Migrant Youths' Educational Achievement: The Role of Institutions

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Abstract: We use 2009 Programme for International Student Assessment (PISA) data to link institutional arrangements in OECD countries to the disparity in reading, math, and science test scores for migrant and native-born students. We find that achievement gaps are larger for migrant youths who arrive at older ages and those who do not speak the test language at home. Institutional arrangements often serve to mitigate the achievement gaps of some migrant students while leaving unaffected or exacerbating those of others. For example, earlier school starting ages help migrant youths in some cases but by no means in all. Limited tracking on ability appears beneficial for migrants' relative achievement, while complete tracking and a large private school sector appear detrimental. Migrant students' achievement relative to their native-born peers suffers as educational spending and teachers' salaries increase, but improves when examination is a component of the process for evaluating teachers.

Keywords: Migrant Youths; PISA Test Scores; Schools; Institutions; Academic Achievement

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Introduction

There is a clear nexus between a nation's educational outcomes and its economic growth rate. However, it is not educational attainment per se but rather what students actually know—as measured by international standardized tests—that is important for economic growth (see Fuchs and Wößmann 2007; Hanushek and Wößmann 2011 for reviews). Relatively small improvements in cognitive skill levels can therefore translate into substantial improvements in a population's future well-being (Hanushek and Kimko 2000; OECD 2010a). This distinction between the quality versus quantity of education is critical because policies designed to increase educational attainment may not be the same ones that improve student achievement. It is perhaps not surprising then that researchers are increasingly turning to cross-country analyses of standardized cognitive-skills tests to understand which educational policies and which institutional arrangements lead to the best student outcomes (e.g., Bishop 1997; de Heus and Dronkers 2010; Fuchs and Wößmann 2007; Hanushek and Wößmann 2011; Schneeweis 2010; Schütz et al. 2005; 2007; Van de Werfhorst and Mijs 2010).

Against this backdrop, there are several reasons to be concerned about the tendency for migrants in many countries to underperform on cognitive-skills tests.[1] First, successful integration into the educational system is a particularly salient issue for the millions of children growing up in migrant families. Many European countries are experiencing serious problems in integrating migrants and their children (see Algan et al. 2010), while the U.S. educational system is struggling to cope with a sharp increase in the proportion of students who are "English Language Learners" (Fix and Capps 2005). Second, educational disparities tend to persist across generations, which can severely limit intergenerational income mobility (see Solon 2004; d'Addio 2007). Thus, the long-term economic and social integration of migrant communities is directly linked to their ability to make effective human capital investments and to pass these investments on to future generations. Finally, economic growth rates will be lower—and improvements in living standards slower—if education systems within host countries are not effective in fully developing the skills and talents of migrant children.

This paper contributes to this emerging literature on the role of education policies and institutions in student achievement by carefully analyzing cross-national differences in the nativity gap in cognitive-test scores.[2] Our objective is to understand which education systems, policies, and institutions are most effective in promoting the cognitive development and educational integration of migrant youths. To this end, we take advantage of Programme for International Student Assessment (PISA) data for 2009 that provide us with standardized math, science and language test scores for migrant and native-born students nearing the end of compulsory schooling across a range of countries. The PISA data are designed to measure broad competencies rather than understanding of the specific school curriculum, and are therefore useful in understanding the extent to which students have acquired the knowledge and skills that are essential in adulthood.

We conduct separate analyses for those migrant students who do and those who do not speak the host-country language at home, in order to account for the critical role of language in the formation of cognitive skills. Students with a migration background are also differentiated by their age at migration in order to account for the point at which they entered the host-country educational system. We then utilize a number of macro indicators capturing the nature of immigration policy and educational systems within each host country to shed light on the policies and institutional arrangements that are most effective in facilitating the educational integration of migrant youths.

Our focus on migrant youths' age at migration is fundamental to developing a deeper understanding of the pathways through which educational institutions matter and of the critical importance of language skills in achieving the educational integration of migrant children. At its most basic level, age at migration drives the combination of educational institutions to which children are exposed. Children arriving after age five, for example, miss out on any benefits associated with attending preschool in the host country. Those arriving during their high school years do not receive the intensive instruction in numeracy and literacy skills that they would have received in primary school. These gaps are important, as many researchers have argued that proficiency in the national language is critical if children with a migration background are to close the cognitive-skills gap vis-à-vis other children (for example, Dustmann, et al. 2011; Schneeweis 2010). There appears to be a critical age—consistent with critical periods in language acquisition—beyond which child migrants face a much greater risk of not completing high school (Corak 2012; Beck et al. 2012). Similarly, Washbrook et al. (2011) argue that cross-country differences in cognitive outcomes during the teen years have their roots in vocabulary deficits in early childhood, which are either ameliorated or amplified by public policy in the intervening years. The strength of these public policy effects almost certainly rests on the length of time children are exposed to them. Finally, differentiating migrant children by their age at arrival is useful in identifying why some educational institutions appear to have heterogeneous effects on children from different backgrounds (see Ammermüller 2005; Schneeweis 2010; Van de Werfhorst and Mijs 2010; Washbrook et al. 2011).

We find that achievement gaps are larger for migrant youths who arrive at older ages and for those who do not speak the test language at home.[3] Institutional arrangements often serve to mitigate the achievement gaps of some migrant students while leaving unaffected or exacerbating those of others. For example, earlier school starting ages help migrant youths in some cases but by no means in all. Limited tracking on ability appears beneficial for migrants' relative achievement, while complete tracking and a large private school sector appear detrimental. Migrant students' achievement relative to their native-born peers suffers as educational spending and teachers' salaries increase, but improves when examination is a component of the process for evaluating teachers.

In Section 2, we discuss the link between educational institutions and the relative achievement of students with a migration background. The details of the PISA data, estimation sample, achievement test scores, and institutional measures are presented in Section 3. Our estimation approach is outlined in Section 4. Section 5 documents the association between age at migration, the language spoken at home and institutional arrangements on the one hand, and the nativity gap in student achievement on the other. Finally, our conclusions and suggestions for future research are discussed in Section 6.

Educational Integration: Which Institutions Matter?

Institutional arrangements matter for economic and social outcomes because they set the incentives for economic agents and define the constraints under which they will operate. In their review of prior studies, Fuchs and Wößmann (2007) identify several key features of educational systems that have been theorized to impact on the quality of education. These include: (1) the balance of public versus private financing and provision; (2) the centralization of financing; (3) external versus teacher-based standards and examinations; (4) centralization versus school autonomy in curricular, budgetary and personnel decisions; and (5) performance-based incentive contracts.[4]

Cross-national studies of students' performance on standardized, cognitive-skills tests confirm that the institutional arrangements underpinning educational systems have major implications for both student achievement and the degree of intergenerational persistence in educational attainment. Curriculum-based external exit exams are associated with improved student achievement (Bishop 1997), for example. In general, student performance appears to be enhanced by a combination of (1) centralization of examinations and control mechanisms;

(2) school and teacher autonomy (over hiring, teaching methods, etc.); (3) limitations on teachers' unions; and (4) competition from private schools (Schütz et al. 2007; Wößmann 2007). Moreover, intergenerational mobility in educational attainment is promoted by earlier school starting ages and later tracking on ability (Bauer and Riphahn 2007; 2009). Together these results imply that that the way we choose to organize and fund schools has profound implications for economic growth, living standards, intergenerational equity, and social justice.

Researchers have turned their attention to understanding the ways that international differences in the organization of educational systems affect the educational achievement of migrant children specifically. Schools do not appear to function equally well for immigrant and native children. In Germany, for example, the children of immigrants and foreigners receive less education, are on less favorable education tracks, and have increasing difficulty in accessing vocational training (Gang and Zimmerman 2000; Frick and Wagner 2000). Educational attainment is also lower among immigrant youths in the Netherlands (Van Ours and Veenman 2003) and Denmark (Nielsen et al. 2003), while immigrant youths have an educational advantage in Canada (Aydemir et al. 2008) and Australia (Cobb-Clark and Nguyen 2010). Not surprisingly, the educational achievement of migrant children is closely tied to the educational background of their parents (see Dustmann et al. 2011), leaving selective immigration policy a major driver of cross-national differences in migrant children's relative educational achievement.

At the same time, researchers are working hard to find the link between educational outcomes for immigrant youths and the institutional design of national education systems themselves. Nolan (2009), for example, argues that second-generation youths achieve better educational outcomes in countries in which (1) there is a large tertiary sector[5] with easy access to higher education; (2) face-to-face contact is greater in terms of time; (3) the emphasis on homework is lower; and (4) more resources are provided for youths with learning problems, particularly language difficulties. Similarly, Schneeweis (2010) finds that the educational integration of migrant children is facilitated by preschool education, increased hours of instruction, and, at least for science, central (rather than local) examination of student outcomes.

There is little doubt that language acquisition is essential to children's educational achievement. In particular, literacy skills are the bedrock for building competency in math, science, social studies, etc. Many migrant children face an extra hurdle as they work to develop their skills in not one but two languages. It is perhaps not surprising that migrant children who speak the host-country language at home generally have an educational advantage over those who do not (e.g., Dustmann et al. 2011; Schneeweis 2010; Washbrook et al. 2011).

Economists studying the production of cognitive skills have begun to draw on the insights from developmental psychology, and they increasingly model cognitive achievement as a process that is cumulative, dependent on parents' and schools' investments, and sensitive to critical periods in a child's development (e.g. Cunha and Heckman 2008; Cunha et al. 2010; Todd and Wolpin 2003; 2006). Insights from this emerging literature are especially important for understanding migrant children's educational outcomes. In particular, Corak (2012) notes that second-language acquisition is firmly rooted in the idea of "critical" periods. Although the exact age at which any critical period might occur is subject to debate, "in general second-language competencies deteriorate for immigrants with age at arrival" (Corak 2012, 8).[6] This raises the possibility that critical periods in children's language development may manifest themselves as critical periods in other domains. In particular, children migrating to Canada or the United States after age nine have a substantially higher risk of not completing high school, which has important consequences for integration into host-country society (Beck et al. 2012; Corak 2012). These differences in the migration experiences of children make it vital to focus specifically on children's ages at migration when assessing their educational integration.

Literacy skills are not only critical for the development of competency in other areas, but they are also central to measuring both cognitive skills and academic achievement. Success on standardized achievement tests like PISA, for example, relies heavily on the ability to read and write, making it difficult to separate language proficiency from overall academic ability. Akresh and Akresh (2010) find that the foreign-born children of Hispanic immigrants who were randomly allowed to take a standard language achievement test in Spanish scored substantially higher than their peers who took the test in English. U.S.-born children of Hispanic immigrants, on the other hand, did significantly better if they were randomly assigned to take the test in English rather than Spanish. The authors conclude that a substantial portion of the Hispanic-white test gap in math and reading can be explained by test-score language bias. Similarly Washbrook et al. (2011) find that the young children of immigrants underperform in vocabulary tests despite exhibiting no differences in behavior or in nonverbal cognitive skills. Taken together, these results suggest that achievement tests and other cognitive skill measures, which are heavily reliant on literacy skills, may present a distorted picture of migrant children's overall competency. Unfortunately, this may have long-term consequences, as children who score poorly on achievement tests are often tracked into lower-level classes or less selective secondary schools (see Akresh and Akresh 2010).

Finally, it is important to note that host-country educational systems and social policy institutions may either accentuate or mitigate the particular challenges that migrant children face. Migrant children seem to fare better in English-speaking countries like Australia, Canada, New Zealand, the United Kingdom, and the United States, particularly when they have strong English language skills (e.g. Schneeweis 2010; Dustmann et al.

2011).[7] It is difficult to know whether this occurs because English has emerged as a dominant international language or because these countries have long histories of receiving—and therefore integrating—immigrants. The disparity in educational integration within English-speaking countries strongly suggests that immigration policy also plays an important role. Australia, and to a lesser extent Canada, explicitly select immigrants on the basis of their educational qualifications and language skills. Children with a migration background in these countries have parents who are generally highly educated and speak the national language at home—advantages that are reflected in the vocabulary test scores of very young migrant children (Washbrook et al. 2011).

Data

OECD Programme for International Student Assessment (PISA)[8]

The OECD Programme for International Student Assessment (PISA) is an internationally standardized assessment that was jointly developed by participating countries and administered to 15-year-olds in schools. The survey was administered in 43 countries in 2000 (first cycle), 41 countries in 2003 (second cycle), 57 countries in 2006 (third cycle), and 67 countries in 2009 (fourth cycle). In each country, tests are typically administered to between 4,500 and 10,000 students from at least 150 schools (OECD 2009).[9] PISA assesses the extent to which students near the end of compulsory education have acquired the knowledge and skills that are essential for full participation in society. In all cycles, reading, mathematics and science are covered not merely in terms of mastery of the school curriculum but in terms of important knowledge and skills needed in adult life.

Each student takes a two-hour handwritten test. The test include multiple-choice items and questions that require students to construct their own responses. The items are organized in groups based on a passage setting out a real-life situation. In total there are six and a half hours of assessment material, but each student is not tested on all the parts. Following the cognitive test, students also answer a background questionnaire that takes 20 to 30 minutes to complete and provides information about themselves and their homes. Finally, school principals are given a 20-minute questionnaire about their schools.

In this paper, we examine data from the most recent cycle of PISA undertaken in 2009. As in the initial cycle, the 2009 PISA focuses on reading literacy. We present results for this domain along with those for mathematics and scientific literacy. Because we are concerned with the role of immigration policies and educational institutions in explaining the relative performance of migrant youths, we restricted our analysis to OECD countries in order to eliminate sharp differences in political institutions or level of development.[10]

Analysis sample

We further restrict our analysis sample by dropping a small number of students (841 out of an initial sample of 298,454) who lack information on age, gender, or school grade. We also drop 6,131 students who lack country-of-birth information or who do not have country-of-birth information for at least one parent. Finally, we drop 2,372 students who are foreign-born but have no foreign-born parents, as they are likely to be a particularly nonrepresentative group. We then classify all remaining students into the following three groups: (1) native-born: those born in the country where the test was given who have no foreign-born parents; (2) first-generation migrant: those not born in the country where the test was given who have at least one foreign-born parent; and (3) second-generation migrant: those born in the country where the test was given who have at least one foreign-born parent.

First-generation migrant youths are then further classified into three groups based on their age at arrival: up to 4, 5–10, and 11–15. These age groups are chosen to correspond to the major school transition ages in most OECD countries. Because age at arrival is missing for 1,054 first-generation migrants, we are forced to drop these from the sample.[11] These restrictions result in a sample of 238,023 native-born, 14,818 first-generation migrant and 35,215 second-generation migrant students across 34 OECD countries.

Table 1 describes our final analysis sample. Sample sizes range from 3,451 for Iceland to 36,829 for Mexico, with a total sample size of 288,056. Overall, 82.6 percent of students are native-born, 5.1 percent are first-generation migrants and 12.2 percent are second-generation migrants. Among the OECD countries, Luxembourg has the largest proportion of first- and second-generation migrants, at 57 percent, followed by Australia and Switzerland at 42 percent and New Zealand at 41 percent. Korea has the smallest proportion of migrants at 0.3 percent, followed by Poland at 0.6 percent and Japan at 1.1 percent.

Table 1 about here

Measuring PISA Test Scores

PISA includes five plausible values for each test score based on random numbers drawn from the distribution of scores that could be reasonably assigned to each individual, that is, the marginal posterior distribution. This is a statistical method for recognizing that a student's performance on any individual assessment is somewhat random (see Adams and Wu 2002 for technical details). We derive mean test scores by averaging the plausible values in the data. The test scores are standardized across countries so that scores in each domain have a mean of 500 and a standard deviation of 100. In our regression analysis, we restandardize test scores in each domain to have a mean of zero and a standard deviation of 1 across our analysis sample in order to facilitate the interpretation of regression coefficients, which now represent standard deviation changes in the outcome of interest.

Table 2 presents the distribution of these test scores across countries by nativity and, for migrants, by language spoken at home. The results reveal that native-born students have considerably higher test scores than both first- and second-generation migrants in most countries, particularly when migrants do not speak the test language at home. That said, there are a few countries, specifically Australia, Hungary, Turkey, where it is only first-generation migrant youths not speaking the test language at home who do not outperform native-born youths, and others like Canada where the nativity achievement gap is relatively small across the board. Test score gaps are generally similar across the three domains.

Table 2 about here

Measuring educational institutions

Our objective is to understand how institutional arrangements affect the nativity achievement gap across countries. We pay particular attention to the way educational systems are organized, because the design of education policies may affect the performance of native-born and migrant youths differently. In addition, we control for variations in economic and demographic characteristics that are associated with the size and educational composition of immigrant populations and that may determine the educational achievement of migrant youths. In our analysis, the effect of institutional arrangements on educational achievement is captured through the inclusion of a series of country-level variables describing the education system in our regression model. These variables were generated using external country-level data.

Specifically, we generate variables for the primary school starting age (in years), the total duration of primary and secondary education (in years), and public spending on education as a percentage of gross domestic product (GDP), using data from the 2011 World Development Indicators and Global Development Finance Databank of the World Bank. We also generate the proportion of students in upper secondary education enrolled in public schools and average teachers' salaries (lower secondary education) after 15 years of experience/minimum training (in equivalent U.S. dollars adjusted for purchasing power parity, or PPP) using data from OECD (2010b). To obtain a measure of the relative income position of teachers, we divide their salaries by real GDP per capita (based on PPPs) using data from the World Economic Outlook database of the International Monetary Fund (IMF). We further use data from OECD (2007) to generate the age at which students are first tracked (selected) on ability in the education system, the existence of standards-based external examinations, and the percentages of students in schools in which the principal reported that achievement data were being used to evaluate teachers' performance and there was ability grouping for some or all subjects.

In addition to this set of variables describing educational systems, we also control for a country's economic and demographic characteristics by including the number of immigrants as a percentage of the national population (using data from the United Nations 2005; 2006), the Gini coefficient on income (using data from the World Bank Development Research Group and Statistics Iceland), and the logarithm of the GDP per capita measure mentioned above. Table 1 of the appendix shows how institutional arrangements vary by country.

These are of course not the only features of educational systems that might be of interest. In particular, we are not accounting for diversity within schools or the way that children are allocated to schools. Diversity measures are notoriously difficult to calculate and interpret. Our more parsimonious specification allows us to focus on the substantive differences in institutional arrangements.

The Estimation Model

Our empirical analysis of students' test scores begins with a linear regression model of the following form:

$$T_{isc} = \beta_o + M_{isc}\beta_1 + A_{isc}\beta_2 + E_{isc}\beta_3 + X_{isc}\beta_4 + \alpha_c + \varepsilon_{isc}$$
$$i = 1,\ldots,N, \qquad s = 1,\ldots.,S, \qquad c = 1,\ldots.,C, \tag{1}$$

where T is the reading, math or science test score of student i in school s of country c. M includes four population indicators that identify our three groups of first-generation migrants (i.e. those migrating at up to age four, age 5–10, and age 11–15) and the group of second-generation migrants. Additionally, *M* includes interactions between these four population indicators and an indicator variable for whether or not the student speaks the test language in a particular country at home. In other words, there are a total of eight migrant groups whose outcomes are then compared to those for native-born youths.

Our estimation model also includes a set of age (measured in months) and gender indicators (*A)*. Moreover, we account for the effects of immigrant selection across countries by controlling for variables related to immigrant parents (*E)*. Specifically, *E* contains the highest parental education in years, a variable indicating whether parental education is missing or not, and an indicator for whether or not migrant youths have two (versus one) foreign-born parents. We also include a vector of additional individual-specific control variables denoting the household composition, occupational status and employment status of the parents, home possessions, home educational resources, home computer possession, cultural possessions and the number of books at home (*X*).

Our regression model also includes country-specific fixed effects (α_c). These capture the direct impact of country-specific institutional arrangements on overall educational achievement in each country as well as any remaining country-specific factors that influence test scores for both native-born and migrant youths. We refer to equation (1) as our baseline model. In order to gauge the sensitivity of our results to alternative sets of controls, we also present and discuss the results of more parsimonious models in Section 5.1.

Our baseline model is useful in helping us understand the nativity achievement gap in OECD countries between students with the same demographic characteristics, family background, and home environment. It does nothing to shed light on the role of institutional arrangements in facilitating (or hindering) migrant students' relative academic achievement because any effects of host-country institutions are subsumed in the country-specific fixed effects. It is not possible to account for the effect of institutions on overall student achievement by adding country-level institutional controls directly to equation (1), since these controls would be perfectly collinear with the country-specific fixed effects. We can, however, account for the role of institutions in influencing the relative achievement of native-born and migrant students. Specifically, we estimate the following model:

$$T_{isc} = \beta_o + M_{isc}\beta_1 + A_{isc}\beta_2 + E_{isc}\beta_3 + X_{isc}\beta_4 + M_{isc}I_c\beta_5 + \alpha_c + \varepsilon_{isc}$$
$$i = 1,...,N, \quad s = 1,....,S, \quad c = 1,....,C, \tag{2}$$

where our country-level variables describing immigration policy and the education system are captured by the variable vector *I*. We interact the full set of country-level variables with our population indicators (*M*), with native-born youth as the omitted category. Hence, the coefficients in the vector β_5 are interpreted as the differential impact that each country-level characteristic has on test scores for migrant students arriving at different ages and with different languages spoken at home *relative* to the impact each characteristic has on test scores for native-born students. We refer to equation (2) as our full model. Selected results from this model are presented and discussed in Section 5.2.

Hanushek and Wößmann (2011) argue that the main challenge in identifying the causal effects of host-country institutions on educational outcomes is the likely presence of unobserved country-specific effects that are correlated with student achievement. In principle, this problem can be overcome with the inclusion of country-specific fixed effects, as we have done in equations (1) and (2). At the same time, we believe that an equally challenging problem results from the fact that policy formation itself is almost certainly endogenous. That is, educational policy typically changes in response to a perceived shortcoming in student achievement rather than exogenously. There is no straightforward solution to this endogeneity problem when relying upon observational data. Thus, we interpret our estimates as descriptive rather than causal.

Results

The nativity test-score gap and age at migration

Baseline estimates of the average nativity test-score gap by migrants' age at migration and language spoken at home are presented in Table 3. We consider three alternative specifications, each increasing in controls, as follows: (1) Specification A controls only for students' gender, students' age at the time they took the test, and country-specific fixed effects; (2) Specification B adds the controls for parents' education (*E*); and (3) Specification C is the baseline model given in equation (1). The first three columns capture the test-score gap between native-born youths on the one hand and first-generation migrant youths who speak the test language at home on the other hand. The next three columns reflect the test-score gap for first-generation migrants not speaking the test language at home, while results for second-generation migrant youths are presented in the final two columns. Given the parameterization of PISA test scores (see above), all nativity achievement gaps are expressed in terms of standard deviations.

Table 3 about here

When we control only for students' gender and age and country fixed effects (Specification A), we find that, on average, student achievement gaps in OECD countries are wider for migrant youths who arrive at older ages and for those who do not speak the test language at home. In particular, migrant youths arriving in the host country at age four or younger have reading scores at age 15 that are 0.120 standard deviations lower than their native-born counterparts if they speak the test language at home and 0.225 standard deviations lower if they do not. The reading gap for second-generation students speaking the test language at home is smaller but still statistically significant (0.075 standard deviations), while the reading achievement gap for second-generation students not speaking the test language at home is more than five times as large. All of these gaps are statistically significant.

The nativity gap in reading achievement increases sharply with migrant youths' ages at migration, whether or not the test language is spoken at home. In particular, the reading gap among youths who migrated in their primary-school years (ages 5–10) increases to 0.220 standard deviations if they speak the test language at home and to 0.331 standard deviations if they do not. For those migrating during their high school years (ages 11–15), the reading achievement gap is larger still. Increased exposure to the host-country educational institutions is clearly associated with smaller gaps in reading achievement. This relationship between age at migration and relative reading achievement provides one potential explanation for the increased risk of dropping out of high school that is observed for those youths migrating after age nine (see Beck et al. 2012; Corak 2012).

Consistent with previous evidence (Dustmann et al. 2011; Schneeweis 2010; Washbrook et al. 2011), reading achievement gaps are much larger for youths who do not speak the test language at home: 0.747 standard deviations versus 0.310 if migrating after age 10, for example. Importantly, these gaps persist into the second generation. In particular, second-generation migrant youths who do not speak the test language at home have a reading achievement gap that is similar in size to that of otherwise similar first-generation migrants who arrive during their primary-school years.

Nativity achievement gaps in math and science in OECD countries are strikingly similar to that in reading. In fact, only first-generation migrant youths arriving after age 10 and not speaking the test language at home have reading achievement gaps (0.747 standard deviations) that are larger than their achievement gaps in math (0.553 standard deviations) and science (0.700 standard deviations). In almost all other cases, the nativity achievement gap is wider in math and science than it is in reading. It is difficult to know whether this relative underperformance of migrant youths in math and science, however, reflects differences in academic achievement or language competency.[12] Math and science achievement gaps also widen for youths who have less exposure to host-country educational institutions and fewer opportunities to speak the host-country language. As was the case for reading achievement, there remains a sizeable achievement gap in both math and science among second-generation students who do not speak the test language at home.

The intergenerational persistence in educational achievement and attainment in OECD countries has been well documented (see d'Addio 2007). As immigrants in many OECD countries have less education than their native-born counterparts, it is not surprising then that the gaps in migrant youths' reading, math, and science achievement all fall substantially once we account for their parents' lower levels of education (Specification B). Achievement gaps across the three domains are virtually eliminated for first-generation migrants arriving before age 11 and for second-generation migrants once we account for parental education.[13] However, migrant youths who arrive at ages 11 through 15 continue to experience a gap in reading achievement at age 15 of 0.242–0.564 standard deviations. Gaps in math and science competency are similar. Interestingly, parental education does little to mitigate the penalty associated with very late migration. Those youth migrating at ages 11 through 15 remain between a fifth and a half standard deviation behind their native-born peers whether or not we control for parental education. It is possible that this gap results from the limited exposure that these young people have had to host-country schools. At the same time, it is possible that there is a negative selection effect. Families may be prepared to migrate with adolescent children only if those children are not particularly academically oriented.

In addition to accounting for parental education, it is important to account for the extent to which young people's families are able to support their human capital development.

To this end, our full model (Specification C) adds a number of controls that are designed to capture the effect of young people's socio-economic background (e.g. parents' occupational and employment status), household structure, and educational resources at home (possessions, books, computers, educational resources, etc.) on their reading, math, and science achievement.

Accounting for young people's family background often eliminates—and in some cases reverses—their achievement gaps. Immigrant youths arriving in the host country before age 11 are estimated to have significantly higher math achievement (approximately 0.15 standard deviations) at age 15 than do their native-born peers. Only immigrant youth arriving in the host country during the four years before PISA tests are administered and not speaking the test language at home continue to have a significant gap in achievement levels: 0.142 standard deviations (math) and 0.402 (reading). In virtually all other cases, accounting for the effect of family background in addition to parental income is sufficient to eliminate the nativity achievement gap.[14]

Overall, these results are consistent with the substantial international literature that demonstrates the importance of parental education and family resources in promoting children's educational achievement. Much of the achievement gap experienced by immigrant youths in OECD countries is by and large the result of their relatively disadvantaged circumstances. At the same time, it is clear that the extent of the achievement gap narrows as youths gain more exposure to host-country schooling and have more opportunities to speak the test language. There is a substantial achievement penalty, particularly in reading, associated with delayed migration for those not speaking the test language at home, even after we account for the parental education and family background.

The nativity test-score gap and educational institutions

We turn now to consider how the design of OECD countries' educational systems is related to the relative educational achievement of migrant students. In Table 4 (reading), Table 5 (math), and Table 6 (science), we present the estimated effects from a single regression model where each of our country-level educational controls is interacted with our population indicators (*M*C*). This allows us to assess whether specific institutional arrangements are associated with either an increased or a reduced nativity achievement gap in reading, math, or science. Although the coefficients are not presented here, the regression model in each case also controls for students' demographic characteristics (*A*), parental education (*E*), family background effects (*X*) and country fixed effects (see equation (2). Finally, as before, the parameterization of the PISA test scores implies that all nativity achievement gaps are expressed in terms of standard deviations. Negative values imply that a particular institution is associated with lower achievement among migrant students relative to their native-born counterparts (i.e., migrant students are disadvantaged), while positive values imply the opposite.

Tables 4 - 6 about here

Migrant students' relative achievement at age 15 is related to the host-country's school starting age. These effects, however, differ by the age at which migrant youths arrive and the specific domain under consideration. Migrant students' relative achievement is not significantly different in school systems with early (i.e., age five and younger versus standard school starting ages (i.e., age six).[15] Migrant students' relative academic achievement often suffers, however, in educational systems with older school starting ages (i.e., age seven), particularly when they do not speak the test language at home. For example, first-generation migrant students who do not speak the test language at home experience an additional achievement penalty (relative to native-born students) for starting school late, on the order of

0.2 to 0.3 standard deviations. This is perhaps not surprising in light of evidence that an earlier school starting age facilitates intergenerational mobility in educational attainment (Bauer and Riphahn 2007; 2009). We might expect, then, that starting school at an older age would be especially problematic for youths who, like their parents, are themselves immigrants and do not have the advantage of speaking the test language at home.

At the same time, the effect of school starting age on migrant students' relative achievement varies in complex ways across achievement domains and with migrants' age at arrival. The additional penalty associated with starting school late is largest in science, for example, for first-generation students who do not speak the language at home and who arrive young (0.308 standard deviations; see Table 6), while the largest penalty is in reading for those who arrive older (0.364 standard deviations; see Table 4). Starting school at older ages generally exposes first-generation migrants who speak the test language at home and arrive at age four or younger to an additional (relative to the native-born) achievement penalty, but gives those who arrive at ages 11 through 15 an additional achievement benefit. Finally, we find no significant effect of differences in the years of compulsory schooling on the relative reading, math, or science achievement of migrant students.[16] Taken together, these results indicate that additional exposure to host-country schooling benefits certain groups of migrant youth in some cases—as might be expected—but by no means in all.

The way that schools are organized and classes are formed may also affect migrant students' relative performance. In particular, educators often argue that educational outcomes can be improved if students' are tracked (streamed) on ability, yet the concern is that extensive tracking may disadvantage migrant students who may not have the same access to selective schools or enriched classes as their native-born peers.[17] Interestingly, we find that, across OECD countries as a whole, in many cases migrant students' relative academic performance is positively (rather than negatively) related to the extent of ability tracking in the educational system. For example, earlier tracking on ability is associated with a small improvement in the relative reading, math, and science achievement of first-generation migrant youths who arrive during their preschool years and speak the test language at home.[18] The same is true for first-generation migrant students arriving at ages 11 through 15 who do not speak the test language at home. The fact that these two very different groups of migrant students both benefit from being in educational systems that track students earlier is interesting and may point to the importance of migrants' having access to both remedial and extended instruction.[19]

Importantly, however, while some ability tracking (relative to no ability tracking) has additional achievement benefits for some migrant students, the reverse is occasionally true of complete ability tracking, i.e., tracking in all subjects. Moreover, second-generation migrants' relative math achievement rises with the proportion of upper-secondary students who attend public schools. On balance then, while some amount of tracking on ability seems to be associated with improvements in migrants' relative academic achievement, complete tracking—either across all subjects within schools or across the public-private school divide—is often associated with lower relative achievement levels for migrants.

We now consider how school resources and funding levels are related to migrant students' relative academic achievement across the OECD. Interestingly, we find no significant relationship between income levels (as measured by GDP per capita) and migrant students' relative achievement in OECD countries.[20] Controlling for per capita income, however, the association between academic achievement and increased educational expenditure (as a percent of GDP) is often significantly weaker for migrant students than it is for native-born students. For example, in countries with twice the education spending (as a percentage of GDP) the reading achievement of second-generation migrants relative to similar native-born students is between 0.304 (speak the test language at home) and 0.680 (do not speak the test language at home) standard deviations lower than for those migrant students in countries with less educational expenditure. Similarly, the link between achievement and higher teacher salaries is also significantly weaker for many migrant groups than it is for native-born students. To the extent that outcomes are better in countries that place greater emphasis on educational spending generally and teachers' salaries in particular, this implies that migrant students benefit less from this additional expenditure.

The degree of accountability in an educational system has also been linked to educational outcomes (see Hanushek and Wößmann 2011 for a review). It is often argued that external examinations of students provides an important signal of students' overall competency to potential employers, which can increase the incentives to invest in education. Teacher assessments, on the other hand, may be useful in ensuring teacher quality. We find that the link between external examinations and student achievement is in most cases not statistically different for native-born and migrant students. Where we do find significant effects, they are often negative, though not always. This is consistent with Schneeweis (2010), who also finds that external examinations have a mixed association with the educational integration of migrant youths. At the same time, migrant students' achievement relative to their native-born peers improves when examinations are a component of the process for evaluating teachers. In particular, the effect of exam-based teacher evaluation on achievement is larger for reading (0.261 standard deviations), math (0.43 standard deviations), and science (0.347 standard deviations) for first-generation migrant youths who speak the test language at home and who arrive before the start of primary school than it is for native-born students.

Finally, migrant youths' relative academic achievement is related to the wider social context. In particular, migrant students' relative academic achievement is enhanced in countries with proportionately larger foreign-born populations. These countries may simply have more experience in successfully integrating migrant youth into the educational system. While Schneeweis (2010) suggests that higher levels of income inequality reduce the educational integration of migrant students, we believe that the story is more nuanced. The relative achievement gap of first-generation migrant students arriving at younger ages (through age four) and speaking the test language at home is lower in countries with higher income inequality (as measured by the Gini coefficient). The opposite is true for similar migrant students who arrive at older ages (11–15).

Conclusions

The International Organization for Migration estimates that 214 million individuals—many of them children—are living outside their country of birth.[21] Many more children, while born in the host country, are nonetheless touched by the migration experiences of their parents. The successful integration of these first- and second-generation migrant children is critical to ensuring that their skills and talents are not wasted but rather contribute positively to future economic growth and improved living standards. Our goal is to shed light on the institutional arrangements that are most effective in promoting the cognitive development and educational integration of children with a migration background.

We find that achievement gaps are wider for those migrant youths who arrive at older ages and for those who do not speak the test language at home. Both conclusions are consistent with the emerging literature suggesting that critical periods in children's language development may result in critical periods in other competencies (Beck et al. 2012; Corak 2012). We also find that educational systems do not work equally well for native-born and migrant students, or indeed for all groups of migrant students. Certain institutional arrangements, for example, earlier school starting ages, appear to reduce the relative achievement gap for some migrant students while leaving unaffected or exacerbating the relative achievement gap of others. Other arrangements, such as tracking on ability, are beneficial for migrant students when implemented in a limited way, but become detrimental when implemented across the board. Finally, what works for native-born students does not always work for students with a migration background. In particular, migrant students' achievement relative to their native-born peers falls as proportionately more funding is devoted to educational spending generally and teachers' salaries in particular, but improves when examination is a component of the process for evaluating teachers. These results are particularly striking given that our country-specific fixed effects allow us to account for the multitude of ways that OECD countries differ from one another.

These results lead to a number of important conclusions. First, the relationship between specific institutional arrangements and migrant youths' relative achievement at age 15 depends in complex ways on the age at which those youths migrated. In effect, the institutional arrangements that benefit those arriving at younger ages may not provide the same benefits to those arriving at older ages. This implies that we need to know more about what works and why in order to design educational institutions that are sufficiently flexible. Second, the disparity in results between migrant youths who do and do not speak the language at home implies that the effectiveness of particular institutional arrangements may be sensitive to students' underlying language abilities. This is perhaps not surprising given the critical role of language in supporting learning across all domains. It does, however, pose real challenges for educators as they attempt to target interventions and resources toward the migrant students who need them most. Finally, one might expect that the academic achievement of second-generation migrant youths who speak the test language at home would be no different to that of their native-born peers. This is not always the case, however. Having migrant parents appears to pose additional challenges for second-generation youths who are not associated with their own personal migration experience or with their parents' educational attainment, their family background, or the language spoken at home. This raises the possibility that the way that migrant parents interact with and access their children's schools may be fundamentally different from otherwise similar native-born parents.

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Notes

[1] See the following for analyses of cross-country differences in the nativity gap in cognitive test scores: Dronkers (2010); Dustmann et al. (2011); Entorf (2005); Fossati (2010); Levels and Dronkers (2008); Schneeweis (2010); Schnepf (2007; 2008).

[2] The nativity gap refers to the difference in mean test scores for native-born and immigrant children.

[3] The language of the PISA test is typically the language of instruction of the school.

[4] See also Hanushek and Wößmann (2011) for a review of studies assessing international differences in educational achievement.

[5] The tertiary education sector encompasses all post-secondary education including universities and vocational education institutions.

[6] Bleakley and Chin (2010) exploit the fact that children learn languages more easily than adults to construct an instrument for language proficiency based on child immigrants' age at arrival. This instrument produces arguably exogenous variation in language proficiency because children do not choose the timing of their own immigration. The authors use instrumental variables estimation and find a significant positive effect of English proficiency on the adult wages of individuals who migrated to the United States as children.

[7] In fact, Schneeweis (2010) finds that immigrant children in English-speaking countries have higher math and science test scores than do otherwise similar native-born children.

[8] Much of the background information in this section is taken from the PISA website at http://www.pisa.oecd.org.

[9] In each cycle, a two-stage stratified sampling design is used. A random sample of schools is selected and then a random selection of students is chosen from each school.

[10] In particular, PISA also includes developing countries, such as Indonesia, and former socialist countries, such as Albania.

[11] This figure also includes a very small number of individuals who arrived at age 16 in the country of the exam and hence essentially took the exam immediately after arriving.

[12] Achievement gaps are substantially narrower when we do not control for country-specific fixed effects. This suggests that migrant youth are disproportionately located in countries where overall achievement in reading, math, and science is higher.

[13] The exceptions are that reading and math achievement gaps are small and marginally significant for: (1) first-generation immigrants arriving between the ages of five and 10 and speaking the test language at home; and (2) second-generation migrants not speaking the test language at home. Second-generation migrants not speaking the test language at home also experience a small and marginally significant gap in science achievement.

[14] The exception is that there continues to be a small and marginally significant gap in math achievement among second-generation immigrants speaking the test language at home.

[15] The exception is that starting school at age five or younger (rather than at age six) is associated with a small additional reading penalty (0.265 standard deviations) for first-generation migrant children arriving at age four or younger who speak the test language at home in comparison to the same effect for their native-born peers (see Table 4).

[16] Schneeweis (2010) finds that migrant students' relative academic achievement in math and science would improve with some expansion in annual school hours.

[17] In Germany, for example, migrant children are on less favorable education tracks and have increased difficulty in accessing vocational training (Frick and Wagner 2000; Gang and Zimmerman 2000).

[18] Earlier (versus later) tracking is associated with an improvement in second-generation migrant students’ science achievement relative to their native-born peers (see Table 6).

[19] Schneeweis (2010) finds, however, that the availability of enrichment classes is associated with lower relative math achievement for migrant students as a whole.

[20] Schneeweis (2010) finds a similar result in models that include country-specific effects.

[21] This represents 3.1 percent of the world's population. See http://www.iom.int/jahia/Jahia/about-migration/facts-and-figures/lang/en#.

TABLE 1
Nativity Distribution by Country and Language
(in percentages)

	Native-Born	1st Generation		2nd Generation		Sample Size
		Test Lang	Foreign Lang	Test Lang	Foreign Lang	
Australia	57.7	7.5	4.7	26.2	3.9	13,872
Austria	78.1	2.6	2.8	9.9	6.6	6,386
Belgium	73.9	3.6	3.2	13.5	5.8	7,955
Canada	64.5	4.5	6.8	18.9	5.2	22,265
Chile	98.1	0.6	0.0	1.1	0.1	5,475
Czech Republic	91.5	0.5	0.6	7.1	0.4	5,974
Denmark	83.5	2.0	1.6	10.5	2.4	5,698
Estonia	80.9	1.0	0.2	16.5	1.4	4,641
Finland	92.9	0.6	1.4	4.1	1.0	5,705
France	74.4	2.1	1.8	18.2	3.6	4,202
Germany	74.7	3.0	3.5	13.3	5.4	4,345
Greece	82.4	4.3	2.9	9.8	0.6	4,829
Hungary	95.1	1.3	0.1	3.3	0.1	4,543
Iceland	89.9	1.1	2.0	6.3	0.7	3,451
Ireland	74.9	7.7	3.6	13.4	0.5	3,605
Israel	66.4	2.9	4.4	22.9	3.3	5,404
Italy	88.4	2.0	2.7	5.9	1.0	30,257
Japan	98.9	0.1	0.1	0.9	0.0	6,047
Korea	99.7	0.1	0.0	0.2	0.0	4,924
Luxembourg	43.1	7.1	10.3	12.4	27.1	4,439
Mexico	96.6	0.9	0.2	2.2	0.1	36,829
Netherlands	80.1	1.7	2.2	13.2	2.8	4,644
New Zealand	59.1	10.3	8.8	18.1	3.7	4,481
Norway	84.9	1.0	3.1	7.7	3.3	4,555
Poland	99.4	0.0	0.0	0.6	0.0	4,818
Portugal	80.5	3.1	1.0	15.1	0.3	5,580
Slovak Republic	94.1	0.5	0.1	5.0	0.3	4,512
Slovenia	83.6	0.7	1.0	11.2	3.5	6,016
Spain	84.9	5.5	3.6	4.6	1.5	25,120
Sweden	77.5	1.9	2.5	13.6	4.4	4,436
Switzerland	58.3	5.1	4.3	24.2	8.1	11,391
Turkey	98.1	0.2	0.1	1.5	0.0	4,844
United Kingdom	80.9	2.6	3.1	11.3	2.1	11,733
United States	73.1	2.1	4.8	12.3	7.5	5,080

Notes: All results are weighted using the provided student weights.

TABLE 2
Average Test Scores by Nativity, Country and Language

	Native-Born			1st Generation						2nd Generation					
				Test Language			Foreign Lang			Test Language			Foreign Lang		
	Read	Math	Sci	Read	Math	Sci	Read	Math	Sci	Read	Math	Sci	Read	Math	Sci
Overall	495	492	501	-10	-14	-13	-27	-20	-30	3	-2	-3	-25	-30	-33
Australia	511	510	525	20	12	12	-7	8	-11	17	14	14	12	28	6
Austria	482	508	509	-82	-66	-89	-87	-70	-95	-24	-30	-31	-53	-55	-75
Belgium	525	536	528	-38	-52	-53	-79	-82	-85	-26	-35	-34	-76	-79	-77
Canada	526	530	534	1	-11	-8	-10	-4	-15	6	-4	-4	-9	-4	-21
Chile	451	423	449	-7	-24	-22				13	16	13	-18	-43	-25
Czech Republic	480	495	502	-8	-4	-1	8	6	9	-17	-19	-20	17	14	-2
Denmark	501	511	508	-37	-50	-41	-75	-74	-94	-15	-25	-24	-58	-62	-85
Estonia	508	519	535	-13	-11	-17	-60	-71	-69	-30	-33	-34	-35	-32	-41
Finland	539	543	557	-45	-42	-50	-85	-62	-90	-15	-21	-20	-51	-41	-60
France	506	509	510	-58	-55	-61	-67	-63	-65	-24	-32	-30	-72	-73	-77
Germany	515	530	542	-53	-51	-59	-58	-51	-72	-28	-34	-42	-60	-64	-87
Greece	489	471	475	-37	-28	-29	-70	-63	-59	-5	-2	-4	-24	-24	-22
Hungary	494	490	502	4	6	2	-15	-24	21	31	27	29	85	43	67
Iceland	504	510	498	-45	-49	-48	-63	-43	-49	-7	-12	-12	-50	-30	-35
Ireland	499	489	509	1	-2	5	-49	-27	-31	14	13	19	-10	-26	-49
Israel	473	445	453	-18	-10	-26	5	12	0	23	22	23	47	36	43
Italy	491	487	494	-57	-45	-64	-77	-64	-75	-2	-2	-2	-41	-27	-33
Japan	521	530	541	35	54	8	-34	8	-60	-38	-38	-37	-16	-20	-11
Korea	540	547	539	-6	-11	-18				-28	-40	-43			
Luxembourg	500	516	515	-29	-30	-31	-57	-57	-67	-56	-51	-62	-41	-43	-48
Mexico	430	423	420	-93	-81	-62	-109	-92	-75	-54	-54	-41	-85	-58	-44
Netherlands	516	535	533	-35	-38	-48	-42	-56	-77	-21	-30	-31	-52	-62	-72
New Zealand	522	521	537	31	25	21	-30	-17	-34	11	4	5	-53	-46	-63
Norway	508	503	506	5	4	1	-64	-65	-78	-4	-4	-7	-45	-47	-62
Poland	502	496	510	70	165	137				12	-8	-10			
Portugal	500	497	502	-26	-30	-25	-24	-4	-16	9	6	9	-50	-46	-60
Slovak Republic	479	498	492	-15	-11	-7	-8	-38	-47	-5	-4	-5	-50	-57	-52

Slovenia	489	508	519	-61	-73	-61	-71	-89	-80	-16	-21	-24	-45	-46	-65
Spain	488	491	495	-45	-59	-49	-69	-63	-69	5	-3	2	-10	-16	-12
Sweden	507	504	506	-43	-44	-51	-84	-62	-87	-12	-18	-19	-59	-58	-70
Switzerland	512	552	534	-31	-51	-40	-74	-92	-91	-7	-20	-21	-43	-59	-63
Turkey	465	446	455	63	97	62	-78	-53	-55	36	49	33	5	28	-5
United Kingdom	498	496	518	-9	-15	-2	-44	-33	-38	7	3	4	-27	-19	-36
United States	505	494	510	13	4	0	-26	-19	-33	-1	-8	-13	-32	-39	-41
Observations		238,023			7,696			7,122			27,422			7,793	

Notes: All results are weighted using the provided student weights. The figures for migrant groups are relative to those for the native-born in the same country.

TABLE 3
Overall Migrant Test Score Gap in OECD Countries
(standard errors)

	1st Generation - Test Language Spoken at Home			1st Generation - Foreign Language Spoken at Home			2nd Generation	
Age at Arrival	Age 0-4	Age 5-10	Age 11-15	Age 0-4	Age 5-10	Age 11-15	Test Language	Foreign Language
A) Controlling for Country Fixed Effects - R-Squared: Reading = 0.133, Math = 0.155, Science = 0.151								
Reading	-0.120*	-0.220***	-0.310***	-0.225***	-0.331***	-0.747***	-0.0749***	-0.394***
	(0.068)	(0.066)	(0.078)	(0.074)	(0.059)	(0.066)	(0.027)	(0.044)
Math	-0.185***	-0.237***	-0.332***	-0.195***	-0.272***	-0.553***	-0.131***	-0.437***
	(0.057)	(0.065)	(0.070)	(0.064)	(0.056)	(0.065)	(0.026)	(0.041)
Science	-0.165**	-0.244***	-0.375***	-0.302***	-0.392***	-0.700***	-0.149***	-0.485***
	(0.066)	(0.064)	(0.076)	(0.069)	(0.059)	(0.067)	(0.027)	(0.044)
B) Controlling for Parental Education and Country FEs - R-Squared: Reading = 0.210, Math = 0.232, Science = 0.227								
Reading	-0.052	-0.126*	-0.242***	0.009	-0.070	-0.564***	0.001	-0.0814*
	(0.064)	(0.066)	(0.074)	(0.072)	(0.052)	(0.056)	(0.025)	(0.046)
Math	-0.085	-0.105*	-0.223***	0.084	0.036	-0.327***	-0.036	-0.0839**
	(0.054)	(0.063)	(0.066)	(0.063)	(0.048)	(0.055)	(0.023)	(0.042)
Science	-0.030	-0.072	-0.225***	0.020	-0.041	-0.427***	-0.034	-0.0929**
	(0.062)	(0.064)	(0.071)	(0.067)	(0.052)	(0.057)	(0.025)	(0.045)
C) Controlling for Parental Education, Socioeconomic Status and Child Resources, and Country FEs - R-Squared: Reading = 0.365, Math = 0.383, Science = 0.376								
Reading	-0.024	-0.051	-0.075	0.062	0.042	-0.402***	-0.001	-0.046
	(0.052)	(0.053)	(0.066)	(0.069)	(0.050)	(0.054)	(0.022)	(0.042)
Math	-0.047	-0.018	-0.041	0.146**	0.153***	-0.142***	-0.0333*	-0.044
	(0.044)	(0.050)	(0.057)	(0.058)	(0.047)	(0.050)	(0.019)	(0.038)
Science	0.000	0.005	-0.055	0.072	0.068	-0.262***	-0.033	-0.058
	(0.050)	(0.052)	(0.062)	(0.065)	(0.051)	(0.055)	(0.021)	(0.042)
Observations = 288,056								

Notes: All regressions include controls for child age, gender and country fixed effects. The second panel adds controls for parent's highest years of education, whether this is missing, and whether any parent was born in the test country. The third panel adds extensive controls for parental socioeconomics status and educational investments. Robust standard errors that account for school (and country) level correlation in errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 4
Relationship between Country-Level Policies and Migrant Reading Test Score Gap in OECD Countries
(standard errors)

	1st Gen - Test Language Spoken at Home			1st Gen - Foreign Language Spoken at Home			2nd Generation	
Age at Arrival	Age 0-4	Age 5-10	Age 11-15	Age 0-4	Age 5-10	Age 11-15	Test Lang	Foreign Lang
Log Real GDP Per Capita (PPP)	0.070	0.146	0.258	0.114	0.342*	0.253	0.032	0.056
	(0.222)	(0.221)	(0.275)	(0.233)	(0.178)	(0.255)	(0.082)	(0.151)
Gini Coefficient on Income	-2.148**	0.039	3.680**	0.648	0.254	-0.138	0.341	0.046
	(0.950)	(1.031)	(1.519)	(0.934)	(0.775)	(1.110)	(0.339)	(0.632)
Log Percent Foreign-born	0.0994**	0.037	0.204**	0.300***	0.121*	0.085	0.144***	0.228***
	(0.039)	(0.082)	(0.094)	(0.051)	(0.063)	(0.099)	(0.019)	(0.055)
School Starting Age <=5	-0.265*	-0.090	-0.021	-0.124	-0.153	0.252	-0.080	-0.039
	(0.137)	(0.186)	(0.299)	(0.212)	(0.191)	(0.196)	(0.067)	(0.157)
School Starting Age =7	-0.142*	0.035	0.225*	-0.296**	-0.207**	-0.364***	0.020	-0.033
	(0.081)	(0.110)	(0.126)	(0.122)	(0.089)	(0.112)	(0.035)	(0.072)
Years of Compulsory School	0.027	-0.013	0.020	0.033	-0.073	-0.003	0.038	0.010
	(0.070)	(0.096)	(0.167)	(0.093)	(0.077)	(0.107)	(0.031)	(0.061)
Log Educational Expenditure (% GDP)	-0.539***	-0.927***	-0.224	0.038	-0.706***	-0.194	-0.304***	-0.680***
	(0.177)	(0.248)	(0.244)	(0.273)	(0.234)	(0.225)	(0.103)	(0.195)
Log Percent Upper Secondary Public	-0.057	-0.012	-0.113	0.438	0.204	0.226	0.047	0.174
	(0.152)	(0.183)	(0.274)	(0.288)	(0.195)	(0.226)	(0.068)	(0.163)
Log (Teacher's Salaries / GDP PC)	0.021	-0.399**	-0.398	-0.173	-0.103	-0.501**	-0.074	-0.247**
	(0.111)	(0.172)	(0.274)	(0.171)	(0.163)	(0.235)	(0.050)	(0.099)
Age of First Selection	0.0485***	0.0399**	0.020	0.019	0.009	0.0617***	0.006	0.017
	(0.017)	(0.018)	(0.030)	(0.020)	(0.015)	(0.022)	(0.008)	(0.014)
External Examination	0.013	-0.025	-0.175	-0.190*	0.162	-0.062	0.030	0.031
	(0.088)	(0.120)	(0.163)	(0.107)	(0.120)	(0.130)	(0.032)	(0.073)
Some Ability Grouping	0.262	0.663***	0.514*	-0.001	0.269	0.096	0.126*	0.185
	(0.177)	(0.209)	(0.294)	(0.209)	(0.231)	(0.249)	(0.070)	(0.149)
Ability Grouping for All Subjects	0.110	0.309	-0.912	0.098	-0.122	1.331**	-0.061	0.151
	(0.395)	(0.387)	(0.689)	(0.403)	(0.352)	(0.531)	(0.140)	(0.250)
Teachers Evaluated Based on Exams	0.261*	-0.234	-0.040	0.111	0.132	0.107	0.120**	0.174*
	(0.155)	(0.145)	(0.224)	(0.220)	(0.133)	(0.169)	(0.055)	(0.104)
Observations = 288,056								

Notes: All regressions include controls for country fixed effects, child age and gender, parent's highest years of education, whether this is missing, and whether any parent was born in the test country and extensive controls for parental socioeconomics status and educational investments. The school starting age variables are relative to the excluded group of Starting Age =6. Robust standard errors that account for school (and country) level correlation in errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 5
Relationship between Country-Level Policies and Migrant Math Test Score Gap in OECD Countries
(standard errors)

	1st Gen - Test Language Spoken at Home			1st Gen - Foreign Language Spoken at Home			2nd Generation	
Age at Arrival	Age 0-4	Age 5-10	Age 11-15	Age 0-4	Age 5-10	Age 11-15	Test Lang	Foreign Lang
Log Real GDP Per Capita (PPP)	-0.080	0.234	0.247	0.194	0.129	0.354	0.012	-0.112
	(0.191)	(0.212)	(0.231)	(0.206)	(0.179)	(0.253)	(0.078)	(0.140)
Gini Coefficient on Income	-2.135**	0.920	3.198**	1.064	0.425	-0.198	0.328	-0.271
	(0.874)	(1.024)	(1.352)	(0.880)	(0.767)	(1.090)	(0.327)	(0.595)
Log Percent Foreign-born	0.054	-0.001	0.222**	0.170***	0.096	0.065	0.123***	0.167***
	(0.036)	(0.071)	(0.101)	(0.046)	(0.059)	(0.101)	(0.019)	(0.050)
School Starting Age <=5	-0.041	-0.202	-0.047	-0.113	-0.215	0.069	-0.019	0.226
	(0.126)	(0.185)	(0.313)	(0.202)	(0.188)	(0.186)	(0.072)	(0.157)
School Starting Age =7	-0.151	0.114	0.002	-0.185	-0.225**	-0.297***	0.008	-0.060
	(0.092)	(0.135)	(0.142)	(0.126)	(0.094)	(0.109)	(0.040)	(0.077)
Years of Compulsory School	-0.029	-0.021	0.346*	0.021	-0.022	0.041	0.028	-0.047
	(0.077)	(0.120)	(0.197)	(0.089)	(0.072)	(0.104)	(0.037)	(0.063)
Log Educational Expenditure (% GDP)	-0.713***	-1.045***	0.154	-0.281	-0.712***	-0.370	-0.455***	-0.796***
	(0.189)	(0.272)	(0.262)	(0.265)	(0.240)	(0.234)	(0.112)	(0.212)
Log Percent Upper Secondary Public	0.192	0.204	0.399	0.418	0.288	0.407**	0.161**	0.348**
	(0.145)	(0.171)	(0.287)	(0.257)	(0.186)	(0.203)	(0.069)	(0.149)
Log (Teacher's Salaries / GDP PC)	-0.082	-0.224	-0.716**	-0.136	-0.113	-0.341	-0.075	-0.347***
	(0.108)	(0.179)	(0.281)	(0.167)	(0.165)	(0.222)	(0.052)	(0.104)
Age of First Selection	0.0535***	0.021	-0.008	0.017	0.005	0.0481**	0.009	0.016
	(0.017)	(0.021)	(0.034)	(0.021)	(0.016)	(0.020)	(0.008)	(0.014)
External Examination	0.006	0.077	-0.416**	-0.005	0.175*	-0.050	0.008	0.043
	(0.091)	(0.120)	(0.168)	(0.100)	(0.100)	(0.128)	(0.034)	(0.071)
Some Ability Grouping	0.079	0.601***	0.014	0.190	0.500***	0.186	0.091	0.198
	(0.178)	(0.210)	(0.301)	(0.192)	(0.186)	(0.241)	(0.072)	(0.146)
Ability Grouping for All Subjects	0.195	-0.691*	-1.663**	-0.244	-0.586*	-0.160	-0.120	0.126
	(0.383)	(0.416)	(0.681)	(0.390)	(0.339)	(0.466)	(0.143)	(0.243)
Teachers Evaluated Based on Exams	0.343**	-0.068	0.445**	0.004	0.026	0.258*	0.184***	0.008
	(0.149)	(0.157)	(0.223)	(0.196)	(0.127)	(0.155)	(0.056)	(0.099)
Observations = 288,056								

Notes: All regressions include controls for country fixed effects, child age and gender, parent's highest years of education, whether this is missing, and whether any parent was born in the test country and extensive controls for parental socioeconomics status and educational investments. The school starting age variables are relative to the excluded group of Starting Age =6. Robust standard errors that account for school (and country) level correlation in errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE 6
Relationship between Country-Level Policies and Migrant Science Test Score Gap in OECD Countries
(standard errors)

	1st Gen - Test Language Spoken at Home			1st Gen - Foreign Language Spoken at Home			2nd Generation	
Age at Arrival	Age 0-4	Age 5-10	Age 11-15	Age 0-4	Age 5-10	Age 11-15	Test Lang	Foreign Lang
Log Real GDP Per Capita (PPP)	-0.091	0.013	0.165	-0.128	-0.063	0.045	-0.129	-0.179
	(0.220)	(0.207)	(0.268)	(0.231)	(0.186)	(0.294)	(0.083)	(0.141)
Gini Coefficient on Income	-2.298**	1.066	3.372**	2.104**	0.639	1.033	0.142	0.622
	(0.928)	(0.981)	(1.495)	(0.943)	(0.792)	(1.234)	(0.338)	(0.563)
Log Percent Foreign-born	0.008	0.031	0.227***	0.222***	0.104	0.107	0.105***	0.183***
	(0.038)	(0.061)	(0.084)	(0.046)	(0.064)	(0.122)	(0.018)	(0.045)
School Starting Age <=5	-0.093	0.069	0.133	-0.079	-0.213	0.226	0.025	0.041
	(0.134)	(0.185)	(0.290)	(0.220)	(0.194)	(0.210)	(0.068)	(0.157)
School Starting Age =7	-0.193**	0.101	0.274**	-0.308**	-0.185*	-0.173	-0.055	-0.066
	(0.084)	(0.117)	(0.122)	(0.132)	(0.097)	(0.115)	(0.035)	(0.076)
Years of Compulsory School	0.048	-0.039	0.005	0.100	0.003	0.022	0.033	-0.023
	(0.069)	(0.100)	(0.147)	(0.091)	(0.079)	(0.124)	(0.032)	(0.062)
Log Educational Expenditure (% GDP)	-0.399**	-0.752***	-0.082	0.123	-0.749***	-0.419	-0.185*	-0.721***
	(0.175)	(0.217)	(0.227)	(0.282)	(0.235)	(0.264)	(0.099)	(0.198)
Log Percent Upper Secondary Public	-0.001	0.227	0.002	0.379	0.090	0.052	0.135**	0.165
	(0.141)	(0.164)	(0.260)	(0.277)	(0.196)	(0.231)	(0.069)	(0.158)
Log (Teacher's Salaries / GDP PC)	-0.066	-0.247	-0.122	-0.324*	-0.267	-0.559**	-0.0957*	-0.369***
	(0.110)	(0.174)	(0.283)	(0.175)	(0.170)	(0.258)	(0.050)	(0.105)
Age of First Selection	0.0587***	0.0327*	-0.028	0.034	0.005	0.0442**	0.0178**	0.0419***
	(0.017)	(0.019)	(0.029)	(0.023)	(0.017)	(0.021)	(0.008)	(0.013)
External Examination	-0.072	-0.067	-0.326**	-0.110	0.133	-0.126	0.001	-0.007
	(0.084)	(0.112)	(0.166)	(0.096)	(0.112)	(0.146)	(0.031)	(0.071)
Some Ability Grouping	0.221	0.382*	0.453	-0.035	0.448**	-0.038	0.096	0.093
	(0.168)	(0.200)	(0.287)	(0.190)	(0.218)	(0.275)	(0.069)	(0.144)
Ability Grouping for All Subjects	0.393	-0.249	-1.468**	0.282	-0.375	0.117	0.118	0.383
	(0.373)	(0.406)	(0.669)	(0.397)	(0.382)	(0.503)	(0.151)	(0.253)
Teachers Evaluated Based on Exams	0.347**	-0.015	0.129	-0.286	0.094	0.223	0.0987*	0.070
	(0.156)	(0.146)	(0.209)	(0.219)	(0.139)	(0.185)	(0.057)	(0.115)
Observations = 288,056								

Notes: All regressions include controls for country fixed effects, child age and gender, parent's highest years of education, whether this is missing, and whether any parent was born in the test country and extensive controls for parental socioeconomics status and educational investments. The school starting age variables are relative to the excluded group of Starting Age =6. Robust standard errors that account for school (and country) level correlation in errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

APPENDIX
Distribution of Country-Level Policies across OECD Countries

	Mean	Std. Dev.	25th Pctile	Median	75th Pctile
A) Each Country Given Equal Weight					
Real GDP Per Capita (PPP)	33,899	13,068	27,036	34,911	38,818
Gini Coefficient on Income	0.333	0.068	0.283	0.329	0.360
Proportion Foreign-born	0.104	0.090	0.031	0.085	0.138
School Starting Age <=5	0.118				
School Starting Age =6	0.676				
School Starting Age =7	0.206				
Years of Compulsory School	12.410	0.609	12.000	12.000	13.000
Educational Expenditure (% GDP)	0.051	0.011	0.043	0.051	0.057
Percent Upper Secondary Public	0.834	0.154	0.775	0.875	0.942
Teacher's Salaries / GDP Per Capita	1.094	0.346	0.871	1.069	1.265
Age of First Selection	13.910	2.021	12.000	15.000	16.000
External Examination	0.619				
No Ability Grouping	0.348	0.241	0.179	0.296	0.531
Some Ability Grouping	0.520	0.245	0.362	0.453	0.749
Ability Grouping for All Subjects	0.132	0.123	0.049	0.090	0.186
Teachers Evaluated Based on Exams	0.456	0.286	0.249	0.396	0.753
Observations = 34					

B) Weighted by Eligible PISA Population of Each Country					
Real GDP Per Capita (PPP)	33,697	11,642	27,641	35,189	47,335
Gini Coefficient on Income	0.370	0.077	0.316	0.360	0.408
Proportion Foreign-born	0.081	0.063	0.016	0.090	0.128
School Starting Age <=5	0.079				
School Starting Age =6	0.852				
School Starting Age =7	0.069				
Years of Compulsory School	12.180	0.513	12.000	12.000	12.000
Educational Expenditure (% GDP)	0.048	0.008	0.043	0.049	0.055
Percent Upper Secondary Public	0.817	0.145	0.692	0.888	0.914
Teacher's Salaries / GDP Per Capita	1.189	0.332	0.930	1.016	1.383
Age of First Selection	14.190	1.994	12.000	15.000	16.000
External Examination	0.509				
No Ability Grouping	0.322	0.250	0.127	0.281	0.525
Some Ability Grouping	0.556	0.260	0.391	0.459	0.799
Ability Grouping for All Subjects	0.122	0.093	0.074	0.081	0.186
Teachers Evaluated Based on Exams	0.488	0.243	0.285	0.416	0.754
Observations = 288,056					

Notes: See the paper for further details on how each variable is defined. Student weights provided by PISA are used in panel B.