		7.9	*0.45*		6	
		(26.90)			(6.90)					(3.36)			(12.01)				
IRL°		**-10.1**	*0.00*		-4.6	*0.05*		3		19.3	*0.13*		23.6	*0.26*		5	*yes*
		(3.74)			(2.70)					(37.10)			(43.35)				
ISR	**-17.3**	**5.8**	*0.00*	**-14.9**	**17**	*0.04*		8	-5.8	**34.8**	*0.09*	**-11.4**	**20.3**	*0.35*		15	
	(2.20)	(1.58)		(1.88)	(1.36)				(11.61)	(17.48)		(2.18)	(8.74)				
ITA°		**-61.1**	*0.01*		**-12.9**	*0.24*	#	2		-20.1	*0.28*		-30.7	*0.54*		15	
		(1.75)			(4.84)					(18.02)			(26.47)				
LUX	**-66.2**	**-66.9**	*0.11*	**-55.2**	**-57.9**	*0.32*		2	**-22.1**	-26.6	*0.37*	-24.7	-28.0	*0.45*		17	*yes*
	(2.14)	(1.92)		(2.12)	(1.77)				(9.33)	(30.74)		(11.47)	(30.61)				
MNE°		**24.2**	*0.00*		**21.5**	*0.21*		3		**25.4**	*0.23*		**26.0**	*0.29*		15	
		(2.15)			(2.50)					(7.70)			(5.92)				
NLD	**-79**	**-67.5**	*0.06*	**-49.2**	**-30.3**	*0.58*	#	2	-38.1	**-15.7**	*0.57*	**-25.7**	**-14.6**	*0.65*		5	*yes*
	(3.61)	(3.67)		(3.72)	(4.13)				(23.30)	(4.84)		(13.01)	(4.36)				
PRT	-37.2	**-66.9**	*0.02*	-16.3	**-26.7**	*0.44*	#	3	-22.1	-29.2	*0.45*	-16.7	-23.7	*0.52*		7	
	(22.00)	(6.53)		(12.10)	(3.57)				(35.06)	(19.51)		(32.79)	(23.96)				
RUS	**-13**	**-14.2**	*0.00*	**-6.3**	**-9.9**	*0.11*	#	1	-4.8	-6.0	*0.17*	-5.5	-8.8	*0.34*		2	*yes*
	(1.55)	(2.80)		(1.54)	(3.01)				(12.30)	(40.62)		(7.64)	(43.96)				
SVN°	**-57.4**		*0.03*	**-40.8**		*0.47*	#	2	-22.0		*0.48*	-22.5	-14.1	*0.63*		4	
	(2.34)			(2.74)					(32.19)			(25.31)	(34.07)				

Notes :'°': ony one immigrant generation above 3%. Robust standard errors in brackets. In bold: significat at 1%, 5% or 10% levels.

#: statistically significant variation of coefficients from Model I to Model II and from Model III to Model IV, at 1% level.

Table 4b: immigrant performance gaps, schooling, background and interacted variables. Comprehensive

Dependent variable: student scores in Science

Countries	**Model I** - Unconditional gap			**Model II** - Gap conditional to school type and grade			Coefficients variation	*% missing*	**Model III** - Gap conditional to grade, school type and background			**Model IV** - Gap conditional to background. School fixed effects			Coefficients variation	*% missing*	*foreign lang at home*
	2nd gen	1st gen	*Ad. R2*	2nd gen	1st gen	*Ad. R2*			2nd gen	1st gen	*Ad. R2*	2nd gen	1st gen	*Ad R2*			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
AUS	-1.7	-2.5	*0*	-4.3	-0.2	*0.02*		2	1.9	2.6	*0.12*	-2.5	-2.4	*0.26*		6	yes
	(1.60)	(4.50)		(1.52)	(3.50)				(4.58)	(7.10)		(4.15)	(6.37)				
CAN	**-12.5**	**-21.9**	*0.01*	**-17**	**-21.2**	*0.07*		4	**-8.1**	-15.8	*0.11*	**-5.4**	**-13.9**	*0.27*		7	yes
	(1.53)	(1.42)		(2.28)	(2.82)				(2.36)	(8.92)		(1.39)	(5.71)				
DNK	**-85.4**	**-88.6**	*0.06*	**-84.1**	**-75.8**	*0.11*	#	1	**-36.9**	-32.1	*0.16*	-30.1	**-28.0**	*0.28*		7	
	(7.30)	(5.80)		(7.80)	(8.10)				(17.03)	(16.91)		(29.76)	(8.39)				
ESP°		**-65.7**	*0.03*		**-37.74**	*0.31*	#	1		**-34.9**	*0.30*		**-32.9**	*0.42*		5	
		(10.00)			(9.80)					(2.89)			(5.39)				
EST°	**-31.9**		*0.02*	**-38.3**		*0.09*	#	2	**-33.8**		*0.14*	-3.3		*0.30*	#	4	
	(1.73)			(1.55)					(5.09)			(12.74)					
GBR	**-26.4**	**-40.8**	*0.01*	**-26.4**	**-40.7**	*0.01*		3	-9.0	-16.6	*0.09*	-6.2	-9.7	*0.30*		10	
	(4.59)	(11.32)		(4.59)	(11.39)				(5.59)	(24.98)		(10.19)	(16.96)				
HKG	**4**	**-25.9**	*0.01*	**3.5**	**20.9**	*0.12*		1	11.3	26.5	*0.16*	11.5	**25.2**	*0.48*		3	yes
	(1.67)	(2.27)		(1.70)	(2.99)				(19.43)	(3.62)		(19.01)	(5.59)				
LVA°	-3.2		*0*	-4.6		*0.11*		3	-3.7		*0.15*	1.5		*0.30*		5	
	(3.45)			(3.13)					(4.59)			(18.33)					
MAC	**15**	-3.6	*0.01*	**11.2**	**21.2**	*0.25*		2	**10.7**	23.6	*0.27*	**11.7**	24.2	*0.42*		4	
	(1.44)	(2.10)		(0.88)	(2.42)				(1.12)	(13.11)		(2.71)	(14.87)				
NOR	**-57.6**	**-59.6**	*0.02*	**-57.4**	**-57.6**	*0.02*		2	-28.2	-25.9	*0.08*	-22.7	-29.7	*0.18*		6	yes
	(3.90)	(6.10)		(4.00)	(5.80)				(42.55)	(18.56)		(53.24)	(18.42)				
NZL	**-28.1**	**-10**	*0*	**-28.1**	**-9.8**	*0*		2	-10.6	-5.8	*0.11*	-6.2	-11.1	*0.22*		11	
	(3.04)	(1.93)		(3.16)	(1.46)				(6.48)	(8.50)		(13.47)	(13.09)				
QAT	**36.2**	**83.9**	*0.15*	**34.6**	**80.7**	*0.19*		9	**33.7**	**75.4**	*0.24*	27.6	38.7	*0.51*	#	12	
	(1.32)	(1.95)		(1.48)	(1.94)				(9.01)	(13.92)		(18.73)	(25.95)				
SWE	**-47.6**	**-78.1**	*0.04*	**-49**	**-74.3**	*0.06*		2	**-21.5**	**-40.6**	*0.14*	**-18.1**	**-40.3**	*0.24*		6	
	(5.20)	(3.30)		(4.80)	(3.20)				(7.42)	(10.35)		(7.86)	(8.81)				
USA	**-42.8**	**-57.1**	*0.03*	**-41.5**	**-52.9**	*0.12*		3	-8.8	-15.4	*0.16*	-6.4	-15.6	*0.30*		6	
	(5.43)	(9.97)		(5.50)	(11.21)				(8.48)	(54.47)		(5.62)	(47.52)				

Notes :'°': ony one immigrant generation above 3%. Robust standard errors in brackets. In bold: significat at 1%, 5% or 10% levels.

#: statistically significant variation of coefficients from Model I to Model II and from Model III to Model IV, at 1% level (at 10% significance level in Denmark)

Table A1.a. Tracking system. Dependent variable: student scores in Science

	AUT			BEL			CHE		
variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
(Intercept)	523.42 (1.99)	607.56 (1.92)	594.5 (10.00)	523.16 (1.24)	585.68 (0.66)	579.7 (5.57)	530.86 (11.02)	625.54 (2.25)	579.4 (4.97)
2nd gen.	-92.29 (13.40)	-75.94 (5.05)	-39.4 (21.25)	-80.34 (2.53)	-55.76 (2.42)	-32.8 (47.64)	-69.32 (10.36)	-67.33 (10.54)	-34.2 (15.11)
1st gen.	-88.69 (6.66)	-67.98 (2.43)	-31.5 (16.53)	-93.25 (1.41)	-36.62 (4.82)	-22.8 (10.53)	-94.84 (7.93)	-87.61 (4.92)	-50.3 (42.09)
grade 9		-42.56 (1.92)	-41.7 (13.22)		-63.95 (2.96)	-60.3 (2.61)		-41.7 (7.51)	-29.7 (68.71)
grade 8		-116.13 (21.71)	-112.5 (22.67)		-128.7 (3.35)	-124.4 (8.04)		-101.93 (6.41)	-85.9 (68.26)
school 2		-47.7 (1.76)	-44.4 (10.47)		-81.66 (1.35)	-76.4 (1.31)		-53.67 (7.96)	-46.2 (49.75)
school 3		-120.48 (2.48)	-114.8 (4.63)		-109.72 (9.37)	-104.0 (71.99)		-95.39 (2.15)	-79.0 (9.53)
gender			-19.8 (4.63)			-18.0 (2.48)			-11.1 (12.42)
language other						15.8 (5.32)			-30.1 (8.85)
language foreign			-32.0 (22.00)			-33.5 (27.27)			-30.8 (19.64)
parents secondary edu.			3.2 (5.31)			-8.2 (5.83)			-6.0 (2.71)
parents primary edu.			-31.3 (15.03)			-27.3 (17.21)			-30.5 (17.50)
occupHP			0.4 (0.06)			0.3 (0.11)			0.9 (0.16)
n. obs.	4891	4891	4749	8743	8742	7789	12021	12021	11219
adj. R^2	0.1	0.37	0.36	0.09	0.49	0.49	0.12	0.28	0.28
	DEU			**FRA**			**GRC°**		
(Intercept)	531.77 (0.95)	631.76 (2.03)	636.2 (14.99)	504.5 (0.37)	565.61 (0.75)	566.1 (19.70)	477.64 (0.97)	498.31 (1.05)	485.3 (21.26)
2nd gen.	-92.82 (1.88)	-67.02 (1.64)	-32.7 (10.08)	-48.25 (2.53)	-39.84 (4.28)	-29.0 (11.13)			
1st gen.	-76.66 (5.42)	-46.03 (3.88)	-17.9 (67.04)	-66.82 (2.72)	-35.44 (2.70)	-30.8 (7.49)	-49.48 26.87	10.86 (6.89)	20.2 (3.36)
grade 9		-45.23 (3.62)	-42.9 (12.89)		-10.78 (4.95)	-13.5 (5.15)		-21.02 (8.81)	-16.1 (10.33)
grade 8		-98.47 (4.61)	-89.9 (22.68)		-55.54 (6.93)	-57.9 (26.99)		-95.63 (8.48)	-87.5 (67.98)
school 2		-117.28 (4.16)	-104.1 (18.36)		-110.77 (3.30)	-100.7 (6.98)		-102.37 (1.69)	-91.4 (27.29)
school 3		-89.49 (3.24)	-79.9 (3.40)		-202.24 (8.50)	-182.9 (37.31)			
gender			-17.2 (4.23)			-17.4 (1.20)			-0.4 (15.53)
language other						-57.8 (73.18)			
language foreign			-39.1 (53.37)			5.5 (16.03)			-21.7 (23.01)
parents secondary edu.			-10.0 (1.94)			-9.8 (2.78)			-12.1 (3.14)
parents primary edu.			-43.4 (13.77)			-25.4 (6.74)			-40.7 (2.82)
occupHP			0.2 (0.18)			0.3 (0.40)			0.5 (0.51)
n. obs.	4603	4481	3978	4575	4575	4307	4795	4794	4578
adj. R^2	0.09	0.45	0.47	0.03	0.47	0.48	0.02	0.28	0.33
	IRL°			**ISR**			**ITA°**		
(Intercept)	510.42 (3.63)	531.39 (3.46)	524.8 (16.42)	461.85 (2.06)	474.42 (1.50)	490.0 (16.07)	479.3 (1.35)	520.97 (0.43)	512.7 (15.63)
2nd gen.				-17.29 (2.20)	-14.86 (1.88)	-5.8 (11.61)			
1st gen.	-10.06 (3.74)	-4.60 (2.72)	19.3 (37.10)	5.83 (1.58)	17.04 (1.36)	34.8 (17.48)	-61.08 (1.75)	-12.88 (4.84)	-20.1 (18.02)
grade 9		-29.23 (1.46)	-27.2 (17.53)		-6.80 (4.00)	-8.4 (22.81)		-39.9 (1.48)	-39.5 (5.54)
grade 8		-118.7 (12.51)	-108.9 (20.89)		-51.79 (13.99)	-50.4 (135.65)		-131.7 (2.61)	-123.7 (82.40)
school 2			-7.2 (33.17)		-41.38 (3.74)	-36.2 (4.16)		-36.9 (1.15)	-36.7 (2.57)
school 3								-94.29 (21.02)	-84.6 (6.58)
gender			-2.2 (6.18)			-11.6 (16.32)			-19.7 (4.44)
language other			-34.0 (20.56)			-79.9 (9.70)			-6.3 (6.34)
language foreign			-79.4 (20.41)			-24.8 (28.03)			6.2 (55.82)
parents secondary edu.			-27.8 (20.65)			-38.6 (12.74)			8.8 (11.72)
parents primary edu.			-55.9 (16.90)			-80.1 (27.54)			-12.2 (11.39)
occupHP			0.6 (0.05)			0.2 (0.28)			0.4 (0.11)
n. obs.	4442	4442	4367	4201	4201	3875	21260	21260	18545
adj. R^2	0	0.05	0.13	0	0.04	0.09	0.01	0.24	0.28

Notes: standard errors in square brackets. ° Only one generation of immigrant students.

Table A1.a. Tracking system. Dependent variable: student scores in Science (cont)

	LUX			MNE°			NLD		
variables	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
(Intercept)	511.5 (0.95)	574.02 (2.82)	558.3 (9.31)	411.39 (0.78)	460.08 (3.02)	477.7 (3.94)	534.42 (2.20)	638.27 (2.09)	631.1 (21.90)
2nd gen.	-66.22 (2.14)	-55.17 (2.12)	-22.1 (9.33)				-79 (3.61)	-49.17 (3.72)	-38.1 (23.30)
1st gen.	-66.87 (1.92)	-57.88 (1.77)	-26.6 (30.74)	24.19 (2.15)	21.48 (2.50)	25.4 (7.70)	-67.52 (3.67)	-30.31 (4.13)	-15.7 (4.84)
grade 9		4.24 (3.33)	-0.5 (27.16)		-19.39 (1.75)	-19.2 (9.53)		-29.39 (3.13)	-30.7 (8.12)
grade 8		-14.23 (2.98)	-20.6 (9.27)		-91.35 (12.84)	-89.2 (161.44)		0.25 (2.57)	-0.1 (33.09)
school 2		-61.74 (5.43)	-55.3 (18.10)		-73.82 (1.61)	-72.5 (13.73)		-93.86 (1.28)	-89.9 (11.68)
school 3		-97.98 (3.09)	-77.3 (14.74)		-63.4 (5.78)	-61.4 (10.13)		-205.95 (1.19)	-201.2 (5.57)
gender			-15.1 (9.34)			-15.4 (2.04)			-16.9 (2.17)
language other			-5.1 (15.20)			-14.9 (11.30)			
language foreign			-37.0 (7.31)			-19.6 (51.66)			-26.5 (11.40)
parents secondary edu.			-7.5 (32.31)			-7.1 (4.47)			-4.0 (15.63)
parents primary edu.			-22.6 (2.92)			-35.1 (13.55)			-7.1 (20.58)
occupHP			0.5 (0.03)			0.0 (0.17)			0.3 (0.04)
n. obs.	4490	4490	3787	4302	4302	3790	4787	4786	4628
adj. R^2	0.11	0.32	0.37	0	0.21	0.23	0.06	0.58	0.57
	PRT			**RUS**			**SVN°**		
(Intercept)	478.54 (2.16)	536.2 (7.61)	542.1 (30.99)	481.38 (0.45)	506.92 (0.76)	502.3 (8.26)	525.48 (1.11)	589.41 (1.97)	596.7 (8.17)
2nd gen.	-37.24 (21.98)	-16.32 (12.13)	-22.1 (35.06)	-12.98 (1.55)	-6.25 (1.54)	-4.8 (12.30)	-57.44 (2.34)	-40.8 (2.74)	-22.0 (32.19)
1st gen.	-66.92 (6.53)	-26.68 (3.57)	-29.2 (19.51)	-14.18 (2.80)	-9.94 (3.01)	-6.0 (40.62)			
grade 9		-52.49 (3.13)	-49.5 (12.73)		-30.62 (3.00)	-23.4 (33.48)		-72.3 (5.76)	-74.3 (81.40)
grade 8		-118.36 (2.20)	-114.4 (2.06)		-68.09 (3.92)	-56.2 (43.87)			
school 2		-30.77 (8.46)	-28.0 (13.54)		-16.91 (2.82)	-20.6 (21.90)		-89.47 (1.25)	-87.2 (11.19)
school 3		-48.72 (15.36)	-62.0 (104.03)		-84.93 (1.98)	-84.2 (24.28)		-166.32 (1.99)	-163.8 (11.12)
gender			-17.5 (12.96)			-9.3 (2.66)			-20.0 (5.62)
language other									-29.5 (117.14)
language foreign			0.8 (28.48)			-9.3 (2.66)			-29.3 (38.87)
parents secondary edu.			-10.6 (23.58)			-14.3 (1.55)			-10.6 (13.64)
parents primary edu.			-21.9 (9.95)			-46.6 (30.13)			-14.5 (24.68)
occupHP			0.4 (0.26)			0.4 (0.21)			0.2 (0.06)
n. obs.	5053	4960	4744	5714	5714	5677	6486	6486	6318
adj. R^2	0.02	0.44	0.45	0	0.11	0.17	0.03	0.47	0.48

Notes: standard errors in square brackets. ° Only one generation of immigrant students.

Table A32.b. Comprehensive systems. Dependent variable: student scores in Science

	AUS			CAN			DNK		
variables	Model 1	Model 2	Model 3	Model 1	Model 2		Model 1	Model 2	Model 3
(Intercept)	529.18 (0.42)	534.16 (0.45)	503.3 (4.20)	540.9 (1.71)	549.96 (1.33)	518.4 (11.57)	502.98 (5.26)	558.96 (5.26)	538.2 (38.60)
2nd gen.	-1.66 (1.58)	-4.28 (1.52)	1.9 (4.58)	-12.48 (1.53)	-16.95 (2.28)	-8.1 (2.36)	-85.4 (7.32)	-84.06 (7.82)	-36.9 (17.03)
1st gen.	-2.51 (4.46)	-0.19 (3.50)	2.6 (7.10)	-21.94 (1.42)	-21.19 (2.82)	-15.8 (8.92)	-88.64 (5.81)	-75.83 (8.07)	-32.1 (16.91)
grade 9		-51.32 (1.66)	-48.3 (1.64)		-47.88 (3.04)	-41.1 (5.66)		-50.52 (2.35)	-43.4 (42.34)
grade 8					-137.2 (4.95)	-115.2 (25.24)		-110.08 (6.74)	-101.5 (30.46)
gender			-2.8 (2.11)			-6.3 (7.07)			-14.3 (4.61)
language other			-174.4 (7.37)			-29.1 (15.78)			
language foreign			-16.7 (5.82)			-9.6 (10.67)			-39.5 (29.46)
parents secondary edu.			-25.1 (5.05)			-19.4 (6.91)			-21.9 (25.21)
parents primary edu.			-48.0 (2.63)			-45.1 (41.20)			-56.1 (44.15)
occupHP			0.9 (0.04)			0.8 (0.31)			0.6 (0.18)
n. obs.	13844	13844	13370	21743	21743	21167	4493	4493	4207
adj. R²	0	0.02	0.12	0.01	0.07	0.11	0.06	0.11	0.16
	ESP°			**EST°**			**GBR**		
(Intercept)	493.63 (4.16)	529.68 (3.13)	539.1 (11.42)	536.79 (0.46)	597.46 (3.96)	538.2 (64.57)	519.48 (1.20)	519.48 (1.20)	475.3 (11.25)
2nd gen.				-31.94 (1.73)	-38.26 (1.55)	-33.8 (5.09)	-26.42 (4.59)	-26.42 (4.59)	-9.0 (5.59)
1st gen.	-65.73 (9.98)	-37.74 (9.84)	-37.3 (11.32)	-41.72 (5.96)	-40.53 (6.84)	-37.3 (11.32)	-40.79 (11.32)	-40.67 (11.39)	-16.6 (24.98)
grade 9		-85.76 (1.69)	-40.2 (35.64)		-47.76 (3.63)	-40.2 (35.64)			
grade 8		-139.65 (2.65)	-81.8 (46.43)		-93.7 (4.44)	-81.8 (46.43)		-	
gender			-0.9 (11.27)			-0.9 (11.27)			-11.8 (9.07)
language other			-6.9 (13.98)			-6.9 (13.98)			-42.3 (14.73)
language foreign			-24.2 (35.94)			-24.2 (35.94)			-28.2 (38.56)
parents secondary edu.			-6.1 (7.89)			-6.1 (7.89)			-11.1 (0.91)
parents primary edu.			-27.2 (70.93)			-27.2 (70.93)			-68.1 (19.71)
occupHP			1.1 (0.18)			1.1 (0.18)			1.3 (0.15)
n. obs.	19367	19367	18602	4756	4756	4694	12751	12751	11790
adj. R²	0.03	0.31	0.30	0.01	0.09	0.14	0.01	0.01	0.09
	HKG			**LVA°**			**MAC**		
(Intercept)	546.75 (1.40)	561.3 (1.01)	605.0 (32.80)	491.82 (3.08)	565.31 (3.33)	539.1 (44.68)	503.95 (0.87)	546.19 (1.76)	537.7 (4.06)
2nd gen.	3.95 (1.67)	3.55 (1.70)	11.3 (19.43)				15.04 (1.44)	11.15 (0.88)	10.7 (1.12)
1st gen.	-25.89 (2.27)	20.86 (2.99)	26.5 (3.62)	-4.21 (6.92)	-15.6 (7.08)	-23.0 (21.76)	-3.59 (2.11)	21.2 (2.42)	23.6 (13.11)
grade 9		-44.98 (1.53)	-42.6 (7.80)		-63.39 (3.05)	-59.6 (15.64)		-47.86 (2.36)	-48.2 (2.99)
grade 8		-104.23 (3.28)	-90.4 (43.82)		-128.38 (2.69)	-119.3 (4.68)		-97.89 (1.40)	-99.3 (4.25)
gender			-11.7 (3.24)			0.3 (5.06)			-13.4 (3.84)
language other			-5.4 (27.38)			-25.0 (8.63)			14.9 (7.78)
language foreign			-72.2 (15.31)			-33.1 (123.93)			-4.4 (9.56)
parents secondary edu.			-25.9 (4.71)			-13.0 (3.40)			8.1 (5.37)
parents primary edu.			-47.4 (14.47)			-45.2 (91.92)			-2.4 (11.53)
occupHP			-0.2 (0.66)			0.6 (0.49)			0.0 (0.03)
n. obs.	4584	4584	4506	4596	4571	4474	4672	4672	4572
adj. R²	0.01	0.12	0.16	0	0.11	0.15	0.01	0.25	0.27

Notes: standard errors in square brackets. ° Only one generation of immigrant students.

Table A2.b. Comprehensive systems. Dependent variable: student scores in Science (cont.)

	NOR			NZL			QAT		
variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
(Intercept)	493.01 (1.27)	493.24 (1.25)	449.9 (31.28)	535.98 (0.51)	536 (0.46)	501.9 (5.53)	329.62 (0.87)	338.48 (0.67)	355.8 (11.32)
2nd gen.	-57.63 (3.93)	-57.43 (3.96)	-28.2 (42.55)	-28.09 (3.04)	-28.12 (3.16)	-10.6 (6.48)	36.23 (1.32)	34.61 (1.48)	33.7 (9.01)
1st gen.	-59.56 (6.10)	-57.57 (5.84)	-25.9 (18.56)	-9.96 (1.93)	-9.84 (1.46)	-5.8 (8.50)	83.92 (1.95)	80.71 (1.94)	75.4 (13.92)
grade 9		-64.78 (8.79)	-50.8 (111.82)			-59.9 (128.41)		-23.47 (1.05)	-18.3 (4.28)
grade 8								-62.17 (3.51)	-55.8 (7.39)
gender			3.3 (9.91)			3.0 (8.61)			29.6 (4.48)
language other			-82.6 (43.20)			-101.9 (201.41)			-7.4 (2.47)
language foreign			-23.9 (10.99)			-41.5 (10.01)			32.1 (20.14)
parents secondary edu.			-18.9 (17.33)			-24.7 (7.50)			-16.3 (3.10)
parents primary edu.			-63.6 (25.42)			-66.3 (7.35)			-14.8 (6.88)
occupHP			1.0 (0.77)			1.1 (0.13)		-23.47 1.05	-0.3 (0.30)
n. obs.	4585	4585	4398	4711	4711	4283	5718	5718	5501
adj. R^2	0.02	0.02	0.08	0	0	0.11	0.15	0.19	0.24

	SWE			USA		
variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
(Intercept)	512.05 (2.77)	563.27 (5.62)	492.8 (15.24)	498.86 (2.48)	509.76 (2.37)	505.6 (4.83)
2nd gen.	-47.6 (5.20)	-49.02 (4.82)	-21.5 (7.42)	-42.75 (5.43)	-41.48 (5.50)	-8.8 (8.48)
1st gen.	-78.11 (3.33)	-74.34 (3.21)	-40.6 (10.35)	-57.14 (9.97)	-52.94 (11.21)	-15.4 (54.47)
grade 9		-51.02 (6.16)	-40.0 (29.37)		-83.32 (1.64)	-75.9 (6.15)
grade 8		-129.23 (5.40)	-112.5 (25.13)		-161.26 (17.13)	-154.2 (18.40)
gender			-1.2 (6.16)			-6.8 (5.20)
language other			12.0 (67.53)			
language foreign			-33.2 (10.00)			-29.6 (58.02)
parents secondary edu.			-5.4 (15.07)			-34.6 (25.40)
parents primary edu.			-33.5 (4.42)			-57.6 (15.63)
occupHP			1.3 (0.05)			0.4 (0.11)
n. obs.	4362	4362	4157	5422	5420	5295
adj. R^2	0.04	0.06	0.14	0.03	0.12	0.16

Notes: standard errors in square brackets. ° Only one generation of immigrant students.

Table A3: Variables, PISA Codebook	
immigr	Status of immigration of student (categorical variable: first generation, second generation, native; intercept: native)
language	Foreign language spoken at home (categorical variable; intercept: test language)
language other	Other national language spoken at home
parents secondary edu.	Completed ISCED 3B, 3C
parents primary edu.	Not completed ISCED 3B, 3C
occupHP	Index of highest parental occupational status
gender	Gender of student (binary variable: intercept: male)
grade	The grade student is in (categorical variable: intercept: grade >9)
school	Type of school attended by the student. Categorical variable: 1 academic, 2 technical, 3 vocational. Intercept:1.

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