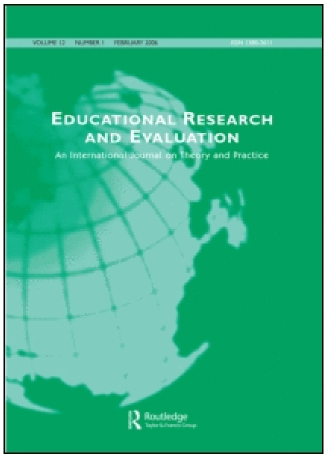

Educational Research and Evaluation
An International Journal on Theory and Practice
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t714592776

Do School Segregation and School Resources Explain Region-of-Origin Differences in the Mathematics Achievement of Immigrant Students?

Jaap Dronkers [a]; Mark Levels [b]
[a] European University Institute, Florence, Italy
[b] Radboud University, Nijmegen, The Netherlands

Online Publication Date: 01 October 2007
To cite this Article: Dronkers, Jaap and Levels, Mark (2007) 'Do School Segregation and School Resources Explain Region-of-Origin Differences in the Mathematics Achievement of Immigrant Students? ', Educational Research and Evaluation, 13:5, 435 - 462
To link to this article: DOI: 10.1080/13803610701743047
URL: http://dx.doi.org/10.1080/13803610701743047

Educational Research and Evaluation
Vol. 13, No. 5, October 2007, pp. 435–462

Do School Segregation and School Resources Explain Region-of-Origin Differences in the Mathematics Achievement of Immigrant Students?[1]

Jaap Dronkers[a]* and Mark Levels[b]
[a]*European University Institute, Florence, Italy;* [b]*Radboud University, Nijmegen, The Netherlands*

(Received 22 February 2007; accepted 18 September 2007)

Levels and Dronkers (2006) showed that educational achievement differs between immigrant students from different regions of origin (Latin America, Northern Africa, and Western Asia). This follow-up paper establishes whether these differences in educational achievement between immigrant students from different regions of origin can be explained by school segregation, whether along ethnic or socioeconomic lines. Ethnic and socioeconomic school segregation have a negative influence on the scholastic achievement of all students, although the impact of socioeconomic school segregation is greater than that of ethnic school segregation. Ethnic school segregation affects the scholastic outcomes of native and immigrant students from some regions of origin more than those of immigrant students from other regions. The analysis shows that neither ethnic, nor socioeconomic, school segregation explains the lower mathematics achievement of immigrant students from Latin America, Northern Africa, and Western Asia.

Introduction

The successful integration of immigrants from all parts of the world into the society and culture of the countries of destination has become one of the greatest challenges of highly developed countries. The existence of large groups of immigrants in these countries produces in many cases social tensions and interethnic conflicts. In view of the large economic differences between the various continents, the increased

*Corresponding author. European University Institute, Via dei Roccettini 9, 50014 San Domenico di Fiesole, Italy. Email: jaap.dronkers@eui.eu

ISSN 1380-3611 (print)/ISSN 1744-4187 (online)/07/050435–28

DOI: 10.1080/13803610701743047

possibilities of traveling cheaply between them, and the political inability of highly developed countries to close the doors to unwanted immigrants, it is clear that the numbers of immigrants in these countries will not diminish.

Traditionally, education is considered one of the major institutions contributing to the integration of newcomers into the society and culture of a nation state (including immigrants). Emile Durkheim, one of the founding fathers of sociology (of education), pointed out the importance of schools for the formation of the one and indivisible French Republic. Numerous American sociologists of education – among others, James Coleman and Daniel Moynihan – have tried to estimate the success of the melting-pot effect of American high schools.

This trust in education as a successful institution for integration has been questioned since the beginnings of sociology. Doubt grew with research that showed that education also contributes to the reproduction of social inequality (Bourdieu & Passeron, 1970). Other studies showed that religious schools were more successful than comparable public schools, including those in France (Dronkers, 2004) and the USA (Coleman & Hoffer, 1987), even for the lower strata of society (Corten & Dronkers, 2006). The same is true for Islamic schools in The Netherlands: These non-Christian schools also perform better than comparable public schools in highly developed countries in general (Driessen, 1997).

Despite these doubts about the effectiveness of education as a means for the integration of immigrants, it remains important to analyze its role in relation to immigrants, not only because more effective integration institutions are not available at the moment but also because education has become the backbone of inequalities in highly developed countries.

However, in view of the similarities in immigration patterns of these highly developed countries, it is remarkable that the study of the role of education has been mostly restricted to individual nation states, as if it were a problem specific to single states. Perhaps this lack of cross-national analyses can still be justified for the North American countries, but for the member states of the European Union (EU) this lacuna is incomprehensible and in the long term dangerous. It is incomprehensible, because in most cases the immigrant is not directed to one specific member state, but to the EU as an economic union. It is dangerous because the success of integrating immigrants into the society of one member state depends on the success of other member states, due to the high mobility of immigrants between member states. Nevertheless, it is only very recently that new cross-national datasets, appropriate for an analysis of the role of education for educational and socioeconomic achievements of immigrants, have been collected within the European Union.[2]

Fortunately, the Programme for International Student Assessment (PISA) 2003 data (n.d.) make it possible to analyze, at least partially, the role of secondary education for 15-year-old immigrant students cross-nationally. Partially, because the authorities of a number of important countries (Canada, England, France, USA) refused to ask for the country of birth of students and their parents. However, other countries (see Table 1) have collected sufficient information, which enables us to analyze the role of education for immigrants while taking into account the countries

Table 1. Absolute and relative[1] numbers of respondents per immigrant generation, by region of origin and country of destination (N = 67865)

	Total	Natives	Migrants	Migrant generation																	
	N	N	N	First	Second	Unknown	NEU	WEU	EEU	SEU	NAM	SAM	NAF	SAF	AUS	OCE	WAS	EAS	SAS	SEAS	Unknown
All																					
N	67865	55744	9607	5374	4233	2514	1033	1234	888	3040	18	53	154	185	295	220	858	291	213	369	2842
%	*100.0*	*82.1*	*14.2*	*7.9*	*6.2*	*3.7*	*1.5*	*1.8*	*1.3*	*4.5*	*.0*	*.1*	*.2*	*.3*	*.4*	*.3*	*1.3*	*.4*	*.3*	*.5*	*4.2*
Australia																					
N	12551	9727	2390	1168	1222	434	511	55	–	133	–	–	–	–	236	–	141	166	100	346	1120
%	*100.0*	*77.5*	*19.0*	*9.3*	*9.7*	*3.5*	*4.1*	*.4*		*1.1*					*1.9*		*1.1*	*1.3*	*.8*	*2.8*	*8.9*
Austria																					
N	4597	3945	578	390	188	74	–	88	50	300	–	–	–	–	–	–	143	–	–	–	64
%	*100.0*	*85.8*	*12.6*	*8.5*	*4.1*	*1.6*		*1.9*	*1.1*	*6.5*							*3.1*				*1.4*
Belgium																					
N	8796	7553	850	456	394	393	7	428	41	–	–	–	153	94	–	–	155	–	–	–	300
%	*100.0*	*85.9*	*9.7*	*5.2*	*4.5*	*4.5*	*.1*	*4.9*	*.5*				*1.7*	*1.1*			*1.8*				*3.4*
Denmark																					
N	4218	3869	111	33	78	238	–	–	–	24	–	–	–	–	–	–	55	–	32	–	139
%	*100.0*	*91.7*	*2.6*	*.8*	*1.8*	*5.6*				*.6*							*1.3*		*.8*		*3.3*
Germany																					
N	4660	3691	564	282	282	405	–	99	177	90	–	–	–	–	–	–	203	–	–	–	390
%	*100.0*	*79.2*	*12.1*	*6.1*	*6.1*	*8.7*		*2.1*	*3.8*	*1.9*							*4.4*				*8.4*
Greece																					
N	4627	4133	444	392	52	50	–	–	114	331	–	–	–	–	–	–	–	–	–	–	29
%	*100.0*	*89.3*	*9.6*	*8.5*	*1.1*	*1.1*			*2.5*	*7.2*											*.6*
Ireland																					
N	3880	3603	227	192	35	50	154	9	9	6	18	2	1	10	4	–	3	2	6	3	49
%	*100.0*	*92.9*	*5.9*	*4.9*	*.9*	*1.3*	*4.0*	*.2*	*.2*	*.2*	*.5*	*.1*	*.0*	*.3*	*.1*		*.1*	*.1*	*.2*	*.1*	*1.3*
Latvia																					
N	4627	4078	478	87	391	71	–	–	497	–	–	–	–	–	–	–	–	–	–	–	35
%	*100.0*	*88.1*	*10.3*	*1.9*	*8.5*	*1.5*			*10.7*												*.8*
Liechtenstein																					
N	332	269	54	31	23	9	–	18	–	30	–	–	–	–	–	–	7	–	–	–	3
%	*100.0*	*81.0*	*16.3*	*9.3*	*6.9*	*2.7*		*5.4*		*9.0*							*2.1*				*.9*
Luxembourg																					
N	3923	2614	1149	637	512	160	–	329	–	829	–	–	–	–	–	–	–	–	–	–	131
%	*100.0*	*66.6*	*29.3*	*16.2*	*13.1*	*4.1*		*8.4*		*21.1*											*3.3*

(*continued*)

Table 1. (*Continued*)

	Total N	Natives N	Migrants N	Migrant generation First	Migrant generation Second	Migrant generation Unknown	NEU	WEU	EEU	SEU	NAM	SAM	NAF	SAF	AUS	OCE	WAS	EAS	SAS	SEAS	Unknown
New Zealand																					
N	4511	3469	846	563	283	196	146	–	–	–	–	–	–	68	55	220	–	113	42	19	377
%	*100.0*	*76.9*	*18.8*	*12.5*	*6.3*	*4.3*	*3.2*							*1.5*	*1.2*	*4.9*		*2.5*	*.9*	*.4*	*8.4*
Switzerland																					
N	8420	6402	1662	980	682	356	–	208	–	1297	–	51	–	–	–	–	147	–	–	–	175
%	*100.0*	*76.0*	*19.7*	*11.6*	*8.1*	*4.2*		*2.5*		*15.4*		*.6*					*1.7*				*2.1*
Scotland																					
N	2723	2391	254	163	91	78	215	–	–	–	–	–	–	13	–	–	4	10	33	1	30
%	*100.0*	*87.8*	*9.3*	*6.0*	*3.3*	*2.9*	*7.9*							*.5*			*.1*	*.4*	*1.2*	*.0*	*1.1*

[1]*Note*. Relative frequencies are in italics.
Source: PISA 2003, according to Level & Dronkers (2005).
NEU = Northern Europe WEU = Western Europe EEU = Eastern Europe SEU = Southern Europe NAM = North America SAM = South and Central America NAF = Northern Africa SAF = Southern and Central Africa AUS = Australia and New Zealand OCE = Polynesia, Melanesia, and Micronesia WAS = Western Asia EAS = Eastern Asia SAS = Southern Asia SEAS = South-Eastern Asia.

of origin and the countries of destination. Levels and Dronkers (2006) showed that regions of origin have a strong influence on the mathematics achievement of immigrant students: Those originating from Western Europe (but only those from less educated classes), Southern and Central America, Northern Africa, and Western Asia show substantially lower mathematics achievement than comparable native students and immigrant students from other origins. Given the unequal distribution of immigrants from various regions of origin over the different countries of destination, an analysis of the role of education for immigrants without taking into account regions of origin would be misleading.[3]

Research Question and Hypotheses

As mentioned, our earlier analysis (Levels & Dronkers, 2006) shows that immigrant students from Western Europe, Latin America, Northern Africa, and Western Asia show substantially lower mathematics achievement than comparable native students and immigrant students from other origins. This follow-up paper establishes whether these differences in mathematics achievement between immigrant students from different regions of origin can be explained by school segregation in the countries of destination. There are three arguments why there might be a relation between the low mathematics achievement of immigrant students from some regions of origin and school segregation in the countries of destination: (1) Different levels of school segregation exist in the various countries of destination, (2) immigrant students coming from some regions of origin are more segregated than other immigrant students, and (3) schools with many immigrant students from some regions have less material and educational resources.

The differences in ethnic and socioeconomic school segregation between destination societies may provide a first explanation for the lower mathematics achievement of students originating from Latin America, Northern Africa, and Western Asia in comparison with immigrant students from other regions. The educational systems of countries of destination can differ in their degree of ethnic and socioeconomic school segregation for three reasons: free school choice, higher levels of district segregation, and the existence of a hierarchy of secondary school types.

One could argue that the greater the choice of schools (e.g., between public and religious subsidized schools), the higher the degree of school segregation will be, given that parents generally prefer schools with a better social composition,[4] but those with more economic and social resources are generally better equipped to ensure their preferences are fulfilled.

On the other hand, if school choice in a country is restricted to school districts, parents might place more value on the social composition of districts, this being related to the school. Therefore, in countries with a lower degree of school choice, there might be a greater homogeneity in district composition and thus a larger variation in housing prices. Parents with fewer economic resources (like immigrant parents) can ill afford the more expensive houses in the districts with better social composition; they are thus restricted to schools with a less attractive social composition. In such cases, school segregation may also be high, but indirectly through high levels of district segregation.

The variation in secondary educational performance differs between destination countries according to Marks (2006), who analyzed the inter- and intra-school differences in student performance using the PISA 2000 data (n.d.). He found the degree of educational differentiation at the country level (a hierarchy of school types) to be correlated with socioeconomic inequalities in education. The explanation of this effect of educational differentiation at the country level is the age at which the selection for these school types takes place. The younger the students are when selection takes place, the stronger the effect of parental background: The higher status parents tend to have greater resolve and the resources necessary to ensure that their children are placed in the more academic schools.

Immigrants from different regions are not equally distributed among all countries of destination, due to chain migration, colonial backgrounds, attractiveness of the labor-market opportunities in the country of destination, and so forth. Table 1 reflects this unequal distribution of immigrants from various origins among the destination countries. Immigrants originating from Latin America, Northern Africa, and Western Asia may go to those countries which have higher levels of educational differentiation and school segregation than immigrants from other regions, such that the lower mathematics achievement of students from these regions relates not to their country of origin, but to the country of destination. Thus our first hypothesis is:

1. The different levels of school segregation in the countries of destination explain the lower mathematics achievement of students originating from Latin America, Northern Africa, and Western Asia (as compared with immigrant students from other regions).

A second possible explanation for the lower mathematical scores of immigrant students from some regions may be the stronger concentration of these students in some schools in comparison with immigrant students from other regions. This might partly be a consequence of the exodus of native students and other immigrant students from these schools and partly a consequence of the preference for schools with students from the same regions. This stronger concentration of immigrant students from these regions increases the school segregation of these immigrants but not of immigrants from other regions. Given the relevance of school segregation for explaining part of the differences in the educational outcomes of individual students, one might assume that a higher degree of school segregation of students from some regions would explain their lower mathematics achievement. Our second hypothesis is therefore:

2. The different levels of school segregation of immigrants from different origins explain the lower mathematics achievement of students originating from Latin America, Northern Africa, and Western Asia (as compared with immigrant students from other regions).

A related third hypothesis, explaining these region-of-origin differences, might suggest that the effects of ethnic school segregation become more noticeable, the more students from these regions are concentrated in certain schools. We therefore expect that:

3. The effects of ethnic school segregation are stronger for immigrants from Latin America, Northern Africa, and Western Asia than for comparable immigrant students from other regions.

A third possible explanation for the lower mathematical scores of immigrant students from some regions is that schools with differing ethnic and socioeconomic composition (and thus with immigrant students originating from different regions) may also differ in their material and educational resources, for instance the student-staff ratio or the quantity and quality of schoolbooks available. A positive relation between school composition and school resources can arise, because schools with a less favorable composition are less likely to obtain sufficient educational resources. For instance, good teachers tend to prefer to work in schools with fewer difficult students in the long term, because of the rewards of working with good students. This kind of Matthew effect[5] can differ between countries. Further, educational systems can influence this relation between school composition and school resources. An educational system with local financing and administration can reinforce this effect, while a nationally financed and administrated system can soften these Matthew effects, because in the latter case schools receive the same amount of resources per student, irrespective of the ethnic and socioeconomic background of the students and their district. In some countries (e.g., Belgium) authorities give even more money per student to those schools with less favorable composition in order to try to neutralize a part of the negative consequences deriving from their composition. Our fourth hypothesis is therefore:

4. The effects of school segregation and of regions of origin on the mathematics achievement of students will become significantly smaller after controlling for differences in school resources.

The PISA 2003 Data

The PISA project is initiated and coordinated by the Organisation for Economic Co-operation and Development (OECD) and consists of a triennial cross-sectional survey of 15-year-old students from OECD countries and a certain number of partner countries. In PISA 2003, all 30 OECD member states participated, as well as 11 partner states (OECD, 2004). In each of these countries a sample of schools was selected; all 15-year-old students and the principals or the designates of each of the selected schools were interviewed, thus providing two sets of data (concerning interviewed students and interviewed principals, respectively). In 2003, well over a quarter of a million students were assessed, representing 23 million 15-year-olds in

41 different countries. From these countries, we selected the highly developed countries in Europe, Northern America, and the Pacific Rim, in order to focus on migration to more or less comparable countries. One of the major advantages of the PISA data is that its questionnaire is almost fully standardized, allowing for the comparison of data both between nations and between the different test years.

The general aim of PISA is to measure how well young adults are prepared, at the end of mandatory schooling, to meet the challenges of today's knowledge societies (OECD, 2004). In order to accomplish this goal, students' knowledge and skills in mathematical literacy, reading, and science are assessed every 3 years. The focus of the assessment varies triennially between these areas of scholastic ability: The main emphasis in the PISA 2000 study was on reading ability, whereas the 2003 study (which we use in this paper) focused primarily on mathematics. In order to collect data which allowed for cross-national comparison of students' performance in mathematics, PISA constructed refined methods for assessing the level of mathematical literacy, typically defined as

> the capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen. (OECD, 2004, p. 24)

Rather than asking students to solve classical mathematical problems, the PISA questionnaire presents respondents with real-life problems that require a certain level of mathematical insight. It is this specific approach towards the role of education in such countries that makes the PISA data so suitable for researching the mathematics achievement of immigrants. The ability to apply mathematical skills is more or less essential for successful participation in society, regardless of one's social or economic background, gender, ethnicity, or origin. Any differences in mathematical abilities along these lines of distinction might therefore be interpreted both as useful indicators of the future success of an individual and also as an indication of how well certain subgroups can be expected to integrate into society.

In order to explain differences in performance between students, the student questionnaire contained questions on a number of relevant background characteristics at the individual level, such as family composition, cultural resources, et cetera. The school principal's survey gives information on the material, educational, and cultural resources of the schools. We have used the operationalization of the family and school characteristics as they are developed by the OECD and made available on their homepage. For reasons of space, we refer to this link of the PISA homepage.[6]

For the first time, the PISA 2003 questionnaire also included questions on the country of birth of both the interviewed students and their respective parents. In addition, a question on the language commonly used at home was included. Based on these variables, it is not only possible to identify students as immigrants, but a more refined classification as first or second-generation immigrants can also be made. However, due to specific consequences of the methods of international data gathering, the results concerning countries of birth varied between the test countries.

PISA allows participating countries to determine possible answer categories themselves, by listing in the questionnaire their most important groups of immigrants. Germany, for example, included countries such as Russia, the Former Yugoslavia, Greece, Italy, Poland, and Turkey as possible answers, whereas students in Scotland could tick China, India, or Middle-Eastern, African, Caribbean, and European countries as countries of birth. Not all participating countries made use of this possibility; some only distinguished between natives and non-natives or used categories that were too broad for analysis. We thus chose to exclude the countries lacking information about the region of birth from our analysis. Only 13 countries had collected data suitable for our analysis: Australia, Austria, Belgium, Denmark, Germany, Greece, Ireland, Latvia, Liechtenstein, Luxembourg, New Zealand, Switzerland, and Scotland. The country of birth of the students and their parents (sometimes with additional information on home language) was used to estimate the region of origin of each student (see for more details Levels & Dronkers, 2006): Northern Europe, Western Europe, Eastern Europe, Southern Europe, North America, Latin America, Northern Africa, Southern and Central Africa, Australia and New Zealand, Polynesia, Melanesia and Micronesia, Western Asia, Eastern Asia, Southern Asia, and South-Eastern Asia. Those students or parents who were not born in the test country but could not be assigned to a region of origin were coded as unknown and deleted from the multilevel analysis. The PISA 2003 data also make it possible to characterize immigrant students as first- or second-generation immigrant students (students with one or two foreign-born parents, themselves born abroad or within the test country).[7]

Table 1 gives the results of the above coding. If cells for immigrants from certain regions of origin are empty, this does not necessarily mean that immigrants from these regions do not exist in the country of destination. Rather, the immigrant student from this region in this country of destination is coded as unknown. Table 1 shows the region-specific migration to certain countries of destination. Table 1 also shows that certain countries, for instance Denmark and Ireland, clearly take fewer immigrants than other countries, such as Australia, Germany, Luxemburg, New Zealand, and Switzerland.

Table 2 shows that immigrant students from various regions of origin differ in a number of aspects. Immigrant students from Northern Europe show higher mathematics achievement than native students in the countries of destination; however, the educational level of their parents is also higher than that of native students. The latter is also true for immigrant students from Western Europe, but their mathematics achievement is nevertheless lower than that of the average native student. Due to these simultaneous variations in social background characteristics and mathematics achievement per region of origin but also per country of destination, Table 2 does not allow us to draw conclusions. Levels and Dronkers (2006) analyzed these effects of countries of destination and regions of origin. As mentioned, both origin and destination had their independent positive and negative effects on the mathematics achievement of immigrant students. In this previous analysis, school segregation was not yet included in order to explain origin and destination effects.

Table 2. Averages and standard deviations[1] of immigrant and family characteristics by country of destination, immigrant generation, and regions of origin (N = 67865)

	Native	Migrant	Generations		Regions of Origin													
	All	All	First	Second	NEU	WEU	EEU	SEU	NAM	SAM	NAF	SAF	AUS	OCE	WAS	EAS	SAS	SEAS
Mathematical	517.75	478.94	476.33	482.32	538.23	493.50	474.62	447.19	518.21	431.10	451.33	489.67	516.19	443.02	432.04	563.77	534.74	544.10
Ability	*91.76*	*98.55*	*101.26*	*94.83*	*88.87*	*101.27*	*91.00*	*84.15*	*84.05*	*81.97*	*88.65*	*102.82*	*93.66*	*83.74*	*88.01*	*97.78*	*96.98*	*91.21*
N students	55744	8694	4907	3787	1033	1234	888	3040	18	53	154	185	295	220	858	291	213	369
Father educational	3.99	3.61	3.76	3.41	4.43	4.26	4.49	2.97	4.50	3.91	2.56	4.60	3.95	3.05	2.46	4.06	4.76	4.44
level	*1.52*	*1.96*	*1.93*	*1.98*	*1.59*	*1.74*	*1.69*	*1.88*	*1.38*	*1.64*	*2.32*	*1.70*	*1.56*	*2.04*	*1.89*	*1.95*	*1.65*	*1.76*
Father occupation	2.84	2.54	2.57	2.50	1.86	2.01	2.54	2.84	2.22	2.20	2.85	1.98	2.26	2.61	2.91	1.78	1.82	2.18
status	*1.17*	*1.17*	*1.16*	*1.19*	*1.11*	*1.14*	*1.14*	*1.01*	*1.00*	*1.11*	*1.19*	*1.17*	*1.21*	*1.23*	*1.11*	*1.01*	*1.18*	*1.22*
Mother educational	3.92	3.42	3.54	3.26	4.37	3.98	4.66	2.70	4.11	4.08	2.35	4.15	4.01	3.35	1.89	3.94	4.46	4.08
level	*1.48*	*1.96*	*1.93*	*1.98*	*1.51*	*1.78*	*1.53*	*1.79*	*1.49*	*1.78*	*2.19*	*1.82*	*1.60*	*1.81*	*1.75*	*1.87*	*1.90*	*1.87*
Mother occupation	2.99	2.50	2.48	2.52	1.78	2.07	2.06	3.02	1.78	2.42	3.22	2.00	1.90	2.22	3.24	1.95	2.07	2.20
status	*1.10*	*1.26*	*1.27*	*1.25*	*1.01*	*1.13*	*1.13*	*1.17*	*.94*	*1.12*	*1.19*	*1.23*	*1.11*	*1.25*	*1.12*	*1.12*	*1.22*	*1.16*
Home educational	.05	−.05	−.10	.03	.09	.10	−.11	−.13	.08	−.30	−.09	−.10	−.06	−.33	−.15	.25	.20	.08
Resources	*.95*	*1.02*	*1.06*	*.95*	*.93*	*.99*	*1.05*	*1.03*	*.81*	*1.34*	*1.07*	*1.07*	*1.07*	*1.07*	*1.03*	*.85*	*.88*	*.92*
Family cultural	−.09	−.24	−.25	−.23	.02	−.11	.27	−.42	.10	−.51	−.54	−.32	−.29	−.49	−.47	−.18	−.26	−.28
Possessions	*1.00*	*.97*	*.96*	*.97*	*1.04*	*1.02*	*.97*	*.88*	*1.03*	*.88*	*.90*	*.94*	*.99*	*.79*	*.84*	*.95*	*1.00*	*.97*
Index of family	.09	−.14	−.18	−.09	.34	.14	−.23	−.37	.30	−.54	−.41	−.15	.00	−.56	−.38	.19	.13	.02
Possessions	*.92*	*.93*	*.98*	*.87*	*.96*	*.98*	*.90*	*.83*	*.82*	*1.01*	*.93*	*1.07*	*.98*	*.77*	*.83*	*.83*	*.89*	*.83*
Nuclear family	.70	.72	.70	.74	.66	.62	.68	.77	.76	.27	.77	.63	.58	.75	.82	.69	.84	.72
	.46	*.45*	*.46*	*.44*	.47	.49	.47	.42	.44	.45	.42	.49	.49	.44	.39	.46	.37	.45

[1]*Note*. Standard deviations are in italics.

Source: PISA 2003, according to Levels & Dronkers, 2006.

NEU = Northern Europe WEU = Western Europe EEU = Eastern Europe SEU = Southern Europe NAM = North America SAM = South and Central America NAF = Northern Africa SAF = Southern and Central Africa AUS = Australia and New Zealand OCE = Polynesia, Melanesia, and Micronesia WAS = Western Asia EAS = Eastern Asia SAS = Southern Asia SEAS = South-Eastern Asia.

The following analysis will start with the outcomes of Levels and Dronkers, adding school characteristics (composition, resources) to the equation.

Ethnic and Socioeconomic School Segregation in Countries of Destination

Table 3 gives the degree of ethnic school segregation in the countries of destination. In the average school, across all 13 surveyed countries of destination, 17.9% of the students were immigrant students (first or second generations combined, and whatever the region of origin). This average is not the indicator for ethnic school segregation, but the standard deviation of this average (18.4% in the countries together) is used as the school segregation index. The larger this standard deviation in the percentage of immigrant students per school in a country, the more the schools of that country vary in the percentage of immigrant students they welcome. Ethnic school segregation, as indicated by this standard deviation, is high in Germany (22.6%) and New Zealand (20.2%) and low in Denmark (10.2%), Ireland (6.6%), Latvia (13.0%), Liechtenstein (13.4%), and Scotland (11.4%). The measurement of school segregation is sensitive to the different definitions of a school in different cultures. In Germany, with its hierarchy of secondary school types, a *Grundschule* is not the same as a *Hauptschule* or *Gymnasium*. The early entrance selection for these different school types makes school segregation visible and measurable. In Denmark, all 15-year-old students attend one comprehensive school, where the internal differentiation (by streaming or some other method) is not institutionalized. As a consequence, school segregation in Denmark is less visible and measurable and automatically smaller because all students attend the same school. But the less visible and measurable internal differentiation within such comprehensive schools can be so large that the factual segregation between native and immigrant students is as large as in an educational system with distinctive school types like in Germany. PISA 2003 data do not measure such internal differentiation[8] with sufficient reliability, and thus school segregation can be underestimated for school systems with comprehensive schools.

The third and fourth columns of Table 3 show that ethnic school segregation is smaller for second-generation than for first-generation immigrant students (8.8% vs. 10.2%), but this trend is not present in all countries. In Australia (9.9%; 8.1%), Denmark (5.9%; 2.5%), Germany (9.8%; 7.2%), and Latvia (10.9%; 3.2%), second-generation immigrants experience a higher level of school segregation than first generation counterparts. Apparently then, there is no natural tendency towards less ethnic school segregation for the second generation.

The next two columns of Table 3 underline the importance of the origin of immigrant students. We distinguish between first-world immigrant students (Europe, North America, Australia, and New Zealand) and third-world immigrant students (Asia, Latin America, Africa, Oceania). The average percentage of first-world immigrant students (11.2%) is more than twice as large as that of third-world immigrant students (3.5%). This is true of nearly all countries of destination, except for Belgium and Denmark. This outcome shows once again that migration is above all

Table 3. Average percentages and standard deviations[1] by school of immigrant, family, and school characteristics of country of destination

Country & N of schools	% Migrants per school	% Migrants First generation per school	% Migrants Second generation per school	% immigrants from Europe, North America, & Australia per school	% immigrants outside Europe, North America, & Australia per school	Average Parental occupational status per school	Average Parental educational Level per school	School size: number of students	% girls in school	Teacher shortage of schools	Quality Material resources of schools	Quality educational resources of schools	Student-teacher ratio of schools
Australia	22.50	9.31	9.74	13.48	5.79	52.44	4.62	896	.49	.15	.18	.51	13.5
321	*17.77*	*8.12*	*9.93*	*9.22*	*9.91*	*7.23*	*.58*	*367*	*.22*	*.88*	*.87*	*.99*	*2.0*
Austria	14.18	8.48	4.09	11.64	4.28	47.36	4.09	647	.49	−.59	.09	.34	12.7
193	*16.53*	*10.02*	*7.34*	*16.00*	*10.33*	*8.07*	*.51*	*535*	*.31*	*.75*	*1.10*	*.98*	8.1
Belgium	14.13	5.18	4.48	5.41	5.09	50.37	4.61	683	.47	.19	.01	.19	9.5
277	*18.72*	*9.33*	*8.09*	*10.56*	*10.31*	*8.25*	*.61*	*327*	*.23*	*.96*	*1.06*	*.95*	*3.2*
Denmark	8.27	.78	1.85	.93	2.30	49.07	4.46	441	.50	−.32	−.17	.04	11.3
206	*10.17*	*2.45*	*5.85*	*5.54*	*6.12*	*6.27*	*.50*	*193*	*.05*	*.66*	*.84*	*.77*	*2.5*
Germany	20.79	6.05	6.05	8.01	4.65	49.29	4.02	678	.51	.13	.13	.20	17.5
216	*22.58*	*7.15*	*9.79*	*9.02*	*9.25*	*8.44*	*.79*	*388*	*.11*	*.89*	*1.07*	*.91*	*4.5*
Greece	10.68	8.47	1.12	22.03	–	46.22	4.12	295	.49	.18	−.42	−.47	9.5
171	*17.42*	*16.16*	*2.09*	*26.80*	–	*8.74*	*.70*	*140*	*.11*	*1.44*	*1.22*	*1.03*	*2.5*
Ireland	7.14	4.95	.90	5.15	.73	48.45	4.23	584	.52	−.28	−.25	−.07	14.5
145	*6.63*	*4.76*	*2.22*	*4.93*	*1.64*	*6.74*	*.54*	*234*	*.35*	*.79*	*1.07*	*.88*	*5.1*
Latvia	11.87	1.88	8.45	9.86	–	50.70	4.90	701	.51	−.13	.04	−.47	13.1
157	*13.02*	*3.22*	*10.88*	*12.40*	–	*5.89*	*.47*	*339*	*.06*	*.66*	*.75*	*.76*	*2.6*
Liechtenstein	18.98	9.34	6.93	11.98	1.64	50.73	3.91	310	.50	−.38	.55	.83	7.5
12	*13.44*	*8.30*	*6.20*	*14.11*	*2.23*	*7.51*	*.57*	*263*	*.06*	*.43*	*.66*	*.96*	*1.5*
Luxembourg	33.37	16.24	13.05	27.82	–	48.10	4.06	1437	.51	.58.	−.14	.15	10.2
29	*16.34*	*10.26*	*5.24*	*14.31*	–	*7.74*	*.71*	*693*	*.19*	*1.01*	*.78*	*.55*	*3.1*
New Zealand	23.10	12.48	6.27	8.39	8.90	51.56	4.23	1140	.49	.34	.23	.26	16.6
173	*20.22*	*11.25*	*10.04*	*7.53*	*14.24*	*6.57*	*.52*	*616*	*.28*	*.82*	*.81*	*.96*	*3.0*
Switzerland	23.97	11.64	8.10	17.81	2.41	48.01	3.88	438	.50	−.31	.47	.60	12.1
445	*18.70*	*11.82*	*8.63*	*15.98*	*4.89*	*6.74*	*.65*	*462*	*.09*	*.84*	*.83*	*.91*	*4.3*
Scotland	12.19	5.99	3.34	8.05	2.29	50.82	4.46	960	.50	−.14	.14	.55	12.5
98	*11.44*	*7.17*	*5.05*	*10.05*	*4.49*	*6.17*	*.55*	*324*	*.06*	*.90*	*.89*	*.92*	*1.7*
All	17.86	7.92	6.24	11.12	3.49	49.68	4.33	734	.49	.00	.07	.22	12.5
2443	*18.38*	*10.16*	*8.82*	*14.48*	*8.33*	*7.61*	*.68*	*499*	*.20*	*.95*	*.97*	*.97*	*4.39*

[1]*Note*. Standard deviations are in italics.
Source: PISA 2003.

a first-world phenomenon. But first-world immigrant students experience greater variation in the level of ethnic school segregation than third-world immigrant students (standard deviation 14.5% vs. 8.3%). This is true of nearly all countries, though in Australia, Belgium, and Germany the variation in ethnic school segregation is more or less equal for first- and third-world immigrant students, while in Denmark and New Zealand the variation in ethnic school segregation is highest among third-world immigrant students.

Of course socioeconomic school segregation also exists, as one can see in the next column of Table 3. Here, the variation in the school averages according to parental occupational status is largest in Greece (8.74) and smallest in Latvia (5.89). The variation in the school averages according to parental educational level is the largest in Germany (.79) and, again, the smallest in Latvia (.47).

Finally, the last columns of Table 3 show that there exist cross-national differences in the material and educational resources of schools, such as the frequency of teacher shortages, the quality of the material resources of the school, the quality of the educational resources of the school, and its staff-student ratio.

The Effect of Regions of Origin of Immigrant Students on Mathematical Score

In order to obtain the correct estimations of the effects of regions of origin and school composition, we apply multilevel analysis using three levels: students, schools, and countries. The students' mathematical score is the dependent variable, because this was the main focus of PISA 2003 (OECD, 2004). Moreover, this multilevel approach makes it possible to establish whether the effect of an independent variable is significantly different at a higher level, for instance between countries. Although 13 countries is not a large dataset, it is sufficient to draw reliable conclusions about these differences in effects (Snijders & Bosker, 1999, pp. 43–44). One of the disadvantages of the multilevel software MlWin1.0 used here is that it does not allow for missing values. Most missing values were in the school characteristics, as measured by the responses of the principals. We deleted these schools and their students from our multilevel analysis set. We did the same with those students who had missing values which could not be estimated using other characteristics (gender, family size, regions of origin). Missing values that could be estimated using other characteristics (like occupational status, on the basis of educational level) were replaced by estimations. Those immigrants for whom the region of origin was unknown (mostly due to the restricted categories of answers in the questionnaire) were also deleted. We used a multilevel analysis set of 57,664 students (originally 67,865) from 2,145 schools (originally 2,443), comprising 49,203 native students (originally 55,744), 4,645 first-generation immigrant students (originally 5,374), and 3,815 second-generation immigrant students (originally 4,233).[9] The reference category for the two generations of immigrants and for the regions of origin is the category of all natives in the 13 countries. The parameters of first and second generation, combined with the specific region of origin, give the deviation in mathematics achievement of an immigrant student, originating from a certain region of origin, as compared with this native group. The multilevel analysis takes into account the country-level variation in mathematical scores, because the constant of the equations is also allowed to vary at the country level.

Table 4 gives the parameters of the various models, in which new independent variables are successively added to the equation. The null model without any independent variables is not shown in Table 4. Its total variance is 9,271, of which 59% at the student level, 32% at the school level, and 9% at the country level.[10] Model 1 contains only the immigrant characteristics and the regions of origin. The origin differences, shown in Table 4, are the averages across the 13 countries of destination and are therefore not fully equal to the observed differences within one country of destination.[11] Remarkable are the positive and significant parameters of first- and second-generation immigrant variables (8 and 14) in Model 1. But these positive effects of generation should be combined with region of origin and speaking a foreign language at home parameters (−11). The combination of the immigrant-generation effects with the region-of-origin effects of Model 1 produces a differentiated result. First- and second-generation immigrant students from Eastern Asia, South-Eastern Asia, and Northern Europe have higher mathematical scores than comparable native students (8 or 14 plus 10; 8 or 14 plus 0; 8 or 14 plus 0) if they do not speak a foreign language at home. First- and second-generation immigrant students from Australia, Eastern Europe, and South Asia have mathematical scores more or less equal to those of comparable native students (8 or 14 plus −10, −17; −4) if they do not speak a foreign language at home. Immigrant students from other regions have lower mathematical scores than comparable natives (8 or 14 plus Oceania −68; Latin America −68; Western Asia −65; Northern Africa −57; Southern Africa −45; Southern Europe −46; Western Europe −29). If a foreign language is spoken at home, their mathematical score decreases by a further 11 points. These region-of-origin effects are substantive and just not a simple distinction between immigrant students from the rich, developed regions and the poor, underdeveloped regions.

Including the immigrant characteristics in Model 2 reduces the total variance to 8,859 (5% reduction). A model (not shown here) with only family characteristics (but without the immigrant characteristics) reduces the variance to 6,809 (27% reduction), while a model with immigrant characteristics and family characteristics (Model 2) reduces the variance further to 6,701 (2% reduction). Thus, family characteristics are more important in the explanation of variances in mathematical scores than the characteristics of migration. At the same time, this difference in unexplained variance between family characteristics and immigrant and family characteristics shows that the weaker scholastic performance of immigrant students cannot be fully explained by their family characteristics alone. Clearly, the region of origin is important to the mathematics achievement of immigrant students. This latter result is not contradictory to that of Marks (2006), who found that family characteristics like parental occupation and education substantially reduce the immigrant/non-immigrant differences. Indeed, adding family characteristics makes

Table 4. The unstandardized effects of immigrant, family, and school characteristics on mathematical score in three-level multilevel analyses. Standard errors between parentheses. N students = 57664, N schools = 2145, N countries = 13

	1: immigrant generation & origins	2: 1 & Family	3: 2 & interactions & random effects of both generations	4: 3 & relative % migrants school	5: 4 & relative mean highly educated parents	6: 5 & school resources	7: 6 & regions of origin* % immigrant school – ethnic school composition random
Constant	508 (8)	619 (19)	618 (19)	616 (19)	615 (19)	591 (19)	591 (19)
First generation	8 (5)	16 (4)	27 (8)	27 (8)	26 (8)	26 (8)	31 (8)
Second generation	14 (4)	17 (4)	32 (8)	31 (8)	31 (7)	31 (7)	37 (8)
Foreign language	−11 (2)	−5 (2)	−5 (2)	−4 (2)	−4 (2)	−4 (2)	−4 (2)
North Europe	0 (5)	−12 (5)	−24 (6)	−23 (6)	−22 (6)	−22 (6)	−26 (8)
Western Europe	−29 (5)	−30 (5)	−33 (7)	−32 (7)	−32 (7)	−32 (7)	−37 (8)
Eastern Europe	−17 (5)	−17 (5)	−32 (8)	−31 (8)	−32 (7)	−32 (7)	−35 (9)
Southern Europe	−46 (5)	−36 (4)	−34 (7)	−33 (7)	−33 (7)	−33 (7)	−42 (9)
North America	−25 (5)	−29 (5)	−37 (6)	−37 (6)	−36 (6)	−36 (6)	−36 (8)
Latin America	−68 (13)	−60 (12)	−58 (13)	−58 (13)	−60 (13)	−59 (13)	−63 (19)
Northern Africa	−57 (8)	−50 (8)	−47 (10)	−46 (10)	−42 (9)	−42 (9)	−61 (11)
Southern Africa	−45 (8)	−41 (7)	−46 (9)	−45 (9)	−44 (9)	−44 (9)	−54 (10)
Australia	−10 (6)	−15 (6)	−21 (7)	−20 (7)	−19 (7)	−19 (7)	−18 (9)
Oceania	−68 (8)	−62 (7)	−46 (18)	−44 (18)	−43 (17)	−43 (17)	−39 (20)
Western Asia	−65 (5)	−52 (5)	−60 (7)	−59 (7)	−59 (7)	−58 (7)	−71 (8)
Eastern Asia	10 (6)	9 (6)	−25 (13)	−24 (13)	−24 (13)	−23 (13)	−31 (14)
Southern Asia	−4 (7)	−19 (6)	−85 (19)	−85 (19)	−83 (19)	−83 (19)	−87 (19)
South-Eastern Asia	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Occupational status*10		6 (2)	6 (2)	6 (2)	6 (2)	6 (2)	6 (2)
Educational level		2 (0)	2 (0)	2 (0)	2 (0)	2 (0)	2 (0)

(*continued*)

Table 4. (*Continued*)

	1: immigrant generation & origins	2: 1 & Family	3: 2 & interactions & random effects of both generations	4: 3 & relative % migrants school	5: 4 & relative mean highly educated parents	6: 5 & school resources	7: 6 & regions of origin* % immigrant school – ethnic school composition random
Educational resources		4 (0)	4 (0)	4 (0)	4 (0)	4 (0)	4 (0)
Cultural possessions		−3 (0)	−3 (1)	−3 (1)	−3 (0)	−3 (0)	−3 (0)
Family possessions		17 (1)	17 (1)	17 (1)	16 (1)	16 (1)	16 (1)
Nuclear family		8 (1)	8 (1)	8 (1)	8 (1)	8 (1)	8 (1)
Man		19 (1)	18 (1)	18 (1)	19 (1)	19 (1)	19(1)
Age		−11 (1)	−11 (1)	−11 (1)	−11 (1)	−11 (1)	−11 (1)
Grade		42 (1)	43 (1)	42 (1)	42 (1)	41 (1)	41 (1)
1st generation *South-Eastern Asia			−16 (8)	−15 (8)	−15 (8)	−15 (8)	−16 (8)
2nd generation *educational level			−2 (1)	−2 (1)	−2 (1)	−2 (1)	−2 (1)
Educational level *Southern Europe			−3 (1)	−3 (1)	−3 (1)	−3 (1)	−3 (1)
Foreign language *Western Europe			25 (14)	24 (14)	23 (14)	24 (14)	24 (14)
Cultural possessions *North America			7 (2)	7 (2)	6 (2)	6 (2)	6 (2)
Foreign language *Australia			−47 (22)	−48 (22)	−48 (22)	−49 (22)	−45 (23)
Occupational status *Oceania*10			−6 (3)	−6 (3)	−6 (3)	−6 (3)	−6 (3)

(*continued*)

Table 4. (*Continued*)

	1: immigrant generation & origins	2: 1 & Family	3: 2 & interactions & random effects of both generations	4: 3 & relative % migrants school	5: 4 & relative mean highly educated parents	6: 5 & school resources	7: 6 & regions of origin* % immigrant school – ethnic school composition random
Foreign language *Eastern Asia			30 (13)	29 (13)	27 (13)	25 (13)	20 (13)
Cultural possession *Western Asia			−10 (3)	−10 (3)	−10 (3)	−10 (3)	−10 (3)
Educational level *Southern Asia			11 (4)	11 (4)	11 (4)	11 (3)	10 (3)
% immigrants at school*10				−7 (1)	−5 (0)	−5 (0)	−5 (0)
Migrant*% immigrants at school*10				2 (0)	2 (1)	2 (1)	–
Average parental educational level per school					33 (1)	29 (1)	31 (3)
Migrant* Average parental educational level per school					3 (1)	3 (1)	4 (2)
School size*100						2 (0)	1 (0)
% girls*10						2 (0)	2 (0)
Teacher shortage						−3 (1)	−3 (1)

(*continued*)

Table 4. (*Continued*)

	1: immigrant generation & origins	2: 1 & Family	3: 2 & interactions & random effects of both generations	4: 3 & relative % migrants school	5: 4 & relative mean highly educated parents	6: 5 & school resources	7: 6 & regions of origin* % immigrant school – ethnic school composition random
Quality material resources						−1 (1)	−2 (1)
Quality educational resources						2 (1)	3 (1)
Staff-student ratio*10						2 (2)	2 (2)
Latin America*% immigrants at school*10							0 (6)
Northern Africa*% immigrants at school*10							5 (2)
Western Asia*% immigrants at school*10							3 (1)
North Europe*% immigrants at school*10							5 (2)
Western Europe*% immigrants at school*10							−1 (1)

(*continued*)

Table 4. (*Continued*)

	1: immigrant generation & origins	2: 1 & Family	3: 2 & interactions & random effects of both generations	4: 3 & relative % migrants school	5: 4 & relative mean highly educated parents	6: 5 & school resources	7: 6 & regions of origin* % immigrant school – ethnic school composition random
Eastern Europe*% immigrants at school*10							2 (1)
Southern Europe*% immigrants at school*10							4 (1)
North America*% immigrants at school*10							1 (1)
Australia*% immigrants at school*10							−2 (3)
Southern Africa*% immigrants at school*10							4 (3)
Oceania*% immigrants at school*10							1 (2)
Eastern Asia*% immigrants at school*10							7 (2)

(*continued*)

Table 4. (*Continued*)

	1: immigrant generation & origins	2: 1 & Family	3: 2 & interactions & random effects of both generations	4: 3 & relative % migrants school	5: 4 & relative mean highly educated parents	6: 5 & school resources	7: 6 & regions of origin* % immigrant school – ethnic school composition random
Southern Asia*% immigrants at school*10							5 (3)
South-Eastern Asia* % immigrants at school*10							2 (2)
Individual variance	5393 (32)	4577 (27)	4562 (27)	4561 (27)	4563 (27)	4563 (27)	4563 (27)
School variance	2708 (91)	1523 (53)	1492 (52)	1384 (49)	969 (36)	914 (34)	863 (33)
Country variance	758 (312)	601 (244)	670 (272)	631 (255)	642 (258)	626 (251)	639 (256)
−2*log-likelihood	664648	654403	654220	654071	653454	653346	653259

the effects of immigrant generation more positive and thus substantially reduces the migration effect, as Marks (2006) found. But this addition affects immigrant/non-immigrant differences far less than region of origin, thus suggesting that an immigrant's origin is something other than the simple distinction between immigrant and non-immigrant. Moreover, the positive and significant effects on the mathematics achievement of immigrant students varies at the country level for the first,[12] but not for the second generation.[13] This positive parameter of first-generation immigrant students becomes smaller in countries of destination with high average mathematical scores and larger in countries of destination with low average mathematical scores. This shows that the performance differences of immigrants is an international phenomenon, which is, to a certain degree, also sensitive to context (both of region of origin and country of destination).

In Model 3, we add to the equation the significant interaction, which Levels and Dronkers (2006) found in their earlier analysis, and the effects of first- and second-generation immigrant students are free to vary randomly between the countries of destination. These between-destination-country differences of the effects of the first and second generation are now both significant.[14] This result can be interpreted as follows: It is easier for immigrant students to excel in mathematics than in language, due to the lower cultural dependence of mathematics (De Fraiture, Dronkers, & Van Erp, 1998). This excellence is more easily realized in countries where the difference between the average mathematical scores and that of immigrant students is not very large. As the difference between average mathematical scores and those of immigrant students increases, it becomes more difficult for an immigrant student to excel in mathematics. Of course, this interpretation needs to be studied in more depth. Model 3 is an improvement compared to Model 2, both in terms of the decrease in unexplained total variance and the decrease in the log-likelihood. The destination differences are comparable with those reported by Levels and Dronkers.[15] Speaking a foreign language at home has different effects, depending on the region of origin (Eastern Asia and Western Europe positive, Australia negative). In addition, the effects of the first and second generation have become stronger and the differences in the effect of regions of origin have become larger rather than smaller. The above-average mathematical scores of Eastern Asian immigrant students are mostly related to speaking a foreign language at home: thus to a lower level of integration into the culture of the country of destination. The above-average mathematical scores of Southern Asian immigrant students are mostly related to the higher importance of parental education for this category of immigrant students: Only children with less educated Southern Asian parents have lower mathematical scores than comparable native students.

Migrant Origins and School Segregation in the Countries of Destination

Model 3 is the starting point for testing whether the level of school segregation in the 13 countries of destination is capable of accounting for the significantly lower educational outcomes of immigrant students, originating from Latin America, Northern Africa, and Western Asia in comparison with immigrant students from other regions.

We test our first two hypotheses (The different levels of school segregation in the countries of destination explain the lower mathematics achievement of students originating from Latin America, Northern Africa, and Western Asia (as compared with immigrant students from other regions); The different levels of school segregation of immigrants from different origins explain the lower mathematics achievement of students originating from Latin America, Northern Africa, and Western Asia (as compared with immigrant students from other regions)) using Models 4 and 5. In order to test these hypotheses correctly, we added new variables which indicate how far the ethnic and socioeconomic composition of a certain school in a certain country deviates from the average composition of all schools of that country of destination. A school with an average composition in that country thus has a value of zero on these two new indicators of relative school segregation. Schools with more highly educated parents or with more immigrants than the average school have positive scores, whereas schools with less highly educated parents or with fewer immigrants than the average school have negative scores. We use these indicators of relative school segregation because they no longer measure cross-national differences in parental educational levels and percentages of immigrant students. We have experimented with the distinction between the percentages of first- and second-world immigrant students and third-world immigrant students per school, as an alternative for percentages of immigrant students per school. The effects of these two different indicators of ethnic school segregation were more or less equal in size and were comparable to the effect of the percentage of immigrant students per school. This outcome is in itself interesting: Ethnic segregation is about the percentage of immigrant students, irrespective of the region from which they come. To keep our analyses simpler, we use the percentage of immigrant students per school as an indicator of school segregation.

The results of Model 4 (adding the level of ethnic school segregation to Model 3) show that the mathematical scores of native students fall 7 points with each 10% increase in the proportion of immigrant students in a school, whereas the mathematical scores of immigrant students fall by only 5 points (the combination of the main and interaction effects). Thus, a native student at a school with only immigrant students scores 70 points lower on the mathematical test than a comparable native student at a school without any immigrant students; whilst an immigrant student at a school with only immigrant students scores 50 points lower on the mathematical test than a comparable immigrant student at a school without further immigrant students. These lower scores at schools with only immigrant students are large, given the standard deviation on the mathematical test of 92. Although ethnic school segregation is slightly less detrimental to immigrant students (thanks to the interaction effect), ethnic school segregation has negative effects on all students, whether native or immigrant.

In Model 5, we add the school averages of parental educational levels to the equation in Model 4. The addition of the degree of ethnic school segregation made the total variance drop by 48 (6,624 in Model 3 to 6,576 in Model 4), but the degree of socioeconomic school segregation explains more variance: 402 (6,576 in Model 4 to 6,174 in Model 5). The difference in mathematical scores between students in schools with only university-educated parents and comparable students in schools with parents with only vocational college is 33 points. The difference between the mathematical scores of equal students in schools with only the least educated parents and schools with only the most educated parents is thus 198 points (twice the standard deviation). Socioeconomic school segregation has a larger impact on differences in mathematics achievement than ethnic school segregation. Model 5 also shows that immigrant students in schools with highly educated parents have slightly higher mathematical scores (3 points) than comparable native students at the same school. The drop in the effect of ethnic school segregation after the addition of the school averages of parental educational level makes clear that a part of the ethnic school segregation is basically due to socioeconomic school segregation.

In Model 5, we allow the effects of school segregation to vary between countries of destination. The effects of first-generation immigrant students and average parental educational level per school vary significantly between the 13 countries.[16] The effect of the percentage of immigrants per school does not vary significantly between countries.[17] The effects of socioeconomic school segregation are thus not equal in all destination countries.

However, the region-of-origin parameters are hardly affected by the addition of the levels of ethnic and socioeconomic school segregation or by the between-country variation in the effects of first generation and average parental educational level per school. This constancy in the region-of-origin parameters clearly shows that we must reject our first two hypotheses. The different levels of ethnic and socioeconomic school segregation in countries of destination do not explain the lower mathematics achievement of students, originating from Latin America, Northern Africa, and Western Asia in comparison with immigrant students from other regions. Nor do the different levels of ethnic and socioeconomic school segregation of immigrants from Latin America, Northern Africa, and Western Asia explain the lower mathematics achievement of these students in comparison with immigrant students from other regions.

Regions of Origin and Differences in School Resources

We test our fourth hypothesis (The effects of school segregation and of regions of origin on the mathematics achievement of students will become significantly smaller after controlling for differences in school resources) in Model 6. We add a number of indicators of the material and educational school resources to the equation. Students in larger schools have a higher mathematical score (2 points for 100 more students), students in schools with more female students have a higher score (2 for 10% more female students). A higher frequency of teacher shortage in a school lowers the mathematical score. The material resources of a school (quality material resources, staff-student ratio) have no effect on mathematics achievement. But contrary to our fourth hypothesis, the effects of ethnic and socioeconomic school segregation hardly become smaller and they continue to vary between countries of destination. The various effects of ethnic and socioeconomic school segregation on mathematics achievement cannot be explained by the differences in material and educational resources of schools in the various countries of destination. Ethnic and socioeconomic school segregation have independent meanings, which cannot be reduced to resources or school climate.[18] The effects of ethnic and socioeconomic school segregation on the mathematics achievement of immigrant and native students vary between countries of destination after controlling for school resources.

But the region-of-origin parameters are hardly affected by the addition of the differences in school resources. This constancy in the region-of-origin parameters means that we must reject our fourth hypothesis. The varying school resources in schools with different levels of ethnic and socioeconomic segregation do not explain the lower mathematics achievement of students originating from Latin America, Northern Africa, and Western Asia (as compared with immigrant students from other regions).

Regions of Origin and Varying Effects of School Segregation

We test our third hypothesis (The effects of ethnic school segregation are stronger for immigrants from Latin America, Northern Africa and Western Asia than for comparable immigrant students from other regions) using Model 7. The interaction variable *migrant*percentage immigrant students per school* is replaced by a number of interaction variables *migrant from a region of origin*percentage immigrant students per school*. The effect of socioeconomic school segregation still varies significantly between countries in Model 7, but that of ethnic school segregation no longer varies significantly between countries and is therefore fixed in Model 7. Immigrant students from Northern Africa, Western Asia, Northern Europe, Southern Europe, Eastern Asia, and Southern Asia in particular, have higher mathematical scores in schools with higher percentages of immigrant students as compared with comparable students from the same regions of origin in schools with low percentages of immigrant students (respectively 5, 4, 5, 4, 7, and 5 points higher per 10% more immigrant students). These significant interaction effects of regions of origin with the percentage of immigrant students per school more or less fully compensates for the negative main effect of ethnic school segregation (5 points lower per 10% more immigrant students). Immigrant students from Latin America, Western Europe, Eastern Europe, North America, Australia, Southern and Central Africa, Oceania, and South-Eastern Asia, on the other hand, do not see such a significant compensation for the negative effects of ethnic school segregation. The strength of the negative effect of ethnic school segregation is indeed specific to the region of origin of the immigrant student. But it is not true that a high percentage of immigrant students per school is more detrimental to the performance of students originating from regions with the lowest mathematical scores (Northern Africa, Western Asia). Our third hypothesis is only partly correct in the sense that the effects of school segregation vary according to the region of origin. But the direction of the variation is contrary to our expectations: They cannot explain the negative effect of some regions of origin on mathematics achievement. Neither do we have an explanation of why ethnic school segregation has less of a negative effect on immigrant students from certain regions of origin.[19]

Discussion and Conclusion

We started this paper with the conclusion reached in Levels and Dronkers (2006, p. 64) that "immigrant students from Western Europe (but only those from less educated classes), Southern and Central America, Northern Africa and Western Asia have substantially lower mathematics achievement than comparable native students and immigrant students from other origins." We tried to explain this result by looking at the ethnic and socioeconomic school segregation of these immigrant students as a possible explanation.

However, our analysis clearly shows that ethnic and socioeconomic school segregation (as relevant as they are for mathematics achievement) do not provide any explanation for the differences in mathematics achievement of students from various regions of origin. These differences remain more or less unchanged by the addition of school segregation. The question why immigrant students from certain regions of origin have lower mathematics achievement remains unanswered in this article. In a follow-up study (Levels, Dronkers, & Kraaykamp, 2006), we concentrated on economic, social, and cultural macrovariables of both countries of origin and destination, instead of educational mesovariables like school segregation, school resources, and school climate.

Socioeconomic school segregation has negative consequences for immigrant and native students alike, if they do not attend schools with a high average parental educational level. Moreover, immigrant students have a larger advantage in attending schools with a high average parental educational level than comparable native students.

We do not argue that ethnic school segregation is irrelevant for the mathematics achievement of immigrant students, but, compared with the importance of socioeconomic school segregation, ethnic school segregation is only a minor factor among other more important variables (like country of origin). However, the weak relation found between ethnic school segregation and the mathematics achievement of immigrant students deviates from our expectations. Immigrant students from certain regions of origin (Northern Africa, Western Asia, Northern Europe, Southern Europe, Eastern Asia, and 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, and South-Eastern Asia). Do these results mean that schools with a more familiar environment (more immigrants, perhaps from the same origin, instead of many native students) provide a better learning environment for immigrant students? Do we see in the results the positive effect of the specialization of immigrant schools in handling the particular learning and teaching problems of immigrant students? Whatever the explanation, it appears that ethnic school segregation is normally not detrimental to the mathematics achievement of immigrant students, again contrary to socio-economic school segregation and differences between countries of origin of immigrant students.

Notes

1. An earlier version of this paper was presented at the spring meeting 2006 of the ISA Research Committee on Social Stratification and Mobility Intergenerational transmissions: Cultural, economic or social resources?, May 11th – 14th 2006, Nijmegen, The Netherlands. An earlier Dutch version was published in 2005 (Dronkers & Levels, 2005).
2. For instance, only the country of birth of the respondent is measured in the first wave of the *European Social Survey* (n.d.). This means that only the success of the first generation of immigrants can be estimated but not that of the far more important second generation (Dronkers & Wanner, 2006). Only the second wave of the ESS also contains the countries of birth of the parents.
3. Marks (2005) was forced to analyze the role of education for immigrants without knowing their country of origin, because this information was not available in the PISA 2000 data. Although he found interesting differences between the educational achievement of immigrant students in various countries of destination, his analysis of the immigrant effects is unsatisfactory because he cannot control for the quite different effects of their countries of origin.
4. This preference is based on the observation that students in schools with better social composition attain higher educational outcomes.
5. The term "Matthew effect" refers to a text from the bible and is often used in sociology to indicate the phenomenon that the possession of resources tends to lead to further accumulation over time, while a lack of resources tends to lead to an even larger shortage in resources over time.
6. www.pisa.oecd.org
7. Students born outside the test country with parents both born in the test country are not coded as immigrant students.
8. The question for the students about the type of course (usually academic versus vocational) is quite imperfect.
9. We checked the consequences of deleting the migrants with a missing region (the most important group with irreparable missing values) for the differences between the correlations in the original file and the final file. These differences were not substantial enough for the research question of this article.
10. The -2*log-likelihood is 665816.
11. Another reason for this difference is that countries of destination might have immigrants from different countries within the same region.
12. The random effect of the first generation has a significant variance at the country level of 194 with a standard deviation of 87 in Model 2 with random effects for generations. This variance is significantly negative in relation to the intercept of the equation.
13. The random effect of the second generation has a nonsignificant variance at the country level of 93 with a standard deviation of 50 in Model 2 with random effects for generations. This variance is negative in relation to the intercept of the equation, but it is just not significant.
14. The first generation has a significant variance at the country level of 212 (with 94 as standard deviation) and the second generation has a significant variance at the country level of 117 (with 60 as standard deviation).
15. Levels and Dronkers (2006) found only a few significant interactions between country of destination and individual immigrant characteristics, other than generation. For that reason we do not include them in these equations.

16. The random effects have a variance of 148 and 127, respectively, with a standard deviation of 68 and 60. The variance of first generation still correlates negatively with the intercept, but the variance of school average parental educational level does not correlate significantly with the intercept.
17. Variance of random effects at the country level of .083 with .045 as standard deviation.
18. In an analysis, not shown in this paper due to lack of space, we added a number of indicators of school climate to Model 7. This did not produce different results for the effects of ethnic and socioeconomic school segregation.
19. The effects of first-generation immigrant students and school averages of parental educational level still vary significantly between countries. The variance of the first-generation variable still correlates negatively with the intercept.

References

Bourdieu, P., & Passeron, J.-C. (1970). *La reproduction, éléments pour une théorie de système d' enseignement* [The reproduction, elements for a system theory on education]. Paris: Editions de Minuit.

Coleman, J. S., & Hoffer, T. (1987). *Public and private high schools. The impact of communities.* New York: Basic Books.

Corten, R., & Dronkers, J. (2006). School achievement of students from the lower strata in public, private government-dependent and private government-independent schools: A cross-national test of the Coleman-Hoffer thesis. *Educational Research and Evaluation*, *12*, 179 – 208.

De Fraiture, J. F. M., Dronkers, J. & Van Erp, M. (1998). Etnische diversiteit in afstand tussen taal- en rekenscores tussen jongens en meisjes [Ethnic diversity in the distance between lingual and arithmetic scores of boys and girls]. *Tijdschrift voor nascholing en onderzoek van het reken-wiskundeonderwijs*, *17*, 31 – 37. (English version available at http://www.iue.it/Personal/Dronkers/English/fraiture.pdf).

Driessen, G. (1997). Islamic primary schools in the Netherlands: The students' achievement levels, behaviour and attitudes and their parents' cultural backgrounds. *The Netherlands' Journal of Social Sciences*, *33*, 41 – 66.

Dronkers, J. (2004). Do public and religious schools really differ? Assessing the European evidence. In P. J. Wolf & S. Macedo (Eds.), *Educating citizens. International perspectives on civic values and school choice* (pp. 287 – 314). Washington, DC: Brookings Institution Press.

Dronkers, J., & Levels, M. (2005). Migranten en school segregatie in hoogontwikkelde landen [Migrants and school segregation in highly developed countries]. In S. Karsten & P. Sleegers (Eds.), *Onderwijs en ongelijkheid: Grenzen aan de maakbaarheid* (pp. 23 – 52). Antwerpen, Belgium/Apeldoorn, The Netherlands: Garant.

Dronkers, J., & Wanner, R. A. (2006). Waarom verdienen immigranten minder? Effecten van immigratiebeleid en arbeidsmarktkenmerken [Why do immigrants earn less? Effects of immigration policies and labour market characteristics]. *Tijdschrift voor Arbeidsvraagstukken*, *22*, 379 – 394.

European Social Survey. (n.d.). Retrieved September 27, 2007, from http://www.europeansocialsurvey.org

Levels, M., & Dronkers, J. (2006). Verschillen in wiskundekennis in hoog ontwikkelde landen van Europa, Australië en Nieuw-Zeeland, tussen eerste- en tweede-generatie immigrantenleerlingen uit verschillende herkomstregio's en autochtone leerlingen [Differences in Math skills in highly developed countries of Europe, Australia and New Zealand, between first- and second-generation immigrant students from various regions of origin and native students]. In R. Bosman & S. Waslander (Eds.), *Over kansen, competenties en cohesie. Kanttekeningen bij dertig jaar onderwijssociologie* (pp. 53 – 76). Assen, The Netherlands: Van Gorcum. (An English version will be published in *Ethnic and Racial Studies* (2008) and is already available at http://www.iue.it/Personal/Dronkers/English/Peschar.PDF).

Levels, M., Dronkers, J., & Kraaykamp, G. (2006). Het belang van herkomst en bestemming voor de schoolprestaties van immigranten. Een crossnationale vergelijking [The importance of origin and destination for the educational achievement of immigrants. A cross-national comparison]. In F. van Tubergen & I. Maas (Eds.), *Allochtonen in Nederland in internationaal perspectief* (pp. 137 – 160). Amsterdam: Amsterdam University Press. (An English version is available as an *EUI working paper SPS 2007/04*: http://hdl.handle.net/1814/6776).

Marks, G. N. (2005). Accounting for immigrant non-immigrant differences in reading and mathematics in twenty countries. *Ethnic and Racial Studies*, *28*, 925 – 946.

Marks, G. N. (2006). Are between- and within-school differences in student performance largely due to socio-economic background? Evidence from 30 countries. *Educational Research*, *48*, 21 – 40.

Organisation for Economic Co-operation and Development (OECD). (2004). *Learning for tomorrow's world. First results from PISA 2003.* Paris: Author.

PISA 2000 data. (n.d.). Retrieved March, 10, 2005, from http://pisaweb.acer.edu.au/oecd/oecd_pisa_data.html

PISA 2003 data. (n.d.). Retrieved March, 10, 2005, from http://pisaweb.acer.edu.au/oecd_2003/oecd_pisa_data.html

Snijders, T. A. B. & Bosker, R. J. (1999). *Multilevel Analysis. An introduction to basic and advanced multilevel modeling.* London/Thousand Oaks/New Delhi: Sage.