IMMIGRANTS' CHILDREN SCIENTIFIC PERFORMANCE IN A DOUBLE COMPARATIVE DESIGN: THE INFLUENCE OF ORIGIN, DESTINATION, AND COMMUNITY

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IMMIGRANTS' CHILDREN SCIENTIFIC PERFORMANCE IN A DOUBLE COMPARATIVE DESIGN: THE INFLUENCE OF ORIGIN, DESTINATION, AND COMMUNITY

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Abstract

This paper studies the scientific literacy of immigrant children in a cross-classified multilevel framework. Using data from the 2006 PISA survey, features of immigrant children's countries of origin, countries of destination, and communities (the specific origin-destination combination) are taken into account in order to explain macro-level differences in immigrants' educational performance. Our sample consists of 9414 15-year-old immigrant children, originating from 46 different countries, living in 16 Western countries of destination. Results show that differences in scientific performance between immigrant children from different origins and between children living in different countries of destination cannot be fully explained by compositional differences. Contextual attributes of origin countries, destination countries, and communities matter as well. It is for instance shown that the better educational performance of immigrant children living in traditional immigration receiving countries cannot be explained by these children's favourable background characteristics. The political and economic features of the origin countries did not influence the science performance, in contrast with the origin countries' prevailing religions.

Keywords: immigration, origin, destination, educational performance, PISA

Introduction

Today, most Western societies host a substantial and still growing immigrant population (Castles and Miller, 2003). Technological developments such as the internet and (mobile) telephone communication, increased and less expensive ways of long-distance travel, and the emergence of the European Union, have each helped to facilitate migration. Consequently, the share of foreign born pupils in primary and secondary education in many Western countries is now larger than ever before (OECD, 2007; Portes and Hao, 2004). In countries such as Ireland, Spain, and Italy, the percentage of school pupils born in another country has multiplied by three or four since 2000 (European Commission, 2008).

Overall, the educational position of immigrant children has been well documented. Research conducted in the United States has shown that major variation exists in educational outcomes of different ethnic groups: Mexican Americans and blacks obtain lower average grades than Asians and native Americans (Bankston and Zhou, 2002; Kao, Tienda, and Schneider, 1996; Miller, 1995), they are more likely to drop out of highschool (White and Kaufman, 1997), and less likely to earn a college degree (Camburn, 1990; Mare, 1995). Similar gaps in educational success between different immigrant groups have been observed in other Western countries such as the Netherlands (van Tubergen and van de Werfhorst, 2007), Belgium (Timmerman, Vanderwaeren, and Crul, 2003), and Germany (Worbs, 2003). In order to understand these immigrant group differences, research has often relied on classic individual-level determinants (Kao and Thompson, 2003). Overall, these individual-level explanations have focused on the cultural position (e.g. their motivation to perform) and the structural characteristics (e.g. parental capital and the time of arrival) of different immigrant groups. School-level explanations for immigrant group differences in educational success have been studied after the publication of the famous Coleman report in 1966 ("Equality of Educational Opportunity"). Although it has been widely accepted that certain immigrant groups attend 'disadvantageous' schools, elaborate meta-analyses have shown that ethnic and socio-economic school segregation hardly affect the educational performance of immigrant

pupils more than native pupils (Driessen, 2007; Schofield, 1989). Using the PISA 2003 data, Dronkers & Levels (2006) found that ethnic school segregation was, compared with the importance of socio-economic school segregation, only a minor factor among other more important variables. Moreover, immigrant students from certain regions of origin (Northern Africa, Western Asia, Northern Europe, Southern Europe, Eastern Asia, Southern Asia) are less affected by ethnic school segregation than other immigrant students (Latin America, Western Europe, Eastern Europe, North America, Australia, Southern and Central Africa, Oceania, South-Eastern Asia).

Next to the study of the educational performance of different immigrant groups in a single country, cross-national research has been conducted. Cross-national studies such as TIMMS, PISA, and PIRLS that focus on children's performances in numerous subjects have allowed to compare the educational performance of immigrant and non-immigrant pupils in different countries of destination. Individual- and school-level characteristics have been taken into account to explain differences in educational performance between first- and second-generation immigrant pupils and natives with the PISA 2000 (Marks, 2005; Schnepf, 2006).[2] Interestingly, these effects vary substantially between countries. Although not tested, they suggests that these differential effects stem from differences in destination countries' educational systems or immigration policies. However, analyzing the PISA 2003 data, Levels and Dronkers (2008) conclude that both origin and destination of migration have substantial effects on scholastic achievement, and that these effects influence in important ways differences in scholastic knowledge between native pupils, first-generation migrants and second-generation migrants. Analysing migrants' integration in host societies without properly taking into account these origin effects will indeed lead to flawed results. Depending on the composition of the migrant population in a certain society, results may be too optimistic or too pessimistic.

In sum, cross-national and multiple-country research has shown that educational performance varies by immigrant children's origin group, and that immigrant children's performance differs cross-nationally. Therefore we need to apply an analysis model which capture both the origin and the destination characteristics of immigrants' children.

A comprehensive model of multiple origins and destinations

Since immigration is intrinsically a transnational phenomenon, it should be studied accordingly (Portes, 1999). Immigrant parents and children from various countries of origin move to various countries of destination. In order to fully capture the complexity of the migration process, the use of a so called cross-classified multi-level design (or, double comparative design) has been proposed (van Tubergen, Maas, and Flap, 2004). Instead of relying on observation of multiple-origin groups in a single destination or a single-origin group in multiple destinations, the cross-classified design allows a comparison of multiple origins in multiple destinations simultaneously. Since this design disentangles effects of characteristics of countries immigrants come from ('origin effects'), characteristics of the countries to which they migrate ('destination effects'), and characteristics of their specific community (the origin-destination combination), it is extremely useful for attempts to gain insights into immigrants' outcomes such as educational performance.

Despite its clear advantages, the use of the cross-classified approach in immigration research is relatively new. It has been applied to study the influence of origin and destination country characteristics on immigrants' labour market position (van Tubergen, Maas, and Flap, 2004; Fleischman and Dronkers, 2007) and immigrants' destination-language proficiency (van Tubergen and Kalmijn, 2005). Levels, Dronkers, and Kraaykamp (2008) were the first to apply it to educational outcomes. With the use of PISA 2003 data, they took into account various characteristics of countries of origin, countries of destination, and immigrant

communities in order to explain differences in mathematic achievement between immigrant children originating from 35 countries of origin living in 13 Western countries of destination. They found that that cross-national and cross-origin variance in educational achievement of these immigrants' children could not be fully explained by compositional differences. Contextual properties of host countries, origin countries and communities also affected the educational performance of immigrant children, independent of their background characteristics. They showed that the better educational performance of immigrant children in traditional immigrant receiving countries can be explained by composition effects from their strict immigration laws. They further fond that the level of economic development of origin countries negatively affects immigrant children's educational performance, and that children who have a background in more politically stable countries, perform better at school. Finally, they fond that socioeconomic differences between immigrant communities and the native population and relative community size negatively affect immigrant children's scholastic achievement.

This study builds upon Levels et. al. (2008) but improves it by more countries of destination and origin (and thus more degrees of freedom for macro-characteristics, by using PISA 2006 data[3]. Because a larger number of countries in the PISA 2006 study collected information on the countries of birth of pupils and parents (57 versus 41 in 2003), these new PISA wave have allowed us to identify 46 instead of 35 distinct origin groups, living in 16 instead of 13 Western countries of destination. In total, we analyze the scientific performance of 9.414 immigrant pupils (versus 7.403 in Levels et al.'s study) (see table A1, appendix). Moreover, we improve and elaborate the measurement of country and community characteristics that might influence immigrants' educational performance. First, instead of merely approaching destination countries' political views towards immigrants by the historical presence of left-wing parties in government, we additionally take into account a range of actual immigration policies. Second, more dimensions of social distance between countries of origin and destination are taken into account. We do not only focus on differences in socio-economic and cultural capital between immigrant communities and the native population, but also on different religious affiliations and cultural values immigrants from different origins face when moving to their new country of destination.

Why countries' macro-characteristics might matter

Contextual and composition effects

Differences in average scientific performance between different origin groups and different countries of destination can be due to either compositional or contextual effects. The former occur whenever the composition of groups (e.g. origin groups, destination countries), with respect to individual background variables, differs (Hox, 2002). Immigrant children in some countries of destination might outperform immigrant children in others because some destination countries attract immigrants with more favourable individual background characteristics. In a similar vein, different compositions of origin groups may explain part of the variance in educational attainment between these origin groups. Contextual effects refer to origin and destination countries' distinct properties that surpass compositional differences. In order to rule out compositional effects and determine which origin and destination countries' contextual characteristics influence scientific achievement, we control for a range of individual background variables. Since former research has elaborately focussed on individual level determinants of educational success, we will not state separate hypotheses for them.

Destination country characteristics

Although the law prohibits ethnic and racial discrimination in all Western countries, subtle forms of discrimination still remain that negatively affect immigrants' chances to integrate

into their new countries of destination. The legislative measures that national governments adopt to counter this discrimination and foster immigrants' integration is a reflection of countries' dominant ideologies and (legal) view towards immigrants. Policies that encourage immigrants' participation in their new host society are important because feelings of discrimination and being an outsider raise immigrant children's probability of educational failure and assimilation into the lower socio-economic strata of society (Portes and Zhou, 1993).

In order to evaluate destination countries' immigration policies, we use the Migrant Integration Policy Index (MIPEX). This index takes into account over a hundred legal policy indicators in order to determine to what extent immigrants living in a European Union member state profit from legal policies on long-term residence, access to nationality, anti-discrimination, family reunion, political participation, and labour market access (Niessen, Huddleston, and Citron, 2007). Since countries that score high on these policy dimensions are expected to have a positive influence on their immigrant population's economic, political, and social integration, performing well at school pays off for immigrant children. Levels et al. (2008) have not used such a direct indicator of destination countries' immigration policies, only the indirect left-wing government history, which had no significant effect on immigrants' children achievement. We therefore hypothesize that *immigrant children living in countries that have more favourable immigrant policies outperform immigrant children in countries with less favourable immigrant policies (hypothesis 1).* Since Levels et al. (2008) used destination countries' left-wing government history as a proxy for beneficial immigration policies, we also take the years of left-wing government presence into account to connect to their research.

Destination countries also differ in their immigration admission policies. During the past 50 years, traditional immigrant-receiving countries such as Australia, Canada, and New Zealand have instituted skills-based 'point systems' that reward certain socio-economic traits in the admission formula. In general, people with higher educational levels, more job experience, and a better command of English have higher chances to be admitted. In doing so, these countries match immigrant skills with labour market needs and reduce the fiscal burden that immigration would place on the host country's system of social assistance (Borjas, 2001). Research suggests that this careful selection of immigrants positively influences the attitude of natives towards immigrants in traditional immigrant-receiving countries (Bauer, Lofstrom, and Zimmerman, 2000). Although selective admission is directed towards adult immigrants, traditional immigrant-receiving countries also pay more serious efforts to secure the economic viability of immigrant children than European countries. Although the merits of such policies are subject to debate, legislators have passed national and state policy measures to reform the educational system to cope with the specific educational needs of immigrant children (Iredale and Fox, 1996). In Australia, immigrant children from non-English speaking backgrounds are for instance obliged to attend extensive English classes.

Following the above line of argument and given the results of Levels et al. (2008), we expect both composition and contextual characteristics to cause superior scientific performance of immigrant children living in traditional immigrant-receiving countries. Although their higher educational performance will be partly caused by favourable parental background characteristics, positive sentiments towards immigrants and an educational system adapted to the need of immigrant children are likely to positively affect the scientific performance of immigrant children in traditional immigrant-receiving countries on top of compositional differences: *immigrant children living in traditional immigrant-receiving countries outperform immigrant children in non-traditional immigrant-receiving countries, also after controlling for composition effects (hypothesis 2).* Given the selective nature of the immigration policy and the openness to immigrants of these traditional immigrant-receiving

countries, we assume that immigrants with high socio-economic status have profit extra from the migration to these traditional immigrant-receiving countries. For that reason we expect that *immigrant children living in traditional immigrant-receiving countries with parents with high socio-economic status outperform both comparable immigrant children in non-traditional immigrant-receiving countries and immigrant children living in traditional immigrant-receiving countries but with parents with low socio-economic status (hypothesis 2a).*

Origin country characteristics

Next to differences in average scientific performance between immigrants' in different countries of destination, we expect differences between children from different origins regardless of their destination country. In the PISA 2006 wave we can distinguished more countries of origin than in the PISA 2003, and for that reason it is important to replicate some of the findings of Level et al (2008). A first characteristic of origin countries that is likely to affect educational performance after migration is origin countries' level of political stability. *We expect lower scientific performance of children originating from politically unstable countries (hypothesis 3)* for several reasons. 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 out 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 country of destination as only temporary. This might reduce their efforts to invest in (their children's) schooling and diplomas that may not pay off after their expected return to their country of origin. 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. This third hypothesis is upheld by the results of Levels et al. (2008) with the PISA 2003.

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 countries of destination, immigrants from economically more developed countries are likely to have more favourable background characteristics than immigrants from less economically developed countries. Jasso and Rozenzweig have for instance shown that immigrants in the United States from economically developed countries have a better command of English. So, although we expect a positive effect of origin countries' economic development on children's educational performance, we expect this to result fully from compositional differences. So, we argue that *after taking into account composition effects, the positive effect of origin countries' economic development will disappear (hypothesis 4).* This fourth hypothesis is rejected by the results of Levels et al. (2008) with the PISA 2003.

Next to political and economic factors of origin countries, the degree of social distance between origin and destination cultures is likely to influence educational performance. Originally advanced by Bogardus, people feel more distant and less understanding towards some groups of people than towards others. Studies conducted in the United States and Canada have for example shown that natives felt a larger distance towards some ethnic groups

(non-white immigrants) than towards others (Northern Europeans) (Owen, Eisner, and McFaul, 1981). According to Portes and Rumbaut (2001), the ranking of social distance is based on differences in cultural values, socio-economic background, and physical appearance. Greater social distance between natives and immigrant groups has often been related to labour market discrimination, but very likely also translates into lower educational performance of those immigrant pupils that differ culturally and economically from native pupils. We examine this idea by taking into account one dimension of immigrant children's origin cultures: their origin countries' dominant religion. Since all countries of destination analyzed in this paper are predominantly Christian, *we expect immigrant children originating from Christian origin countries to outperform immigrant children from countries with other prevailing religions (hypothesis 5).*[4] This fifth hypothesis is rejected by the results of Levels et al. (2008) with the PISA 2003. Distance in religion between country of destination and country of origin might be mitigated or even neutralized if the immigrants have a higher socio-economic status. For that reason we expect *that hypothesis 5 is only true immigrant children originating from non-Christian countries with parents with low socio-economic status (hypothesis 5a).*

Community characteristics

Next to using religion as a measure of cultural distance, we take into account differences in value orientations between immigrants' origins and destinations. According to Hofstede (1984), cultures differ on several main dimensions. For example, whereas some cultures encourage people to put the interest of the group above their own, others emphasize the realisation of personal goals (the individual-collective dimension). Moreover, whereas some cultures encourage women to work instead of merely care, others underscore the maintenance of a traditional task division between the sexes (the gender dimension). Cultures also differ in the extent to which they provide strict laws and rules to guide behaviour and situations (the uncertainty avoidance dimension). We take these dimensions into account to model cultural differences between immigrant children's origin and destination cultures. Following the above line of reasoning, *we expect children who face large cultural differences between their countries of origin and destination to perform less in school than children who face less cultural differences (hypothesis 6).* Levels et al. (2008) have not used such a direct indicator of cultural differences between immigrant children's origin and destination cultures.

According to Portes and Rumbaut (2001), social distance between natives and immigrants is not only based on differences in cultural values, but also on differences in socio-economic background. Adults from immigrant communities with more socio-economic and cultural capital relative to the native population are less likely to be regarded with prejudice by natives, they have better chances of providing their children with resources that stimulate upward mobility, and they are more likely to convince their children that upward mobility is possible. Levels et al. (2008) found a significant effect of social distance between natives and immigrants in socio-economic background.. We therefore hypothesize that *immigrant children from communities with higher levels of socio-economic and cultural capital than the native population outperform those from communities with lower levels of capital (hypothesis 7).*

PISA 2006 and its focus on scientific literacy

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 to which extent 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, the language spoken at home, the birth countries of both the parents and the student) and the school they attend (e.g. the teacher-student ratio, the number of vacant science positions, the school's location) through respectively administering a student and a principal questionnaire.

The dependent variable of this study is scientific literacy, which was the main focus of the PISA 2006 wave. In order to be able to cover as many facets from 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 science performance, and will be used as the dependent variable of this study.[5]

Determining pupils' country of origin and immigrant status

Since specific information on the country of birth of both the parents and the student is necessary to be able to determine a pupil's country of origin, countries that did not allow enough specificity in birth countries could not be taken into account. Therefore, although no less than 57 countries participated in the 2006 PISA wave, only data from the following 16 developed countries are suited to test the hypotheses: Australia, Austria, Belgium, Denmark, Finland, Germany, Greece, Latvia, Liechtenstein, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Switzerland, and Scotland. Since the majority of European immigrants in the Netherlands originates from Germany, and the majority of non-European immigrants originates from Turkey (Garssen, Sprangers and Nicolaas, 2005; Garssen, Lalta and Portegijs, 2006), the Netherlands could be taken into account despite its relatively broad categories of 'born in the Netherlands', 'born in another European country', and 'born in another non-European country'.[6]

In order to determine pupils' country of origin, 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 country of origin, 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. Immigrant students were either classified as first or second generation immigrants, with the former being those students who were born abroad themselves as well (see table A2, appendix, for an elaborate overview of the decision rules applied). Finally, the decision rules used to identify pupils' country of origin and immigrant status amounted up to a final sample of 9414 immigrant students, originating from 46 different countries of origin.

Table 1 provides a first insight into the variation in scientific literacy between immigrant children from different origin groups in various destination countries.

Table 1 about here

On average, the 9414 immigrant pupils living in our 16 countries of destination have a scientific literacy score of 468, which is 50 points below the average science score of their native counterparts. Except for Australia, natives in all destination countries surpass the immigrant pupils in scientific performance, ranging from a difference of 3 points in Latvia to no less than 113 points in Denmark.

However, as becomes clear from the table, a mere distinction in performance between natives on the one hand and immigrants on the other is insufficient. After all, the educational achievement of immigrants considerably differs across immigrants from different countries of origin. The immigrants' average scientific performance of 468 conceals the considerable variation by country of origin, ranging from a score of 404 for the Albanian immigrants to a score of 571 for the American immigrant pupils. Other high performers are the Chinese and Australian immigrants (552 and 548 respectively). Those variable scores of immigrants originating from different countries might indicate the existence of origin effects end they once more underscore the necessity to take into account immigrants' roots.

Next to those apparent origin effects, destination effects seem to exist as well. Whereas immigrant pupils in Australia outperform their native counterparts with an average science score of 536, the Danish immigrant pupils have a score of no higher than 388. So, irrespective of country of origin, average science performance of immigrants also differs across different countries of destination.

Hence, although both origin and destination countries seem to have an independent influence on the scientific literacy of immigrant pupils, their specific combinations need to be taken into account as well. For instance, whereas the Turkish immigrants in Germany have a score of 411, their Turkish counterparts in Austria have a score of 380. This difference in scores of 31 points largely exceeds the 1 point overall difference in immigrants' average scores between Germany (438) and Austria (437). Apparently, therefore, the specific situation of these two Turkish communities determined their deviance from the pattern expected from the independent origin and destination effects. Thus, in sum, taking into account the community-level allows us to determine whether some groups perform especially good or bad in certain destinations, irrespective of the general impact of countries of origin and destination (van Tubergen, Maas and Flap, 2004).

Independent variables

The destination-level

To answer this study's research questions, various data sources were used. At the destination level, a dummy was created to distinguish the *traditional immigration countries* Australia and New Zealand that have received large inflows of immigration from the 19th century onwards, from the European destination countries where immigration became important after World War II (Bauer et al, 2000).

Left-wing government presence measures the degree to which left-wing parties were present in government during the last thirty years. In line with Beck et al. (2001), a destination country received a score of 1 for each year that its government was fully made-up of left-wing parties; a score of 0.5 for presence of a left-wing party in a coalition with centre and/or right-wing parties; and a score of 0 to indicate a year without left-wing parties in government.

A more direct measure of destination countries' immigrant policies is *the Migrant Integration Policy Index (MIPEX)*, which displays on a scale from 0 to 100 to what degree a country's immigrant policies foster integration (Niessen, et al., (2007). Next to the overall score, we take into account the degree to which policies encourage integration in the sub areas of long-term residence, access to nationality, anti-discrimination policy, family reunion, political participation, and labour market access (all on a scale from 0 to 100). Whereas Portugal has the highest values on both the overall scale (79) and most of the subscales, Latvia's immigrant policies are the least in favour of immigrant integration (a score of 30 on the overall scale). Since the MIPEX does not take into account our destination countries New Zealand, Australia, and Liechtenstein, we decided to approach the scores for Liechtenstein by its surrounding countries Germany, Austria, and Switzerland. In case of New Zealand and Australia, we imputed the overall means of all 28 countries participating in the MIPEX.

The origin-level

At the origin level, we used the *Kaufmann's indicator for political stability* and the Freedom House's *index of civil rights.* Ranging from -2.5 to 2.5 (standardized scores), the Kaufmann's indicator 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. The index of civil rights was derived from the United States' Freedom House (2008) that annually rates countries' political rights and civil liberties on a scale from 1 (most free) to 7 (least free). As a result of mirroring, high scores refer to countries with high levels of political freedom and civil rights.

A country's level of economic development was approached 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 (2007) 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.

Last, we include several measures of social distance. In order to take into account *origin countries' religious backgrounds*, dummy variables were created to indicate whether or not at least fifty percent of the countries' inhabitants are Catholic (reference category),[7] Protestant, Christian (others),[8] Eastern Orthodox, Eastern religious[9], Islamic, or non-religious. Countries[10] in which no religious denomination has the support of at least fifty percent of the population were classified as 'no prevailing religion'. In our analysis, the first four categories will be regarded as Christian origin countries.

The community-level

Geert Hofstede's (1984) cultural dimensions were used to determine to what degree immigrant communities experience incongruity between dominant values of their countries of origin and their new host countries. Communities with high scores on the *collectivization distance scale* experience a high discrepancy between the degree to which their countries of origin and destination value individual above group interests. Communities with high scores on the *gender attitudes distance scale* experience a high discrepancy between their origin and destination countries' view towards men and women's task divisions. Communities with high scores on the *uncertainty avoidance distance scale* experience a high discrepancy between the degree to which their countries of origin and destination use strict rules to guide behaviour. A

community that scores relatively high on all three value distance scales is for instance the Pakistani community in Scotland.

Community-relative socio-economic and cultural capital refers to the differences in the average socio-economic and cultural capital of natives and immigrant children from each country of origin in each country of destination. We have used the individual-level variable 'parental socio-economic and cultural capital' (to be described below) to construct this variable. Positive values refer to communities that have more socio-economic and cultural resources than the natives in the respective country of destination, negative values indicate communities that have less resources.

The individual-level

To account for compositional differences, we controlled for the following individual level characteristics.

Second-generation immigrant. A dichotomous variable was created that distinguishes second-generation immigrants (1) from first-generation immigrants (0). Moreover, an *immigrant generation missing dummy variable* distinguishes immigrants with an unknown generation (1) from first-generation immigrants.

One native parent. A dummy variable was used to identify pupils who had one immigrant and one native-born parent (1); pupils with two non-native parents represent the reference group (0).

Official language of destination country spoken at home. We included a dummy variable to differentiate immigrant children who speak one of their destination country's official languages at home (1) from children who speak a foreign language (0). A *language missing dummy variable* was taken into account in order to compare pupils of whom their language spoken at home is unknown (1) to children who speak a foreign language at home.

Arrival age. In order to allow a further specification of immigrants' immigrant situation, the age of arrival in the country of destination was taken into account as a continuous variable, ranging from 0 to 16 years of age.

Parental socio-economic and cultural capital is a combined scale of the highest international socio-economic index of occupational status of the father or mother, the highest educational level of parents converted into years of schooling and the index of home possessions. This scale was developed by PISA (OECD, 2007). The student scores on the ESCS-index are standardized factor scores ranging from -4.4 to 3.0.

Female. We control for gender-effects by using a dummy variable indicating whether a pupil is female (1) or male (0).

Table 2 provides an overview of minimum and maximum scores, the mean and the standard deviation of all variables in our analysis.

Table 2 about here

Results

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 (Raudenbush and Bryk, 2002; Snijders and Bosker, 1999). To analyze non-hierarchically structured data, cross-classified multilevel regression analyses are appropriate. We used Iterative Generalized Least Squares (IGLS) estimation techniques from the statistical analysis program MLwiN to estimate models

(Browne, 2003). Although originally designed to fit hierarchical models, IGLS can also be adapted to non-hierarchical data structures. IGLS is based on an iterative procedure which provides point estimates for all parameters, including their standard deviations.

Variance components

Table 1 clearly indicates that immigrants from different countries of origin and immigrants living in different countries of destination differ in average scientific literacy (that is to say, irrespective of where they migrate to, immigrants from different origins have different average science scores, and irrespective of where they come from, immigrants living in different countries of destination differ in average scientific performance). However, a so called 'empty model' that does not take into account any of the independent variables yet needs to be estimated to show to what extent differences in science performance between immigrants can be attributed to different origins, destinations, communities, and individual characteristics.

As can be seen from table 3, by far most variance occurs at the individual level: 74 per cent of the differences in science performance between immigrants is caused by differences in individual characteristics. Since our data set contains 16 relatively homogeneous (developed) destination countries, the small variance of 6 per cent at the destination level is not surprising. A larger amount of variance can be attributed to variance across origin groups: 19 per cent of the differences in science performance between immigrants can be attributed to Last, no variance has been detected at the community level. Notable is the relatively large share of origin variance in comparison to the variance at the destination level. Whereas Levels et. al. (2008) found equal variance proportions of 8 per cent. A reason for this might be the larger variety in origin countries.

Table 3 about here

Test of hypotheses

Table 4 displays the results of our cross-classified multilevel analyses. As can be seen from the table, characteristics of the four different levels were added in a stepwise manner and finally combined in model 5. Model 6 differs from model 5 in that it takes into account characteristics at the destination-, origin-, and community-level, but leaves out individual-level characteristics.

In order to rule out compositional differences between origin groups and destination countries, model 1 starts by adding individual level predictors to the initial empty model. Considering these possible compositional effects is important since not doing so would overestimate the influence of countries' contextual features. By adding the individual-level variables, the total unexplained variance has been reduced by 20 per cent. Most striking is the reduction in unexplained variance at the origin level: no less than 53 per cent of the initial variance in science performance between different origin groups can be explained by compositional differences. This reduction is largely caused by parental economic and socio-cultural capital. Apparently differences in average science performance between different origin groups are to a large extent caused by differences in average economic and socio-cultural background of these groups. Overall, the influence of individual-level characteristics is line with previous research: parental resources positively influence immigrant children's performance, second-generation immigrants perform better than first-generation immigrants, and the later immigrant children have arrived in their new host country, the worse they perform in school (Kao and Thompson, 2003). Levels et al.'s finding that boys outperform

girls in mathematics by no less than 13 points, is not reflected in our data on science performance. Boys and girls perform equally well in science.

Model 2, 3, and 4 respectively add variables at the destination-, origin-, and community level (see table A3 in the appendix for a stepwise addition of the macro-level variables to model 1 of table 4). First, at the destination level, countries' immigrant policies do not have an influence on the educational performance of immigrant children. A possible explanation for this might be that since immigrant policies are overall aimed at affecting immigrant children's parents, immigrant children are only indirectly affected by them. However, leaving parental socio-economic and cultural capital out of the equation does not change the insignificant effects of immigration policies. Hypothesis 1 has to be rejected. The second hypothesis, on the other hand, is confirmed by our results. As expected under hypothesis 2, immigrants living in the traditional immigration countries New Zealand and Australia outperform immigrants living in the other countries that have a less long history of immigration. As becomes clear from comparing the coefficient for traditional immigration countries in models 5 (b=35.27*) and 6 (b=32.91*), the relatively high average educational performance of immigrant children in these countries cannot be explained by their favourable background characteristics. Even if New Zealand and Australia would attract immigrants with less advantageous background characteristics, immigrant children in these countries would still outperform their counterparts in other Western countries. This finding suggests that the traditional immigrant receiving countries might indeed be better adapted to meeting the specific needs of immigrants and their children. But we gave the average score of the European countries on the MIPEX indices to Australia and New Zealand, this finding can also imply that these two countries rank in reality far higher on these immigrant policy indices than the European societies.

At the origin level, no support was found for hypothesis 3, which stated that immigrant children originating from politically unstable countries would perform less than immigrant children from politically stable countries. Although analyses have revealed that origin countries' level of political stability (measured by the Kaufmann and civic rights indicator) is indeed positively related to scientific performance (see table A3, appendix), the effects for both the Kaufmann and civic rights indicator were insignificant. An insignificant effect has also been detected for origin countries' level of human development. When comparing the HDI coefficients in model 5 and model 6 (b=50.25 in model 5 versus b=67.57* in model 6), it becomes clear that composition effects play a role here. Although children from more economically developed countries have on average higher science scores than children from less economically developed countries, this can be fully explained by compositional differences. In fact, it can be fully explained by a difference in average arrival age in the new host country. Immigrant children from economically developed countries perform better in science because they have spent more time in their new home countries (and therefore, their new home countries' education system) and not because of contextual characteristics of their countries of origin. Consequently, hypothesis 4 can be confirmed. Last, in contrast to hypothesis 5 which stated that immigrant children from predominantly Christian countries perform better than their counterparts from other religious origins, results show that children originating from prevalently Catholic, Protestant, or Eastern Orthodox countries perform less than children originating from Eastern religious or non-religious countries. The lowest performers (ceteris paribus) are the immigrant children from other Christian countries, thereby clearly rejecting hypothesis 5. Interesting is the finding that the positive effect of originating from an Eastern religious country is even stronger after taking into account individual-level characteristics. This indicates that despite their relatively unfavourable background characteristics (an increase from 28.05* in model 6 to 37.97* in model 5), children from Eastern religious countries (in our case, the Asian countries India and China)

outperform children from other origins. This finding is in line with former research that has shown that children originating from Asian countries are extremely motivated to perform (Baker, Akiba, le Trendre, and Weiseman, 2001; Dronkers and de Heus, 2010).

At the community-level, no evidence was found for the expectation that large cultural differences between immigrants' countries of origin and destination harm educational performance (hypothesis 6). Although all three measures that were used to measure cultural distance revealed that a larger discrepancy between values of origin and destination countries had the expected negative effect on educational performance, those effects are not significant (see table A3, appendix). Last, in line with the expectations, immigrant pupils from communities with higher levels of socio-economic and cultural capital than the native population outperform those from communities with lower levels of capital. Although much of this positive effect can be explained by compositional differences between these communities (b= 35.06* in model 5 versus b= 68.45* in model 6), the effect of communities' relative socio-economic and cultural capital supersedes the effect of composition. Hypothesis 7 can be confirmed.

Table 4 about here

Cross-level interactions

With regard to hypotheses 2a and 5a, the significant cross-level interactions reveal some interesting additional insights. First, as can be seen from the significant interaction between parental socio-economic status and traditional immigrant receiving countries (b=9.71*), the positive effect of living in traditional immigrant countries is strongest for immigrant children from the highest status families (b = 32.43 + (3*9.71) = 61.56). Although immigrant children with an average parental status (0) still profit from living in traditional immigrant receiving countries (b=32.43), children from the lowest class families do not (b = 32.43 - (4.4*9.71) = -10.29). Our hypothesis 2a is accepted: the traditional immigrant receiving countries are most open and profitable for immigrants with higher socio-economic status. Second, the significant cross-level interaction between parental socio-economic status and Islamic origin countries (b=-11.08*) indicates that originating from an Islamic country on educational performance only has a negative effect for children from the highest status families (b = -15.93 + (3*-11.08) = -49.17). That is to say, children from high status families who originate from an Islamic country, perform less in school than comparable children from high status families who have originated from catholic, protestant, or eastern orthodox origin countries. This result (the only significant interaction term between parent socio-economic status and non-Christian country of origin) runs against our hypothesis 5a. Higher socio-economic status of immigrants does not mitigate or neutralize religious distance between country of origin and of destination, especially when Islam is the prevalent religion in the country of origin.

Table 5 about here

Conclusion and discussion

Multiple research has shown that individual pupils' educational achievement is influenced by numerous (multilevel) factors such as their family characteristics, their peers, the schools they attend, and their educational system's features. For immigrant pupils, this web of influence is even more complex. Next to being shaped and socialized within the context of their new country of destination, their former home countries should be regarded as well. Only then, the transnational character of the migration process is fully captured and a better understanding of the multilevel factors influencing immigrant children's educational performance can be reached. We conducted cross-classified multilevel analysis on PISA 2006 data concerning

9414 immigrant pupils, originating from 46 countries of origin, living in 16 countries of destination in order to establish which individual-, community-, and macro-level features affect immigrant children's performance.

To explain differences in educational achievement between immigrants in our 16 countries of destination, we have focussed on two specific sets of policies: the policies regulating the inflow of immigrants (distinguishing traditional immigrant receiving countries from non-traditional immigrant receiving countries) and the policies designed to facilitate the integration of immigrants after migration (using the MIPEX policy measures). With regard to the former, our analyses have indeed shown that immigrant children living in the highly selective traditional immigrant receiving countries Australia and New Zealand outperform immigrant children in the other countries of destination. However, our analyses have also shown that this higher performance is not related to these countries' selective admission process: immigrant children living in these two countries would still outperform their immigrant counterparts in other countries if they would have the same individual background composition. This finding (which contradicts the positive but insignificant coefficient of this macro-characteristic in Levels et al., 2008) is in line with research suggesting that immigrants living in traditional immigrant receiving countries profit from a relatively favourable view of non-immigrants toward immigrants (Bauer et al, 2000), for instance because the educational system that is better able to cope with the specific educational needs of immigrant children (Iredale and Fox, 1997) or that the immigrant policies of these two countries is far more inclusive than those of the European countries. However, our finding (which is not found by Levels et al. 2008) that lower status immigrant pupils living in traditional immigration countries do not outperform their counterparts in non-traditional immigration countries suggests that these merits are not effective for lower class immigrants. A reason might be that because of the historical selection of and focus on prosperous immigrants, these countries are less willing to support the few lower status immigrants they attract. However, since this study was merely able to take into account only two traditional immigration countries, future research taking into account other traditional immigrant receiving countries (Canada and the United States) and more direct measures of these countries' educational systems and immigrant attitudes would be necessary to better understand what it is exactly that makes higher status immigrants gain, and lower status immigrants loose in the traditional immigration countries.

With regard to destination countries' policies designed to facilitate legally the integration of immigrants after migration, our analyses have revealed that these policies cannot explain differences in immigrants' educational achievement, at least not for the European destination countries. The degree to which countries encourage legally immigrants' integration through supporting among others political participation, labour market access, and long term residence is unrelated to immigrant children's educational performance. Although this lacking policy influence might seem surprising, earlier studies have revealed that the influence of policy indicators on immigrants' labour market integration is meagre at best as well. (Fleischmann and Dronkers, 2008). This possibly hints at a gap between countries' intended legal policies and their actual implementation.

At the origin level, political and economic features were shown not to influence the educational performance of immigrant children originating from these countries. That is to say, no support was found for the idea that immigrant children from politically unstable countries perform less in science than their counterparts from politically stable countries. Moreover, as expected, the positive effect of origin countries' economic development was completely due to a composition effect: children originating from economically developed countries outperform children from less developed countries, not because of contextual features of these countries, but because these children have been living in their new

destination countries for a longer period. The strongest origin effects were found for countries' prevailing religions.[11] Unlike expected, everything else being equal, immigrant children originating from Catholic, Protestant or other Christian countries are not the highest performers. Instead, immigrant children from non-religious countries (China; Russia) and eastern religious (India, Vietnam) countries have the highest scientific literacy. This finding is not in line with social distance theory that relates social distance (being either cultural, socio-economic or physical) to feelings of discrimination and misunderstanding, and consequently, lower educational performance. Interesting in this light is the finding that children from high status families who originate from an Islamic country, perform less in school than comparable immigrant children from high status families who originate from catholic, protestant or eastern orthodox origin countries. A possible explanation is the current negative societal view towards immigrants originating from Islamic countries. Other possible explanations are the negative selectivity of guest-worker programs, which brought many Islamic immigrants to Europe (Dronkers and Heus, 2009), or some values in Islamic religion which contradict conditions of success in education in western societies (gender inequality; honour; authoritarianism). However, since PISA does not allow determining immigrant pupils' individual religious affiliation, it is not possible to state to what extent the negative Islam effect is due to contextual features of the Islamic countries or rather due to the individual religious views of the (high status) children originating from them. But using the European Social Surveys, Fleischman and Dronkers (2008) found significant effects of individual religion on labour-market outcomes of immigrants in the EU, Dronkers and Fleishmann (2009) on educational outcomes of second generation male immigrants in the EU and André, Dronkers and Fleischmann (2008) on perceived in-group discrimination by immigrants in the EU.

Last, our results have shown that it does not only matter from which country immigrant children come from (irrespective of to which country they migrate) or to which country they migrate (irrespective of from which country they come from), but that the specific origin-destination combination matters too. Children from immigrant communities that have higher levels of socio-economic and cultural capital than the native population, outperform comparable children from communities with relatively lower levels of capital. This is to a large extent the case because children from these relatively high status communities have higher levels of parental socio-economic and cultural capital and have a better command of their destination country's language (composition effect). However, on top of that, the community's relative position matters too, suggesting that a favourable socio-economic and cultural distance between immigrant communities and the native population leads to a stronger position in the country of destination and a more positive outlook on immigrants' future chances in school. Unlike communities' relative socio-economic and cultural capital, communities' differential value patterns as relative to their destination country's native population do not lead to lower science performances among their members. However, that this might be due to data restrictions is very likely. Cultural distance scales could not be established for 39 out of 91 communities and a missing dummy check has revealed that the science scores of pupils from these missing communities are significantly lower. Since the communities used to test the hypothesis on cultural distance are a selective group of well performing communities, the chance to detect significant effects is reduced.

In sum, our analyses have offered meaningful explanations for macro-level differences in immigrant children's educational performance. Although most variance in scientific performance occurs at the individual-level, origin-, destination-, and community characteristics influence educational performance on top of individual characteristics. Moreover, the variance at the origin-level is more important than on the destination- or community-level. We therefore once more underscore the added value of studying immigrant

performance in a cross-classified multilevel design. We could deepen the earlier analysis with PISA data of Levels et al. (2008), because we had more statistical power with the PISA 2006, showed more effects of macro-characteristics of origin and destination. The number of destination countries has increased to 16 in PISA 2006, but nevertheless important countries such as the two other traditional immigrant receiving countries Canada and the United States, but also France and England, are missing. A larger number of destination countries would increase further the robustness of our hypotheses tests. Moreover, our theoretical insights would gain enormously from including information on individual feelings of prejudice and discrimination in the PISA study. A number of our theoretical expectations are build upon the idea of subjective feelings of discrimination and prejudice, but cannot, due to a lack of information, be tested in a direct way. Although for instance some findings seem to suggest that immigrants' educational performance is harmed by social distance between immigrants and non-immigrants, the mechanisms behind this social distance need to be clarified. Why is 'being different' bad in some instances (e.g., the high status immigrant children from Islamic origins), and advantageous in others (e.g. immigrants' positive socio-economic position as relative to the native population)? How does this relate to intervening mechanisms such as (feelings of) prejudice and discrimination?

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Notes

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[2] The PISA 2000 data did not contain country of birth of pupils and parents information. The PISA 2003 data provided that information for 13 countries.

[3] The choice to analyze scientific performance as the dependent variable reflects PISA 2006's focus on science. Each wave of the PISA study has a different main focus: PISA 2000 focused on reading literacy, PISA 2003 on mathematical literacy, and PISA 2006 on scientific literacy. The majority of testing time is devoted to the particular wave's main focus. However, since our results hardly change if mathematical or reading literacy are used as the dependent variable, scientific performance could also be interpreted as the broader concept of educational performance.

[4] Unlike the European Social Survey, PISA does not ask pupils or parents for their individual religious affiliation. Therefore, conclusions about countries' dominant religions should not be translated to individual religions.

[5] As recommended by the OECD (2007) and Hox (2002), we initially created a measurement model below the student-level. In taking into account the error term of a student's plausible values, this model provides a more reliable estimation of a student's true science score. However, due to the complex cross-classified nature of our analysis, MLwiN was unable to convert if we added the error terms as lowest level. Since the Cronbach's alpha of the five plausible values is extremely high, however, we are convinced that the parameters of our equations are unbiased.

[6] Additional analyses that did not take into account the Netherlands have revealed highly similar results. None of the significant variables shown in table 4 (to be discussed later) turned insignificant after omitting the Netherlands from the analysis. The second largest non-Western immigrant group in the Netherlands are the Moroccans. Taken into account that their educational achievement is very similar to the Turkish immigrants' achievements (scores of 438 and 429 respectively; table 1), and that the other Western immigrant groups living in the Netherlands come rather close to the German scores (a score of 528 for the Belgian immigrants, versus a score of 526 for the German immigrants), this is not a very surprising finding.

[7] Countries with prevalent catholic religion are among others Austria, Australia, Belgium, Germany, France, and Portugal.

[8] This category also takes into account the total share of protestant and catholic people. However, countries belonging to this category do not have a protestant or catholic portion of more than fifty per cent. These countries are among others Hungary, the Netherlands and the United States.

[9] Countries with a prevalent eastern religion are India and Vietnam.

[10] Countries without a prevalent religion are among others China and Russia

[11] Levels et al (2008) found a significant effect of origins countries' economic development, but they did not include in their analysis the prevalent religion in the origin countries.

Table 1. Average scientific literacy of immigrant pupils per country of destination and country of origin (N=9414)

	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

Notes: AU=Australia; AT=Austria; BE=Belgium; CH=Switzerland; DE=Germany; DK=Denmark; EL=Greece; FI=Finland; LI=Liechtenstein; LU=Luxembourg; LV=Latvia; NL=the Netherlands; NO=Norway; NZ=New Zealand; PT=Portugal; SC=Scotland.
Source: PISA 2006.

Table 2. Descriptive statistics of variables (N=9414)

	Minimum	Maximum	Mean	Standard Deviation
Dependent variable				
Scientific literacy	130.30	841.04	468.35	103.10
Destination-level variables				
Average science performance natives	479.77	565.41	523.08	12.68
Left Wing Government	0	20	12.10	3.49
MIPEX Total	30	79	53.39	9.42
MIPEX labour market access	20	90	59.72	14.95
MIPEX family reunion	34	84	50.94	9.04
MIPEX long term residence	48	74	57.06	8.05
MIPEX political participation	11	86	55.91	18.38
MIPEX access to nationality	22	71	44.45	11.85
MIPEX anti-discrimination	33	87	52.28	15.87
Traditional immigrant receiving country	0	1	0.22	0.41
Origin-level variables				
Kaufmann's indicator of political stability	-2.31	1.92	0.04	0.74
Civil Rights	1	6	4.75	1.43
Human Development Index	0.41	0.96	0.85	0.10
GDP per capita	300	46000	18124.40	12259.81
Catholic country (ref. cat.)	0	1	0.42	0.49
Protestant country	0	1	0.10	0.29
Eastern orthodox country	0	1	0.17	0.38
Prevalently Christian country	0	1	0.01	0.12
Islamic country	0	1	0.23	0.42
Eastern religious country	0	1	0.05	0.23
Country without prevalent religion	0	1	0.02	0.13
Country without religious affiliation	0	1	0.01	0.06
Community-level variables				
Collectivization distance scale (Hofstede)	1	75	24.13	18.92
Gender role attitudes distance scale (Hofstede)	0	52	15.73	10.3
Uncertainty avoidance distance scale (Hofstede)	0	93	23.79	16.52
Relative-community socio-economic and cultural capital	-1.38	1.39	0	0.46
Individual-level variables				
Parental socio-economic and cultural capital	-4.44	2.97	-0.023	1.02
Second generation immigrant	0	1	0.50	0.50
Missing dummy immigrant generation	0	1	0.04	0.19
One native parent	0	1	0.06	0.23
Language of test spoken at home	0	1	0.50	0.50
Missing dummy language spoken at home	0	1	0.11	0.31
Arrival age	0	16	5.63	3.46
Female	0	1	0.50	0.50

Table 3. Variance components of immigrant children's scientific performance (Model 0, empty model)

	Destination countries	Origin countries	Communities	Individuals
Unexpl. variance	686	2051	0	7855
Percentage of total	6	19	0	74

Table 4. Cross-classified regression of societal characteristics of countries of origin and destination, community characteristics, and individual characteristics on the scientific literacy of immigrant pupils; Nd=16, No=46, Nc=91, Ni=9414

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Intercept	467.48* (7.35)	471.47* (3.60)	439.59* (32.95)	498.43* (6.46)	151.81* (88.82)	122.57* (100.7)
Destination effects						
Average science performance natives		0.50* (0.24)			0.57* (0.17)	0.60* (0.19)
Traditional immigrant receiving country		59.36* (9.35)			35.27* (8.31)	32.91* (9.47)
Origin effects						
Catholic country			ref.		ref.	ref.
Protestant country			8.87 (12.84)		-1.44 (9.85)	-1.69 (11.25)
Eastern orthodox country			-18.577 (10.37)		-3.17 (7.71)	-0.61 (8.81)
Prevalently Christian country			-63.49* (26.98)		-47.51* (21.7)	-51.30* (25.07)
Islamic country			-32.70* (9.715)		-8.96 (8.26)	-9.362 (9.50)
Eastern religious country			43.52* (13.96)		37.97* (11.82)	28.05* (13.42)
Country without prevalent religion			-1.68 (17.96)		-12.01 (15.21)	-31.21* (17.24)
Country without religious affiliation			50.08* (23.77)		56.85* (21.09)	52.18* (23.59)
Human Development Index			59.91 (36.71)		50.25 (28.3)	67.57* (32.49)
Community effects						
Relative communal economic and socio-cultural capital				46.52* (6.40)	35.06* (6.09)	68.45* (6.81)
Individual effects						
Second generation immigrant	7.01* (2.06)	6.95* (2.06)	7.16* (2.06)	7.26* (2.06)	7.47* (2.04)	
Immigrant generation unknown	-18.05*(4.59)	-18.12*(4.59)	-18.19*(4.59)	-18.14* (4.59)	-18.09* (4.58)	
One native parent	5.39 (4.10)	5.51 (4.10)	4.91 (4.10)	4.50 (4.09)	4.50 (4.09)	
Language of test country spoken at home	17.62* (2.44)	17.96* (2.43)	17.54* (2.43)	15.96* (2.44)	16.70* (2.43)	
Language spoken at home unknown	-28.50*(3.06)	-28.51*(3.05)	-28.45*(3.05)	-29.06* (3.05)	-28.79* (3.05)	
Arrival age	-2.79* (0.29)	-2.81* (0.29)	-2.80* (0.29)	-2.83* (0.29)	-2.84* (0.29)	
Parental economic and socio-cultural status	29.72* (1.0)	29.75* (1.0)	29.66* (1.00)	29.15* (1.01)	29.15* (1.00)	
Girls	-2.38 (1.72)	-2.39 (1.72)	-2.40 (1.72)	-2.40 (1.72)	-2.44 (1.72)	
Variance components						
Destinations	566 (300.24)	0 (0)	358 (187.2)	294 (166.61)	0 (0)	0 (0)
Origins	962 (193.86)	896 (164.62)	509 (112.52)	553 (120.34)	328 (70.78)	451 (93.36)
Communities	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Individuals	6910 (101.17)	6910 (101.17)	6910 (101.15)	6908 (101.13)	6905 (101.06)	7850 (114.91)
Total unexplained variance	8438	7706	7777	7755	7233	8310
Deviance (IGLS; -2*LL)	110152.00	110128.80	110109.6	110110.4	110057.8	111276.1

Table 5. Cross-level interactions, controlled for all variables in model 5, table 3.

Main effects	
Parental economic and socio-cultural status	30.39* (1.33)
Traditional immigrant receiving country	32.43* (8.39)
Islamic country	-15.93 (8.42)
Cross-level interactions	
Parental economic and socio-cultural status * Traditional immigrant receiving country	9.71* (2.73)
Parental economic and socio-cultural status * Islamic country	-11.08 (2.33)
Variance components	
Destinations	0 (0)
Origins	334 (71.20)
Communities	0 (0)
Individuals	6869
Total unexplained variance	7203
Deviance (IGLS; -2*LL)	110010

Appendix I: Countries of origin, countries of destination, and communities

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

	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

Notes: AU=Australia; AT=Austria; BE=Belgium; CH=Switzerland; DE=Germany; DK=Denmark; EL=Greece; FI=Finland; LI=Liechtenstein; LU=Luxembourg; LV=Latvia; NL=the Netherlands; NO=Norway; NZ=New Zealand; PT=Portugal; SC=Scotland.
Source: PISA 2006.

Appendix II: Determining pupils' country of origin and immigrant status

This appendix provides a comprehensive description of the decision rules that have been used to determine pupils' country of origin and immigrant generation. Table A1 schematically displays these rules and will be described below.

The *country of origin* was based on information on the birth countries of both the pupil and the parents. In table A1, the letter T indicates that the birth country equals the country of destination, and the letters A,B, and C refer to countries of birth other than the destination country. In order to determine the country of origin, the following decision rules have been used:
1. If all three countries of birth were known and the same, this country became the country of origin.
2./4. If two countries of birth were known and the same and the other country was either different or unknown, the country of birth that was mentioned twice became the country of origin.
3. If all three countries of birth were known but different, the mother's country of birth was coded as country of origin.
5. If two countries of birth were unknown, the known birth country became the origin country.
6. If, on the other hand, two countries of birth were known but not the same and the other country was unknown, the parents' birth countries overruled the child's, and the mother's overruled the father's.
7. And finally, if all three countries of birth were unknown, the country of origin was also decided to be missing. However, in a few exceptional cases were sound arguments convinced us to do so, we decided to abandon this rule (e.g., the 'missing' Vietnamese speaking pupils in Australia who have ultimately received Vietnam as origin country).

The *immigrant status* was also based on the combination of the student's birth country and her/his parents' birth countries.
- Natives are those students who originated from the country of destination (T), irrespective of their country of birth.
- Immigrants are those students who originated from a country outside the country of destination, with:
• first generation immigrants born outside the country of destination.
• second generation immigrants born in the country of destination.

For those immigrants who had a missing value on the country of birth, the generation is unknown.

Table A2. A schematic overview of the decision rules used to determine a pupil's country of origin and immigrant status.

	Country of birth student	**Country of birth mother**	**Country of birth father**	**Country of origin**	**Immigrant status**
1	A	A	A	A[1]	I, first generation
	T	T	T	T[2]	N
2	B	A	A	A	I, first generation
	T	A	A	A	I, second generation
	A	T	T	T	N
	A	B	A	A	I, first generation
	A	T	A	A	I, first generation
	T	A	T	T	N
	A	A	B	A	I, first generation
	A	A	T	A	I, first generation
	T	T	A	T	N
3	A	B	C	B	I, first generation
	T	A	B	A	I, second generation
	A	T	B	T	I, second generation
	A	B	T	B	I, first generation
4	Miss.	A	A	A	I, generation unknown
	Miss.	T	T	T	N, country of birth unknown
	A	Miss.	A	A	I, first generation
	T	Miss.	T	T	N
	A	A	Miss.	A	I, first generation
	T	T	Miss.	T	N
5	Miss.	Miss.	A	A	I, generation unknown
	Miss.	Miss.	T	T	N, country of birth unknown
	Miss.	A	Miss.	A	I, generation unknown
	Miss.	T	Miss.	T	N, country of birth unknown
	A	Miss.	Miss.	A	I, first generation
	T	Miss.	Miss.	T	N
6	B	Miss.	A	A	I, first generation
	T	Miss.	A	A	I, second generation
	A	Miss.	T	T	N
	B	A	Miss.	A	I, first generation
	T	A	Miss.	A	I, second generation
	A	T	Miss.	T	N
	Miss.	B	A	B	I, generation unknown
	Miss.	T	A	T	N, country of birth unknown
	Miss.	A	T	A	I, generation unknown
7	Miss.	Miss.	Miss.	Miss.	Miss.

[1] Country of origin *not* equal to current destination country
[2] Country of origin equal to current destination country

Appendix III: Bivariate results

Table A3. The coefficients, standard errors and improvement in model fit in a stepwise addition of the origin, destination, and community features to model 1 of table 3.

		Co.	SE	IMF
Destination effects	Average science performance natives	0.731*	0.337	4.3
	Left Wing Government	-1.516	1.732	0.7
	MIPEX Total	0.465	0.616	0
	MIPEX labour market access	0.368	0.456	0
	MIPEX family reunion	0.786	0.579	0
	MIPEX long term residence	-0.257	0.926	0
	MIPEX political participation	-0.097	0.353	0
	MIPEX access to nationality	0.376	0.530	0
	MIPEX anti-discrimination	0.609	0.411	2
	Traditional immigrant receiving country	62.303*	9.51	18.8
Origin effects	Kaufmann's indicator of political stability	9.112	4.977	3.2
	Civil Rights	1.398	2.715	0.2
	Human Development Index	104.379*	35.635	8.1
	Catholic country	ref	ref	ref
	Protestant country	14.98	12.534	39.9
	Eastern orthodox country	-22.418*	10.28	39.9
	Prevalently Christian country	-68.559*	27.376	39.9
	Islamic country	-40.677*	8.692	39.9
	Eastern religious country	37.553*	13.66	39.9
	Country without prevalent religion	2.52	18.253	39.9
	Country without religious affiliation	46.742	24.122	39.9
Community effects	Collectivization distance scale	-0.157	0.233	12.1
	Collectivization distance scale, missing	-28.98*	8.25	12.1
	Inequality acceptance distance scale	-0.191	0.328	12
	Inequality acceptance distance scale, missing	-29.095*	8.276	12
	Gender attitudes distance scale	-0.601	0.388	14
	Gender attitudes distance scale, missing	-29.533*	8.182	14
	Relative-community socio-economic and cultural capital	46.518*	6.399	41.7