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Abstract
The aim of this paper is to empirically test the negative selectivity hypothesis of Europe's guest-worker immigration. We do this by comparing the educational achievement of children of guest-worker immigrants in various European countries to the educational achievement of the pupils in their origin countries, using the PISA 2006 data. Our analysis supports the thesis that guest-workers in Europe have been negatively selected from their native population. The average science score of children of guest-workers is substantially lower than the science score of comparable native pupils in their origin countries. The Islamic background of the Turkish guest-workers is not related to the negative selectivity of guest-workers in Europe. However, a large gap between the science performance of immigrants and the native population in their home countries is also observed for first generation Austrian and French immigrant pupils and for second generation German pupils. A possible explanation is that non-guest-worker immigrants in Europe also have more difficulties in establishing themselves in their new home countries as compared to immigrants in the traditional immigration countries (e.g. the USA, Australia, and Canada).

Keywords: immigration; guest-workers; selectivity of immigration; educational performance

Introduction
PISA 2003 and 2006 data have revealed that Turkish immigrant pupils perform significantly less than immigrant pupils from other countries of origin. These lower scores of Turkish immigrant pupils cannot be fully explained by their individual background characteristics (e.g. parental education, parental occupational status, resources available in their homes, and language proficiency) or by economic or educational system characteristics of the countries they have migrated to (Levels and Dronkers, 2008; de Heus, Dronkers, and Levels, 2008).

An important explanation that has been raised to explain the (remaining) educational disadvantage of Turkish immigrant pupils is the negative selectivity of 'guest-worker migration'. Guest-worker programs were implemented in the 1950s as the need for workers in low skilled jobs could no longer be filled by natives. Countries such as Germany, Belgium, Austria, and Switzerland recruited inexpensive and unskilled laborers from the poorest and most backward rural regions of Turkey, Italy, Portugal, Spain, and the former Yugoslavia (Hunn, 2005).

No study so far has empirically tested the influence of immigrants' guest-worker origins on their educational performance. Therefore, this paper aims to establish whether the educational performance of children from origin groups that have a guest-worker past is lower than the educational performance of native pupils in their countries of origin. Such a lower educational performance would be a strong indicator of the negative selectivity of guest-worker programs. In order to rule out the possibility that all immigrant groups are equally negatively selected, the discrepancy between the educational performance of immigrant children from non-guest-worker origins and the educational performance of native pupils in their origin countries will

also be analyzed. Comparing the educational performance of immigrant children to the performance of pupils in their origin countries provides a more reliable estimation of selective migration than comparing the educational level of the migrating parents to the educational level of the native parents in their origin countries.

In order to rule out the possibility that other characteristics of immigrants' countries of origin and destination can explain the educational disadvantage of certain origin groups, we connect to previous research by taking into account religious, economic, and political indicators of countries of origin and educational system features of countries immigrants have migrated to.

Theories and empirical evidence on immigrant selectivity[1]

Immigrants are selected on various characteristics such as education, occupation, skills, age, ambition, and gender. The (self-)selection process of all these characteristics occurs on several complex and interrelated levels. First, since only some people want to migrate and have the resources to do so, the choice to emigrate is in itself a selective one. Second, countries such as the former Soviet Union have historically had restrictive exit policies that only allowed a select group of individuals to emigrate. Countries such as Australia and New Zealand have adopted a qualification system to encourage the selection of highly skilled immigrants (Winkelmann, 2001; Levels, Dronkers, and Kraaykamp, 2008). In other words, countries' immigration policies influence the composition of their immigrant compositions. Third, political and economic conditions in the sending country influence the nature of the migrant flows (Massey, 1999; Rumbaut, 1997). Fourth, the demand for certain types of workers (for instance, unskilled workers or guest-workers) affects the selectivity of economic immigrants from different countries (Massey, 1999). And finally, the historical relationship between receiving country and sending country (for instance Portugal and Brazil) guides immigrant selection.

Since the 18th century,[2] scholars have disagreed considerably on how immigrants compare to those who are left behind. Immigration might be selective, but what does this selection look like? Some researchers argue that all immigrants, whether legal or illegal, represent a positively selected group from the home country because they are more ambitious and willing to work or have higher levels of education than their counterparts who stayed behind (Portes and Rumbaut, 1996; Treiman et al. 1986). Massey (1987, 1999) has contended that although migrants tend to be positively selected initially, they become less selected as successive waves migrate from a particular country. Over time, the network of immigrants from a particular origin country expands, and as migration driven by social networks continues, migration for the next wave becomes less costly, and persons who are relatively low educated or skilled begin to migrate.

Other scholars have underscored the importance of migration motives related to the situation of the origin countries and destination: if migrants leave because of "plus factors" (or pull factors) in the destination country, they will be positively selected. If they are responding to "minus factors" (or push factors) in the sending society, they will be negatively selected (Lee, 1966). Related to this, Borjas (1987, 1991) has argued that the level of positive or negative selection to the USA is related to the level of income distribution in the sending countries as compared to the income distribution in the USA. However, according to economists studying selective migration, political refugees who respond to push factors may not be as negatively selected as others. This would be the case because according to those economists, only economic migrants are (self-)selected (Chiswick, 2000). The analysis of the

PISA 2003 data by Levels et al. (2009) of the educational performance of children of immigrants from various origins and with diverse destinations confirms the importance of the migration motives. Immigrant children from politically unstable origin countries perform, *ceteris paribus,* less well at school, while immigrant children from countries with a lower level of economic development perform relatively well in school.

Furthermore, migration obstacles are argued to be an important factor: immigrants who face the greatest barriers in migrating will be the most positively selected (Schultz, 1984). An example of this is the distance (and therefore financial burden) between the origin country and the preferred destination country.

In sum, the literature devoted to the selectivity of the migration process suggests that the degree to which migrants differ from non-migrants in their homelands varies by origin countries. Even if immigrants are all positively selected, there may be substantial variability in the *level* of selectivity by origin country, such that immigrants from some countries are more positively selected than others

As noted above, the outcome of these (self-)selection processes in migration has not been studied in Europe. Although selective migration to and within Europe has been suggested (for instance in relation to guest-worker programs), the existing empirical studies relate only to migration to the USA. This study aims to empirically compare the educational achievement of children from immigrant groups that were recruited as guest-workers (Italy, Portugal, Spain, Turkey and the former Yugoslavia) with those pupils who have remained in their origin countries. The discrepancy between the educational performance of both groups of pupils can be interpreted as an indicator of the selectivity of guest-worker immigrants, especially if this discrepancy is larger than the difference in educational performance between non-guest-worker immigrants and the natives in their origin countries.

Selective migration of guest-worker immigrants

Guest-worker programs got implemented in the 1950s as the need for workers in low skilled jobs could no longer be filled by natives. As an example, the German government signed bilateral recruitment agreements with Italy in 1955, Greece in 1960, Turkey in 1961, Portugal in 1964 and Yugoslavia in 1968, which allowed guest-workers from these origin countries to enter Germany easily. Other European states such as Belgium and later Austria and Switzerland followed the German example. These agreements allowed the recruitment of guest-workers from these countries who were supposed to work in industrial sector jobs that required few qualifications. Guest-workers from Turkey, Italy, Yugoslavia, Spain, and Greece, mostly male, were allowed to work in Germany for a period of one or two years before returning to their home country in order to make room for other migrants. Many of these migrant workers, not being satisfied by the accommodations of the institutions, were permitted to re-unite with their existing families. In the event, many migrants decided not to return to their origin countries (see the classical work on the Turkish guest-workers in West-Germany of Abadan-Unat, 1976).

This implementation of the so called guest-worker programs might have caused a negative selection of Italian, Portuguese, Spanish, Turkish and Yugoslavian citizens into unskilled labour in Europe. The selection of these guest-workers deviated from other immigrants from most other regions. In order to attract relatively inexpensive and unskilled labour for the richer West-European countries, guest-workers were systematically recruited from the poorest and most backward rural regions of Italy, Portugal, Spain, Turkey and the former Yugoslavia (Hunn, 2005).

The socio-economic background of these workers was relatively low compared to the rest of the population of their origin countries. The connection between the guest-worker immigrants in Europe and the poorest and most backward regions remained intact after the abolishment of guest-worker programs, by family-reunification and marriages between children of guest-workers and their relatives from these poorest and most backward regions. Based on this summary, the following hypotheses can be derived: *1. Children of guest-worker immigrants in European countries have lower science scores than native pupils in their origin countries (Italy, Portugal, Spain, Turkey, and the former Yugoslavia); 2. The difference in science scores between children of guest-worker immigrants and native children in their countries of origin is larger than the difference in science scores between children of non-guest-worker immigrants and the native children in their countries of origin.*

If guest-workers are only characterized by poor socio-economic backgrounds, one would expect that controlling for differences in parental socio-economic background would substantially diminish the differences between the lower science score of children of guest-worker immigrants and the score of the pupils in their origin countries. If this would be the case, the difference between immigrants with guest-worker origins and their native population would also come closer to the difference between immigrants without guest-worker origins and their native population. However, due to the large cultural and economic distance between the poor origin regions and the prosperous destination countries and the continuing family and marriage links with these regions, controlling for differences in parental socio-economic background might not diminish all differences between the lower science score of children of guest-workers immigrants and the higher score of the pupils in their origin countries. Therefore we assume that *3. Children of guest-worker immigrants have lower science scores than the average pupils in their origin countries, even after controlling for parental socio-economic background characteristics of parents in origin and destination countries. 4. Children of guest-worker immigrants differ more in science performance from the pupils in their origin countries than children of non-guest-worker immigrants, even after controlling for parental socio-economic background characteristics of all immigrants, and the macro-characteristics of their origin and destination countries.*

Selective migration of guest-worker immigrants versus Islamic religion

Although their parents' guest-worker past is a plausible explanation for the relatively low educational performance of Turkish immigrant pupils, their Islamic background might be an alternative explanation. Although individual religion is only rarely taken into account in comparable analyses of immigrant integration, Fleischmann & Dronkers (2008) have shown that it is an important predictor of socio-economic outcomes. Using the European Social Survey data, they present negative effects of the Islamic religion in all EU destination countries, even after controlling for human capital measures. They for instance show that Muslim men have significantly higher unemployment rates than non-Muslim men, they tend to have lower returns of education on labour market participation, a lower occupational status, and less chances of employment in the non-routine and non-manual sector. Muslim women are primarily affected in terms of educational attainment and their chances of participation on the labour market. Moreover, de Heus and Dronkers (2008) have found a significant negative effect of originating from a Muslim origin country on the educational performance of immigrant pupils, even after controlling for a wide range of micro- and macro-characteristics.

Three important processes might account for this negative Islam-effect. Firstly, it is possible that Muslims have a different religious habitus which decreases their chances to succeed in education or on the labour market. If for instance one of their religious values (honour) partly contradicts one of the conditions of success of modern capitalism (productivity), their success might be hampered. A second explanation might be discrimination against Muslims, be it direct or indirect, on the labour markets of the EU countries. Andre, Dronkers, and Fleischmann (2008) have shown that Islamic immigrants and immigrants who adhere to a non-Latin-Christian religion feel more discriminated than immigrants from non-religious backgrounds in the EU countries. A third explanation is the deviant selectivity of the guest-workers who were imported from three Islamic countries (Morocco, Algiers, Turkey).

Resulting from the above findings and line of reasoning, we formulate our fifth hypothesis: *the difference in science scores between Turkish immigrant pupils and the native pupils in Turkey is larger than the difference in science scores between the children of Christian guest-worker immigrants and the native pupils from their Christian origin countries Italy, Portugal, Spain, and the former Yugoslavia.*

Macro-characteristics of countries of origin and destination

In order to account for the possibility that the low educational performances of Turkish immigrant pupils are caused by other factors than their guest-worker or Islamic origin, macro-characteristics of the countries of origin and destination are taken into account as control variables.

Economic development and political stability of origin countries

A first characteristic of origin countries that is likely to influence immigrant children's educational performance is origin countries' level of political stability. A lower mathematic performance of children originating from politically unstable countries was found by Levels et al. (2008) using PISA 2003 data. Several explanations support this finding. First, politically motivated migrants are not so much attracted by the expected better (economic) condition in their destination countries, but are more or less pushed away by threats experienced in their origin countries (Chiswick, 1999). Depending on the degree of political instability, immigrants from less stable political countries are often traumatized by the migration process. Whereas first-generation immigrant children might have experienced the trauma themselves, second-generation immigrants are influenced by it through their family members. Second, immigrants from politically instable countries might perceive their stay in their new destination country as only temporary. This might reduce their efforts to invest in (their children's) schooling and diplomas that may not pay off after returning to their origin country. Third, natives in countries that receive a lot of political refugees tend to be relatively concerned about immigration's impact on social issues such as crime (Bauer et al., 2000). Although de facto this refers to a destination effect, it nevertheless implies a discriminative attitude towards political refugees that might translate into lower educational achievements of children originating from these countries.

Moreover, van Tubergen et al. (2004) have argued that migrants originating from economically developed countries generally have more human capital skills than migrants from developing countries. Since the education systems of economically developed countries transfer skills and diplomas that are also of value in immigrants' new economically developed destination countries, immigrants from economically more developed countries are likely to have more favourable background

characteristics than immigrants from less economically developed countries. This expected positive effect of origin countries' level of economic development has not been detected by Levels et al. (2008) using PISA 2003 data, but it has been identified by de Heus and Dronkers (2008) using PISA 2006 data. This differential result might be explained by the fact that Levels et al. (2008) used a more restricted measurement of economic development (GDP per capita) than de Heus and Dronkers (2008) (the Human Development Index).

Moreover, since the average educational performance of natives also varies across immigrant children's origin countries, we take into account this average performance of the natives as a control variable. This approach has been suggested by van Tubergen et al. (2004) since it accounts for the fact that origin countries differ in the educational quality they offer.

The educational system of the destination countries

Next to the above described characteristics of immigrant children's origin countries, the quality of the educational system of immigrant children's destination countries is likely to affect their educational performance. We control for this educational quality by taking into account the average science scores of the natives of their destination countries. This average reflects the quality of that educational system and the standards for educational performance in their destination countries. Furthermore, since de Heus et al. (2008) using the same PISA 2006 data found effects of the degree of differentiation and teacher shortage on the educational performance of immigrants, we take those two measures into account as well.

Differentiation of the education system refers to the extent to which pupils of the same age are divided into separate types of education. Whereas highly stratified systems track pupils into different types of secondary education at a relatively young age, systems that are less differentiated postpone that decision until a later age. In addition to this institutional differentiation, pupils can also be grouped according to ability. The central argument behind institutional tracking or types of ability grouping is that homogeneous learning environments permit a focused curriculum and paced instruction, which increases the average performance of all students (Hanushek and Wössmann, 2006). This expected higher average performance has however been argued to come at a cost: highly differentiated systems seem to hinder the educational performance of lower class children. The rationale behind this is that educational choices made at a relatively early age are more heavily influenced by parental background than by children's actual achievements (Mare, 1981; Shavit and Blossfeld, 1993), leading to an overrepresentation of lower class pupils among the lower educational tracks. Rational choice models have explained this by pointing to a mechanism called 'relative risk aversion' (see e.g. Breen and Yaish, 2006). The central idea of relative risk aversion is that the major educational goal of young people (and their families) is to reach an educational level that allows them to attain a class position that is at least as good as that of their parents, leading to less ambitious choices among lower class pupils. These pupils are therefore overrepresented in schools and tracks in which the disciplinary climate and the teaching conditions are less favourable and in which the curriculum is less ambitious (Dupriez, Dumay, and Vause, 2008). Pfeffer (2008) has recently underscored the importance of parents' strategic knowledge of the education system as a crucial resource that translates into different educational choices. Parents' strategic knowledge is especially important in highly stratified systems. Overall, higher educated parents will be better aware of the different educational options and will therefore be better able to navigate their

children successfully through the educational labyrinth. If this line of reasoning is applied to the educational position of immigrant children, their educational performance is likely to be lower in highly differentiated educational systems. After all, as a result of an overall lower level of parental resources and specific features related to their immigrant background (a lower command of the host country's language and a different cultural background), they are more likely to be selected into lower educational tracks. Moreover, immigrant children's parents will generally have less 'know-how requirements' regarding the functioning of the host country's educational system, which is especially detrimental in highly differentiated systems. We therefore control for the degree of differentiation of educational systems in the destination countries. Using PISA 2006 data, de Heus et al. (2008) have shown that the average performance of immigrant children is lower in countries that have a highly differentiated educational system (e.g. Austria, Germany, and the Netherlands).

Despite the limited support for a positive influence of school resources on educational achievement, the picture might look differently for immigrant children. Next to having a socioeconomic disadvantage to natives, immigrant children's educational performance is also hindered by specific immigrant characteristics. Immigrant parents' limited knowledge of the education system and their often restricted language skills hinder their possibilities to help their children with their homework or prepare them for tests. Due to a lack of support provided by immigrant children's parents, the educational achievement of immigrant children is expected to depend more on the resources provided by their educational systems. We therefore control for the quality of resources of a destination country's educational system (in this case, the shortage of teachers). In line with expectations, de Heus et al. (2008) have shown that immigrant pupils have a lower average performance in countries that have high degrees of teacher shortage.

Data and variables

Since 2000, the Organization for Economic Co-operation and Development (OECD) has tri-annually conducted large scale tests among 15-year-olds living in its member states and partner states in order to assess pupils' mathematical, reading, and scientific literacy. In doing so, the OECD has aimed to find out the extent to which pupils near the end of compulsory education have acquired some of the knowledge and skills essential for full participation in society. Alongside information on pupils' educational performance, PISA also provides information on their individual characteristics (e.g. on parental education and careers, resources that are available in the child's home, and the birth countries of both the parents and the student).

The data we use (PISA 2006) do not allow to test other hypotheses related to the lower educational achievements of immigrants in Europe, such as discrimination or religion, because indicators for discrimination or religion (even the most indirect) are not part of the PISA survey.

Science score as dependent variable

The dependent variable of this study is scientific literacy, which was the main focus of the PISA 2006 wave.[3] In order to be able to cover as many facets of the scientific field as possible (in general, the scientific field should be regarded as a combination of the disciplines of Biology, Physics, Chemistry, and Geography, covering topics such as health, natural resources, and environment), a test with a total assessment time of 390 minutes was developed. However, since it would not be sensible to administer a test of more than 6 hours to an individual pupil, 13 largely comparable item clusters (also

called booklets) with a duration of 2 hours each were derived from the core test. These booklets were allocated to individual students according to a random selection process. Each participating student spent two hours carrying out pencil-and-paper tasks, of which approximately 54 per cent of the testing time was devoted to science, 31 per cent to mathematics, and 15 per cent to reading. The booklets contained tasks requiring students to construct their own answers as well as multiple-choice questions. However, since two booklets can never have exactly the same average difficulty, Item Response Modelling was used to establish comparable science results across students. Item Response Modelling involves the construction of several plausible science values for each student. So, instead of obtaining just one score to indicate each student's science ability, a range of 5 possible science score values per student was estimated. Since the scale of these five plausible science values has a Cronbach's alpha of 0.987, the average of these 5 values is an unbiased estimation of a student's overall science performance, and will be used as the dependent variable of this study.

Origin country and destination country

Specific information on the country of birth of both the parents and the student is necessary to be able to determine a pupil's origin country. Since the OECD allows participating countries to propose their own birth country categories, some countries have allowed more detail than others. Therefore, although not less than 57 countries participated in the 2006 PISA wave, only data from the following 11 European countries are suited to test the hypotheses: Austria, Belgium, Denmark, Finland, Germany, Latvia, Liechtenstein, Luxembourg, Norway, Portugal and Switzerland.[4]

In order to determine pupils' origin country, several decision rules have been used based upon their own birth country and the birth countries of both of their parents. Next to the pupil's origin country, we identified his/her immigrant status. Students of whom at least one of the parents was born in a country different from the destination country were identified as immigrants. Given the available countries of origin of the immigrant pupils in these 11 European destination countries, we can only take into account immigrant children originating from 17 countries of origin: Austria, Belgium, Brazil, Croatia, France, Germany, Italy, the Netherlands, Poland, Portugal, Rumania, Russia, Serbia Montenegro, Spain, Sweden, Switzerland, and Turkey. Only these countries of origin participated in PISA 2006 and thus the sciences scores of the natives in these countries of origin are available (see tables in appendix).

Unfortunately, we cannot perform comparable analyses for Moroccans, Pakistani or Indians, because these countries did not participate in PISA. Consequently, we do not have the scores of the native pupils in these countries.

It is important to keep in mind that we only have information on country of birth, and not on the more subjective memberships of ethnic, religious or cultural groups. If an immigrant child was born in Germany and then moved to another country, he or she will be measured as a German immigrant. As soon as these movements between European countries during the life course of both non-European and European immigrants becomes less exceptional, the use of the country of birth as an indicator of one's ethnic, religious or cultural group becomes less reliable.

The two tables in the appendix present the real number of immigrants in the various destination countries (de Heus & Dronkers, 2008) and their score on the science test.

Parental background measures

Parental educational level is measured according to the ISCED scale (UNESCO, 2006) and ranges from 0 to 6. We use the ISCED level of the most educated parent.

Parental occupational status is measured according to the ISEI scale (Ganzeboom, de Graaf, Treiman, and de Leeuw, 1992), which ranges from 16 to 90. We use the ISEI score of the parent with the highest occupational status.

PISA index of educational resources at home. This scale is based on the availability of the following items in the students' home: a desk to study at; a quiet place to study; a computer they can use for school work; educational software; their own calculator; books to help with their school work; and a dictionary. Higher values refer to more educational resources available at home.

PISA index of cultural possessions at home was derived from students' reports on the availability of the following items in their homes: classic literature (examples were given), books of poetry and works of art (examples were given). Higher values refer to higher levels of cultural possessions.

Generation

Immigrant students were either classified as first or second generation immigrants. The *second generation* are those students of whom at least one of the parents was born abroad and who were born in the current destination country themselves. The *first generation* was born in their origin country, just as at least one of the parents. Although it is tempting to interpret the first generation as recently arrived immigrants (between 1991 and 2001[5]) and the second generation as immigrants who have migrated since the early 1960s,[6] one can also reasonably argue that the two generations reflect different conditions of immigration (guest-worker program versus restricted entrance; guest-worker program versus EU membership with free movement for Italy, Portugal and Spain; guest-worker programs versus family-reunion-migration). These different meanings of immigrant generation should be remembered while interpreting our results.

Macro characteristics of origin and destination countries

In order to take into account *guest-worker migration,* we have created a dummy that identifies whether immigrant pupils originate from origin countries that participated in guest-worker programmes (Italy, Spain, Turkey, Serbia and Montenegro, Croatia, and Portugal; 1) or not (Austria, Belgium, Brazil, France, Germany, Poland, Rumania, Russia, Sweden, and Switzerland; reference category).

The *average science score of the native pupils in the origin countries* are the reference line to establish the differences between children of immigrants and the pupils in their counties of origin[7].

Origin countries' level of *political stability* is measured by the Kaufmann's indicator. Ranging from -2.5 to 2.5 (standardized scores), it assesses the probability that an origin country's government in function will be overthrown in the near future by unconstitutional or violent means (Kaufmann, Kraay, and Mastruzzi, 2006). Higher scores refer to less chance of violence and therefore higher levels of political stability.

An origin country's *level of economic development* was measured by its Human Development Index (HDI). Whereas a country's Gross Domestic Product (GDP) per capita merely refers to a country's economic development level in taking into account the total amount of final goods and services (in US dollars) that are

produced by a country in a year (CIA World Factbook, 2008), the HDI provides a broader picture of a county's human development level. Ranging from 0 to 1, the Human Development Index (2007/2008) combines information on countries' life expectancies, adult literacy rates, gross enrolment ratios in primary, secondary, and tertiary education, and GDPs in order to measure countries' levels of human development.

At the destination level, the *average science score of the native pupils in the destination countries* should be regarded as an indication of the average quality of the education in the destination countries.

Differentiation of destination countries' educational systems is taken into account as a dummy variable. We define Austria, Switzerland, Germany, and Liechtenstein as highly differentiated systems (1), and Portugal, Belgium, Denmark, Finland, Luxembourg, Latvia, and Norway as moderately/hardly differentiated systems (0; reference category). This categorization is based on descriptions of national experts (Schneider, 2008; Shavit and Müller, 1998; UNESCO, 2007).

The *degree of teacher shortage* is an index provided by PISA (IRT scaling) that indicates the extent to which extent instruction is hindered by the following factors: a lack of qualified science teachers, a lack of qualified mathematics teachers, a lack of qualified language teachers, and a lack of qualified teachers of other subjects. Again, the index is based on answers provided by principals. Positive values refer to higher teacher shortages.

Dropout from school before the age of 15.

PISA measures the science performance of 15-year-olds attending secondary education in the participating countries. Although compulsory school age in all participating PISA countries is 15 or higher, legal norms may not reflect the social reality. This discrepancy between the legal obligation to attend school and the reality of regularly attending school will be large in Brazil and Turkey, and to a smaller extent also in Croatia, Romania, Russia, and Serbia/Montenegro (OECD, 2007). This implies that the 'real' science score of all 15-year-olds in these origin countries will be lower than measured by the scores of the pupils participating in PISA. This will be especially the case for pupils living in the rural areas of these countries: the measured scores of the pupil living in the rural areas might be an overestimation of the real score. The weighting by PISA will not have solved this dropout problem fully in these countries. This dropout from school before the age of 15 should also be remembered while interpreting our results.

Dropout from the PISA survey

Given the political and social importance of the PISA measurement in a number of countries (notable Germany), one can imagine that schools hinder their weakest pupils from participating in the PISA survey, even if they know that their results will never be published at the individual recognizable school-level. In particular, first generation immigrants who have arrived more recently will have a higher probability of not participating in the PISA survey, with the argument that they do not master the test sufficiently. This is, given the language-rich way PISA measures science literacy, a plausible reasoning. But this will lead to upward biased science scores of the first generation immigrants, because only the successful or the early arrivers will have participated in the PISA survey. This argument that pupils would be excluded from the PISA survey is less reasonable for the second generation immigrants, and thus they will more often participate in the PISA survey. As a consequence, the science

score of the second generation will be closer to their real score, while that of the first generation can be overestimated.

The same mechanism of exclusion can be expected in relation to the origin country. Pupils from EU countries have a lower probability of being excluded than pupils from non-EU countries. As a consequence, the observed score of pupils from non-EU countries is an overestimation of the lower 'real' science score of all immigrant pupils from non-EU countries, while the science score of the pupils from EU-countries will be closer to their real score.

This differential exclusion of less successful pupils should be remembered while interpreting our results. However, it is unreasonable to assume that countries of test will differ strongly in applying this differential exclusion of less successful pupils. Moreover, it is highly implausible that Germany or the Netherlands (with the highest science scores, see table 1) have the strongest differential exclusion of less successful pupils in comparison, while Romania and Turkey (the lowest science score in Europe) hardly excluded unsuccessful pupils at all.

Results

Table 1 does not clearly support the hypothesis that the children from quest-worker immigrants have the largest negative science score as compared with the scores of the native pupils in their origin countries. The negative difference with the score of the native pupils in their origin country is largest for Italian second generation pupils (-63), Austrian first generation pupils (-59), French first generation immigrant pupils (-58), Italian first generation pupils (-57) and German second generation pupils (-54). Large differences between the science scores of immigrant pupils and the native population in their country of origin are thus found among immigrants from countries that never participated in guest-workers programs: Austria, France, and Germany. An ad-hoc but implausible explanation of this unexpected result might be that the majority of the immigrant pupils from Austria, France and Germany are children from guest-worker immigrants, who are born in Austria, France or Germany, but who moved to another European countries later on, and thus are coded as immigrant children from Austria, France or Germany. Although this "measurement error by the use of country of birth" might explain low scores in some cases, it is implausible that a majority of the 52 Austrian, 430 French, and 570 German immigrant pupils belongs to this group of "measurement error by the use of country of birth in stead of subjective ethnic group."

The negative differences between science scores relative to the scores of the native pupils in their origin country are smaller for most origin countries of the guest-workers: Croatia (-15; -10), Portugal (-27; -3), Serbia Montenegro (-27, -5), Spain (-17; +27), and Turkey (-6, -9). Italy is a clear outlier among the guest-worker countries. A possible explanation for the very low science scores of the Italian immigrant pupils might be that the majority of these Italian immigrants came from the southern part of Italy where the average PISA scores are much lower than the scores of pupils in the northern parts of Italy (even after controlling for socio-economic background). The pupils from some of the northern, richer Italians regions, have average scores between 520 and 540 on the science test, whereas pupils from some of the southern, poorest Italian regions, have an average score between 436 and 450.[8]

Our first hypothesis can be accepted. Children of guest-worker immigrants in European countries indeed have lower science scores than native pupils in their origin countries (Italy, Portugal, Spain, Turkey, and the former Yugoslavia). However, hypothesis 2 can only be partly confirmed. Although the largest gap in educational

performance between immigrant pupils and the native population in their home countries has been observed for the children of Italian guest-workers, the children of some non-guest-worker groups also show a relatively large gap.

[Table 1 about here]

Controlling for social background differences between immigrant children and native children provides a slightly different result. The negative difference is visible for most children from guest-worker origin countries: Croatia (-139; +4), Italy (-54; -57), Portugal (-18; -4), Serbia and Montenegro (-39, +12), Spain (-1; +25), and Turkey (-23, -33). Italy remains a clear outlier among the guest-worker countries, and the substantial negative difference of the Croatian first generation pupils is caused by their relatively advantageous social background in comparison to the native Croatian pupils. An analogous effect has been observed for the Serbian first generation pupils: controlling for social background increases the negative difference from -27 to -39. Controlling for social background also increases the negative difference for Turkish immigrant pupils, for the first generation from -6 to -23, and for the second generation from -9 to -33.

In a number of cases, second generation pupils have higher scores than native pupils from their origin country, either observed or controlled. This is the case for Brazil (observed; +169, controlled; +68), Croatia (-10, +4), the Netherlands (+37, +33), Romania (+6, +9), Serbia and Montenegro (-5, +12), Spain (+27, +25), and Sweden (+19, +8). These cases show that positive selectivity on the unmeasured differences between immigrants and non-immigrants also exists in Europe. But it is difficult to assume that emigration from Sweden and the Netherlands also contains a positive selectivity dimension, unless one assumes that the strong equality ethos of these countries drives the more adventurous Dutch and Swedes into emigration to respectively Belgium or Finland and Norway.[9]

Overall, the results lend support for hypothesis 3. Like expected, children of guest-worker immigrants have lower science scores than the average pupils in their origin countries, even after controlling for parental socio-economic background characteristics. However, the gap in performance between children of some non-guest-worker immigrants and their native population is also large. Moreover, second generation immigrant pupils from the guest-worker countries Croatia, Serbia Montenegro, and Spain have higher science scores than the natives in their countries of origin (in the case of Croatia and Serbia and Montenegro, this holds only after controlling for the socio-economic background of the immigrants and natives).

Although these findings are insightful, sounder tests of the hypotheses require controlling for macro-characteristics of immigrants pupils' countries of origin and destination. Possibly, the relatively low science scores that have been observed for immigrant children from many of the guest-worker countries are a mere reflection of other country characteristics. In order to account for this possibility, multilevel results will be presented in the next paragraph.

Multilevel analysis

By using individual-level techniques (such as OLS regression) on data with multiple levels, standard errors of the macro-level effects will be underestimated, and consequently, parameters may unjustly appear to be significant. To analyze non-hierarchically structured data (origin and destination countries cannot be hierarchically ordered), cross-classified multilevel regression analysis is the

appropriate technique (Raudenbush and Bryk, 2002; Snijders and Bosker, 1999). We used Iterative Generalized Least Squares (IGLS) estimation techniques from the statistical analysis program MLwiN to estimate models (Browne, 2003).

In table 2, predictors at the different levels are added stepwise. In model 1, only the average science performance of natives in immigrants' countries of origin and destination are included. In model 2, the dummy that indicates whether a child originates from a guest-worker country is added. Models 3 and 4 respectively add macro-characteristics of countries of origin (economic development, political stability, and Islamic religion) and destination (differentiation of the education system and the degree of teacher shortage). In model 5, individual level predictors are included and model 6 estimates those cross-level interactions, which are possible related to the guest-worker origin of immigrant pupils.

[Table 2 about here]

Model 1 shows the importance of the average educational performance of the natives in the origin countries: its parameter is significant and positive (b=0.96**), while the parameter of the educational performance of the natives of the destination countries is insignificant. More importantly, this is more or less equal in all six models, meaning that the other results can not be explained by the quality of the education of the origin and destination countries.

Model 2 provides another test of hypothesis 2 which stated that the difference in science scores between children of guest-worker immigrants and native children in their countries of origin is larger than the difference in science scores between children of non-guest-worker immigrants and the native children in their countries of origin. The significant negative effect of the variable (b=-50.76**) indicates that such is indeed the case. Controlled for the average score of natives in their countries of origin, immigrant pupils originating from Italy, Portugal, Spain, Turkey and the former Yugoslavia (the guest-worker countries) perform less in science.

Model 3 shows that this negative effect of guest-worker origin cannot be explained by the economic, political or religious macro-characteristics of the origin countries. The negative effect of guest-worker background is hardly affected by the inclusion of these macro-characteristics (a reduction from -50.76** to -46.71**). The parameter of the variable Islamic country is non-significant, thereby rejecting hypothesis 5. So, the difference in science scores between Turkish immigrant pupils and average pupils in Turkey is not larger than the difference in science scores between the children of Christian guest-worker immigrants and the native pupils from their Christian origin countries Italy, Portugal, Spain, and the former Yugoslavia.

In model 4, we test whether the characteristics of the educational systems of the destination countries are responsible for the negative effect of guest-worker origin. Immigrant pupils in destination countries with higher levels of teacher shortages perform lower than immigrant children in destination countries with lower levels of teacher shortage. Highly differentiated educational systems have no significant effect on performance of immigrant children. The degree of teacher shortage and the degree of differentiation are not able to explain the negative effect of guest-worker origin (b=-42.38**). Formulated in a more blunt way: the highly differentiated educational system of Germany is not the correct explanation of the low educational performance of the immigrant children with a guest-worker background in Germany.

In model 5, we test whether the individual characteristics of the immigrants, and especially the less favorable ones of the guest-workers, can explain the negative

guest-worker effect. Irrespective of their high predictive power (all individual level effects are significant at the 0.05 level), the inclusion of the individual level characteristics is unable to fully account for the negative guest-worker effect (b=-24.89**). Hypothesis 3 can be accepted. However, the fact that the inclusion of the individual characteristics results in a drop of the strength of the guest-worker parameter of about 1/2, implies that part of the negative guest-worker effect can be explained by the individual characteristics of the guest-worker children (the so called 'composition effect'). It is important to note that the difference in educational performance between the first and second generation is only modest (b=10.16**). This means that there is not a strong improvement in educational performance by the second generation, simply because they are born in the destination country.

In the sixth model, three interaction terms are added. The first term refers to the common finding that educational performance is more heavily determined by parental background in highly differentiated educational systems. Given that guest-workers often migrated to countries with highly differentiated educational systems (such as Austria, Germany, and Switzerland), the guest-worker origin effect might be explained by the negative effect of being a pupil with low educated parents in a highly differentiated educational system. The results of model 6 however do not support this expectation. This suggests that what might be true for native pupils with lowly educated parents is not necessarily true for immigrant pupils with lowly educated parents. The reason might be that the cause for the low parental education is fundamentally different for natives than for immigrants: the latter had fewer possibilities to be educated in their origin country while the former had not enough cognitive abilities to reach a higher educational level.

The second cross-level interaction term that is added to model 6 refers to the possibility that the negative effect of guest-worker origin only holds for pupils with parents with a poor educational background. This could be a consequence of the negative selectivity of guest-workers argument. As can be seen from the table, the interaction is indeed significant (b = -6.42**). In combination with the positive main effect of parental education (b=9.78**) and the insignificant effect of guest-worker origin (b=1.52), this finding implies that the educational performance of immigrant pupils with a guest-worker origin hardly increases with their parental education. The educational performance of immigrant pupils without a guest-worker origin on the other hand normally increases with their parental education. Basically, this result indicates that pupils who originate from a guest-worker country and have highly educated parents, underperform. Therefore, they are 'responsible' for the overall negative effect of guest-worker origins. Figure 1 illustrates this finding.

[Figure 1 about here]

The third cross-level interaction term that is added to model 6 refers to the possibility that especially pupils with lower educated parents that originate from an Islamic country perform poorly in education. However, the insignificant interaction term shows that this is not the case. It signifies that the interaction between guest-worker origin and parental education can not be explained by the interaction term Islamic origin country and parental education.

In sum, hypothesis 4 (Children of guest-worker immigrants differ more in science performance from the pupils in their origin countries than children of non-guest-worker immigrants, even after controlling for parental socio-economic background characteristics of all immigrants, and the macro-characteristics of their

origin and destination countries) can be partly confirmed by our multilevel results. The negative main effect of guest-worker origin only holds for pupils from highly educated parents. That is to say, whereas immigrant pupils who originate from guest-worker countries and have lower educated parents do not perform less than their counterparts from non-guest-worker origins, immigrant pupils who have highly educated parents and originate from guest-worker countries 'underperform'.

Conclusions and discussion

Our analysis supports the thesis that guest-worker immigrants were negatively selected from their native population. That is to say, the average score of children of guest-worker immigrants is substantially lower than the science score of comparable native pupils in their origin countries Italy, Portugal, Spain, Turkey, and the former Yugoslavia. However, the negative effect of originating from a guest-worker country only holds for children of parents with higher educational levels; children from guest-worker origins who have very low educated parents score as high as comparable immigrant children from other origin countries, even if we take into account the average performance of native pupils in the origin and destination countries.

Our analyses have revealed that other country characteristics that affect educational performance of immigrants cannot explain the guest-worker effect. Neither economic development, political stability, and the dominant Islamic religion[10] of immigrant children's origin countries nor the degree of differentiation and teacher shortage of destination countries' educational systems can account for the negative guest-worker impact.

A common explanation for low educational achievement scores of immigrant pupils in the USA is the low quality of schools which they attend (Feliciano, 2005). The quality of schools within European countries also varies and immigrant pupils more often attend schools with a low socio-economic student-composition (Dronkers & Levels, 2007).Therefore, immigrant pupils are more hampered from achieving high educational scores. However, the quality variation between European schools is smaller than that of schools in the USA (Scheerens & Bosker, 1997), as a consequence of equal funding of comparable secondary schools by the European national states, and the unequal funding of secondary schools by unequal local tax revenues in the USA.[11]

On the whole, we find more negative selectivity of immigration into Europe than positive selection, if we rely on the method of comparison between immigrants and their natives in their origin countries. This outcome deviates from the positive selectivity of a number of immigrant groups in the USA (Borjas, 1987, 1991; Feliciano, 2005). A possible explanation is that immigrants in Europe (irrespective of their guest-worker origin) have more difficulties in establishing themselves and their children in comparison with immigrants in the traditional immigration countries such as the USA. Levels et al. (2008) have shown that immigrant children in traditional immigrant receiving countries, *in casu* Australia and New-Zealand, perform better at school. They have mentioned that this better performance can be explained by composition effects due to restrictive immigration policies of these two traditional immigration countries. However, researchers have also suggested that in traditional immigration countries, non-immigrants hold a more favorable view towards immigrants' contribution to the economy (Bauer, Lofstrom and Zimmerman 2000). With the economic viability of immigrants in mind, national and state level policy measures in traditional immigration countries have adopted the educational system in such a way that it can cope with the specific educational needs of immigrant children

(Iredale and Fox 1997). The lower level of societal openness towards immigrants in Europe may explain why immigrant children perform relatively bad in Europe as compared to the traditional immigrant receiving countries. As a consequence, most immigrants in Europe seem to be more negatively selected. This might however be misleading: immigrants in Europe have fewer opportunities in comparison with immigrants in traditional immigrant states.

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Notes

[1] This section quite elaborately builds on the seminal article of Feliciano (2005)

[2] Benjamin Franklin, one of the founding fathers of the USA and a famous natural scientist, maintained that the Germans immigrating massively to American English colonies in the middle of the 18th century were "the most stupid of their own nation".

[3] Science performance is the focus of PISA 2006, while reading and math performance are measured more superficially. However, if we use reading or math performance instead of science performance as the dependent variable, we find substantially the same results.

[4] The Netherlands could not be taken into account since the immigrant children's country of origin could not be unambiguously determined; in the Dutch case, PISA 2006 only distinguishes between immigrants who were born in western countries of origin (the majority of them being German) and immigrants who were born in non-western countries (the majority if them being Turkish). Greece and Scotland only identified immigrant pupils from origin countries that did not participate in PISA 2006 (and therefore, the average scores of the natives in those origin countries cannot be established), and could therefore also not be taken into account.

[5] Given that a first generation pupil is born in the country of origin and given that he or she is 15 years old when he or she participates in PISA 2006, the parents cannot have migrated to the destination country before 1991. If the pupil migrated after age 10 (thus after 2001), it is implausible that he or she has a good enough command of the language of the destination country to be allowed to participate in PISA.

[6] If we accept that most children are born before the 40th birthday of their parents and that these interviewed children are 15 years old in 2006, 1950 is the earliest birth year of the migrated parents of the pupil.

[7] We exclude all immigrants in the origin countries while computing this average score.

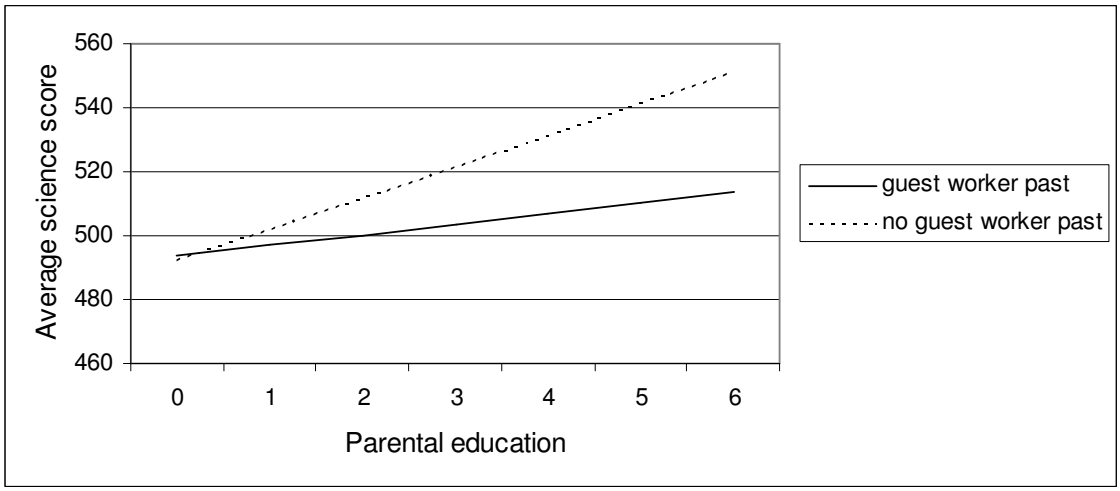
[8] Again, we find the positive selectivity effect of the restricted possibilities for permanent settlement in Switzerland and the strict Swiss policy of sending away unemployed immigrants, which also produce positive selectivity of Italian immigrants: the observed science scores of the first and second generation Italian immigrant pupils in Switzerland are 476 and 451, versus 416 and 417 in Germany and 453 and 424 in Luxembourg. The native pupils in Italy have a score of 473.

[9] However, the migrating Swedes measured by the PISA data have migrated to Finland and Norway, which are as equalized societies as Sweden. The Dutch migrants have migrated to Belgium, a step which is difficult to characterize as adventurous.

[10] On can argue with good reasons that the Islam of Turkey is not representative of countries of origin where the Islam religion is dominant. The former is more secular and less orthodox than in other countries like Bangladesh, Morocco and Pakistan. That might be the explanation for not finding an effect of Islamic country in this more restricted analysis with only Turkey, while Heus & Dronkers (2008) found in their analysis with all origin countries a clear negative effect of Islamic origin county.

[11] It is difficult to imagine that the low score of Turkish immigrants in Denmark (374; see table 2A of appendix) could be explained by the huge quality discrepancy between Danish secondary schools.

Figure 1. The influence of parental education on the scientific performance of immigrant children from guest-worker origins and non-guest-worker origins.



Source: PISA 2006.

Table 1. The average science score of immigrant pupils from 17 different origin countries and that of the native pupils in their origin country, both observed and controlled for cultural possessions at home, home educational resources, parental education, and parental occupation.

Origin country		*Immigrants*		*Native pupils*		*Difference*	
	Gen	Obs.	Contr.	Obs.	Contr.	Obs.	Contr.
Austria	1	449	452	518	517	-59	-63
	2	492	513			-27	-4
Belgium	1	557	518	517	518	+40	0
	2	514	490			-3	-28
Brazil	1	428	387	385	385	+42	+2
	2	544	453			+169	+68
Croatia	1	340	348	496	487	-15	-139
	2	486	491			-10	+4
France	1	442	453	500	500	-58	-47
	2	488	471			-12	-29
Germany	1	518	503	530	530	-12	-27
	2	476	481			-54	-49
Italy	1	416	418	473	472	-57	-54
	2	410	415			-63	-57
Netherlands	1	527	533	529	529	-2	+4
	2	566	562			+37	+33
Poland	1	471	460	497	498	-20	-38
	2	500	492			+3	-6
Portugal	1	448	457	475	475	-27	-18
	2	472	471			-3	-4
Rumania	1	425	410	417	417	+8	+7
	2	423	426			+6	+9
Russia	1	469	473	478	478	-9	-5
	2	465	462			-13	-16
Serbia Montenegro	1	406	394	433	433	-27	-39
	2	428	445			-5	+12
Spain	1	465	482	482	483	-17	-1
	2	509	508			+27	+25
Sweden	1	495	490	506	506	-9	-16
	2	525	518			+19	+8
Switzerland	1	519	520	531	531	-12	-11
	2	520	517			-11	-14
Turkey	1	410	395	416	417	-6	-23
	2	407	384			-9	-33

Sources: PISA 2006. Natives are those pupils of whom both parents were born in the origin country. Immigrants are those pupils of whom at least one parent is born in the origin country. One Unianova analysis for control for background per country.

Table 2: Cross-classified regression of macro-characteristics of origin and destination countries, including guest-workers background and Islamic origin country, controlled for individual characteristics, on the scientific literacy of immigrant pupils; No=17, Nd=11, Ni=5.618

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Intercept	461.06** (7.16)	484.02** (7.17)	555.98** (105.46)	550.20** (101.89)	520.20** (90.28)	492.01** (88.19)
Average score natives in origin countries	0.96** (0.11)	0.54** (0.12)	0.77** (0.19)	0.88** (0.19)	0.61** (0.17)	0.57** (0.17)
Average score natives in destination countries	0.06 (0.38)	0.41 (0.32)	0.33 (0.33)	0.22 (0.33)	0.39 (0.27)	0.38 (0.26)
Origin level variables						
Origin countries with guest worker origin		-50.76** (9.56)	-46.71** (9.75)	-42.38** (9.81)	-24.89** (8.77)	1.52 (10.83)
Origin countries with guest worker origin * parental education						-6.42** (1.65)
Human Development			-82.79 (121.49)	-73.54 (117.12)	-139.0 (103.75)	-128.26 (101.11)
Political stability			-8.63 (10.49)	-11.53 (10.22)	0.29 (29.07)	1.14 (8.85)
Islamic country			-3.42 (13.45)	-0.67 (13.05)	-14.97 (11.54)	-16.84 (12.48)
Islamic country * parental education						-0.001 (1.84)
Destination level variables						
Degree of teacher shortage				-23.78** (10.59)	-19.63** (7.76)	-18.26** (7.08)
Highly differentiated education system				-13.23 (14.68)	-14.59 (11.24)	-17.05 (11.99)
Highly differentiated education system * parental education						1.11 (1.41)
Individual level variables						
Second generation immigrant					10.16** (2.43)	10.39** (2.43)
Parental education					5.61** (0.73)	9.78** (1.43)
Parental occupational status					0.99** (0.08)	0.96** (0.08)
Cultural possessions available at home					9.09** (1.30)	8.89** (1.30)
Educational resources available at home					8.36** (1.11)	8.38** (1.10)
Boys					6.52** (2.20)	6.69** (2.20)
Variance components						
Destination	287	183	224	154	54	35
Origin	630	339	298	275	215	204
Individual	7299	7297	7297	7296	6616	6601
Deviance (IGLS; -2*LL)	66015.6	65993.3	65991.0	65986.1	65428.3	65412.2

Source: PISA 2006, own calculations.

Notes: standard deviations in parentheses; ** = significant at the 0.05 level, * = significant at the 0.1 level

Appendix (de Heus, Dronkers & Levels, 2008)

Table A1. An overview of the unweighted number of immigrant pupils by origin country and destination country.

	Destination countries																
	AU	AT	BE	CH	DE	DK	EL	FI	LI	LU	LV	NL	NO	NZ	PT	SC	Total
Origin countries																	
Albania	0	13	0	125	0	0	187	0	1	0	0	0	0	0	0	0	326
Australia	0	0	0	0	0	0	0	0	0	0	0	0	0	54	0	0	54
Austria	0	0	0	31	0	0	0	0	21	0	0	0	0	0	0	0	52
Bangladesh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
Belarus	0	0	0	0	0	0	0	0	0	0	107	0	0	0	0	0	107
Belgium	0	0	0	0	0	0	0	0	0	89	0	0	0	0	0	0	89
Bosnia Herzegovina	0	136	0	0	13	40	0	0	0	0	0	0	0	0	0	0	189
Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	45
Cap Verde	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	80
China	252	8	0	0	0	0	0	0	0	0	0	0	0	117	4	16	397
The Congo	0	0	137	0	0	0	0	0	0	0	0	0	0	0	0	0	137
Croatia	0	36	0	0	14	0	0	0	0	0	0	0	0	0	0	0	50
Czech Republic	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	24
Estonia	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	8
France	0	0	125	119	0	0	0	0	2	184	0	0	0	0	0	0	430
Germany	0	44	147	173	0	0	0	0	16	100	0	90	0	0	0	0	570
Greece	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	15
Hungary	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
India	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	107
Italy	0	0	0	300	30	0	0	0	13	98	0	0	0	0	0	0	441
Rep. of Korea	69	0	0	0	0	0	0	0	0	0	0	0	0	76	0	0	145
Liechtenstein	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
Macedonia	0	18	0	0	4	0	0	0	0	0	0	0	0	0	0	0	22
Morocco	0	0	225	0	0	0	0	0	0	0	0	0	0	0	0	0	225
The Netherlands	0	0	95	0	0	0	0	0	0	0	0	0	0	0	0	0	95
New Zealand	263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	263
Pakistan	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	17	42
The Philippines	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	134
Poland	0	25	94	0	77	0	0	0	0	0	0	0	0	0	0	0	196
Portugal	0	0	0	241	0	0	0	0	6	799	0	0	0	0	0	0	1046
Romania	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
Russia	0	0	0	0	79	0	0	25	0	0	186	0	0	0	0	0	290
Samoa	0	0	0	0	0	0	0	0	0	0	0	0	0	130	0	0	130
Serbia Montenegro	0	78	0	952	21	0	0	0	14	0	0	0	0	0	0	0	1065
Slovakia	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Slovenia	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
South Africa	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112
Spain	0	0	0	119	0	0	0	0	3	0	0	0	0	0	0	0	122
Sweden	0	0	0	0	0	0	0	11	0	0	0	0	39	0	0	0	50
Switzerland	0	0	0	0	0	0	0	0	63	0	0	0	0	0	0	0	63
Turkey	0	161	156	244	198	81	0	0	11	0	0	505	0	0	0	0	1356
Ukraine	0	0	0	0	0	0	0	0	0	0	101	0	0	0	0	0	101
United Kingdom	490	0	0	0	0	0	0	0	0	0	0	0	0	200	0	0	690
United States	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47
Vietnam	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33
Total	1504	575	979	2308	452	146	187	44	150	1350	394	595	63	577	49	41	9414

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Source: PISA 2006.

Table A2 Average scientific literacy of immigrant pupils per destination country and origin country (unweighted; N=9.414).

	Destination countries																
	AU	AT	BE	CH	DE	DK	EL	FI	LI	LU	LV	NL	NO	NZ	PT	SC	Mean
Origin countries																	
Albania	0	412	0	359	0	0	434	0	358	0	0	0	0	0	0	0	404
Australia	0	0	0	0	0	0	0	0	0	0	0	0	0	548	0	0	548
Austria	0	0	0	495	0	0	0	0	554	0	0	0	0	0	0	0	519
Bangladesh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	476	476
Belarus	0	0	0	0	0	0	0	0	0	0	504	0	0	0	0	0	504
Belgium	0	0	0	0	0	0	0	0	0	528	0	0	0	0	0	0	528
Bosnia Herzegovina	0	445	0	0	451	421	0	0	0	0	0	0	0	0	0	0	440
Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	464	0	464
Cap Verde	0	0	0	0	0	0	0	0	0	380	0	0	0	0	0	0	380
China	562	518	0	0	0	0	0	0	0	0	0	0	0	547	458	483	552
The Congo	0	0	427	0	0	0	0	0	0	0	0	0	0	0	0	0	427
Croatia	0	458	0	0	433	0	0	0	0	0	0	0	0	0	0	0	451
Czech Republic	0	569	0	0	0	0	0	0	0	0	0	0	0	0	0	0	569
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	411	0	0	0	411
Estonia	0	0	0	0	0	0	0	437	0	0	0	0	0	0	0	0	437
France	0	0	448	507	0	0	0	0	446	505	0	0	0	0	0	0	488
Germany	0	521	508	549	0	0	0	0	550	532	0	504	0	0	0	0	526
Greece	0	0	0	0	419	0	0	0	0	0	0	0	0	0	0	0	419
Hungary	0	561	0	0	0	0	0	0	0	0	0	0	0	0	0	0	561
India	551	0	0	0	0	0	0	0	0	0	0	0	0	0	0	541	551
Italy	0	0	0	443	415	0	0	0	445	430	0	0	0	0	0	0	438
Rep. of Korea	514	0	0	0	0	0	0	0	0	0	0	0	0	528	0	0	521
Liechtenstein	0	0	0	496	0	0	0	0	0	0	0	0	0	0	0	0	496
Macedonia	0	407	0	0	433	0	0	0	0	0	0	0	0	0	0	0	411
Morocco	0	0	438	0	0	0	0	0	0	0	0	0	0	0	0	0	438
The Netherlands	0	0	522	0	0	0	0	0	0	0	0	0	0	0	0	0	522
New Zealand	508	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	508
Pakistan	0	0	0	0	0	383	0	0	0	0	0	0	0	0	0	454	412
The Philippines	512	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	512
Poland	0	523	439	0	497	0	0	0	0	0	0	0	0	0	0	0	473
Portugal	0	0	0	454	0	0	0	0	445	420	0	0	0	0	0	0	428
Romania	0	439	0	0	0	0	0	0	0	0	0	0	0	0	0	0	439
Russia	0	0	0	0	466	0	0	550	0	0	496	0	0	0	0	0	493
Samoa	0	0	0	0	0	0	0	0	0	0	0	0	0	425	0	0	425
Serbia Montenegro	0	426	0	427	414	0	0	0	417	0	0	0	0	0	0	0	467
Slovakia	0	507	0	0	0	0	0	0	0	0	0	0	0	0	0	0	507
Slovenia	0	416	0	0	435	0	0	0	0	0	0	0	0	0	0	0	420
South Africa	541	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	541
Spain	0	0	0	466	0	0	0	0	516	0	0	0	0	0	0	0	467
Sweden	0	0	0	0	0	0	0	522	0	0	0	0	465	0	0	0	477
Switzerland	0	0	0	0	0	0	0	0	521	0	0	0	0	0	0	0	521
Turkey	0	380	414	425	411	374	0	0	389	0	0	466	0	0	0	0	429
Ukraine	0	0	0	0	0	0	0	0	0	0	472	0	0	0	0	0	472
United Kingdom	542	0	0	0	0	0	0	0	0	0	0	0	0	569	0	0	550
United States	571	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	571
Vietnam	518	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	518
Mean immigrants	536	437	453	444	438	388	434	522	498	445	492	472	444	525	464	474	468
Mean natives	524	525	527	527	531	501	480	565	540	512	495	540	492	537	482	516	518
Difference (I-N)	12	-88	-74	-83	-93	-113	-46	-43	-42	-67	-3	-68	-48	-12	-18	-42	-50

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Source: PISA 2006.