Schnepf, Sylke Viola

Working Paper

Inequality of learning amongst immigrant children in industrialised countries

HWWI Research Paper, No. 1-12

Provided in cooperation with:
Hamburgisches WeltWirtschaftsInstitut (HWWI)

Suggested citation: Schnepf, Sylke Viola (2008) : Inequality of learning amongst immigrant children in industrialised countries, HWWI Research Paper, No. 1-12, http://hdl.handle.net/10419/48198

Hamburg Institute
of International
Economics

Inequality of Learning Amongst Immigrant Children in Industrialised Countries

Sylke V. Schnepf

HWWI Research
Paper 1-12
by the
HWWI Research Programme
Economic Trends

Hamburg Institute of International Economics (HWWI) | 2008
ISSN 1861-504X

Sylke Viola Schnepf
School of Social Sciences and S3RI
University of Southampton
Southampton | SO 17 1BJ | United Kingdom
svs@soton.ac.uk

HWWI Research Paper
Hamburg Institute of International Economics (HWWI)
Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776
info@hwwi.org | www.hwwi.org
ISSN 1861-504X

Inequality of Learning Amongst Immigrant Children in Industrialised Countries

Sylke V. Schnepf

Abstract

Literature examining immigrants' educational disadvantage across countries focuses generally on average differences in educational outcomes between immigrants and natives disguising thereby that immigrants are a highly heterogeneous group. The aim of this paper is to examine educational inequalities among immigrants in eight high immigration countries: Australia, Canada, Germany, New Zealand, Sweden, Switzerland, UK and USA. Results indicate that for almost all countries immigrants' educational dispersion is considerably higher than for natives. For most countries higher educational dispersion derives from very low achieving immigrants. Quantile regression results reveal that at lower percentiles language skills impact more on educational achievement than at the top of the achievement distribution. Results are presented separately for immigrants of different age cohorts, varying time of immigrants' residence in the host country and subject examined (maths and reading) highlighting thereby the different patterns found by immigrant group and achievement measure.

Keywords: Education, educational inequalities, immigration, PISA, TIMSS, PIRLS

JEL classification: I21, J15, O15

Acknowledgements

I am grateful to Kevin Denny, Jaap Dronkers, Amy Lutz, Dorren McMahon, John Micklewright, James Raymer, Tim Smeeding, Nikos Tzavidis and participants at a seminar at the Geary Institute, University College Dublin and at the APPAM Fall conference 2007 for suggestions and comments.

1 Introduction

In many OECD countries the question of how to facilitate immigrants' integration is of increasing importance. A precondition of incorporation is immigrants' point of departure for labour market success: their education and ability. The examination of immigrants' performance in schools provides a first indication for future success or failure of young immigrants in their host country.

The recent availability of educational achievement surveys makes it possible to compare immigrants' educational disadvantages across countries[1]. However, literature using these surveys generally examines average differences between immigrants' and natives' achievement (OECD 2006, Schnepf 2007, Marks 2005) disguising thereby that the group of immigrants is highly heterogeneous within most countries. This stands in contrast to the increasing number of studies that emphasise the importance of diversity within the immigrant population (Rumbaut and Portes 2001).

The value added of this paper is to examine inequalities in educational outcomes among immigrant pupils in eight industrialised countries with high immigration: Australia, Canada, Germany, New Zealand, Sweden, Switzerland, UK and USA. The use of different sources of educational achievement data allows employing three diverse perspectives for comparing inequalities: first, inequalities compared between two different groups of immigrants (those recently arrived and those born in the host countries), second, inequalities at two time points (pupils in the 4^{th} and in the 8^{th} grade) and third, inequalities using two different achievement subjects (maths and reading).

Based on these three perspectives two main questions will be examined. First, what is the extent of educational inequalities among immigrants compared to those of natives and across countries? The paper will provide a first cross-national picture on inequalities among

[1] First, these surveys provided measures of educational outcomes that are aimed to be comparable across countries. Second, the same questions on immigrant status are asked in all countries, so that the definition of immigrants can be chosen to be equal for each country. Differences in country-specific educational attainments and varying definitions of immigrant status (based on e.g. country of birth or naturalisation) had hindered cross-country comparisons in the past.

immigrants. One result shows that consistently across countries immigrants' educational dispersion is considerably higher than that of natives. As a consequence, in a second step it is explored what explains these high inequalities. For answering this question, the distribution of immigrants' achievement scores is examined. The main result shows that again consistently across countries groups of very low achieving immigrants drive educational dispersion up. Using quantile regressions it is examined whether compositional differences between immigrants at different achievement percentiles can explain the low achievement of some immigrant groups.

The remainder is as follows: Section 2 introduces into data sources and inequality measures used for the analysis. Session 3 reviews literature and discusses theoretical considerations of the analysis. Section 4 examines the extent of immigrants' educational dispersion within and between countries. Section 5 investigates causes of high inequality among immigrants. Section 6 concludes.

2 Data and tools

Three different educational achievement surveys with similar sample designs are used: TIMSS (Third International Maths and Science Study), PISA (Program of International Student Assessment) and PIRLS (Progress in International Reading Literacy Study). Typical sample size in any country is about 4000 to 6000 pupils. For the examination of immigrants' inequality in achievement in mathematics, TIMSS data for children in grade 4 (usually aged 9-10) and 8 (usually aged 13–14) are used. The focus on inequalities in reading achievement is based on PIRLS that provides data for children in grade 4 (usually aged 9-10) and PISA that covers 15 year olds. Data for TIMSS and PISA refer predominantly[2] to the 2003 rounds of these surveys. PIRLS data were collected in 2001.[3]

[2] Data for TIMSS 8th graders in Switzerland and Germany are an exception and refer to 1995.
[3] Results of the very recently available data of TIMSS 2006 and PISA 2006 are not considered in this paper.

TIMSS data for 8th graders and PISA data for 15 year olds cover all eight countries examined. TIMSS and PIRLS 4th grader data cover only six out of the eight countries.

In all three surveys, pupils answer in addition to an ability questionnaire a questionnaire on their family background, e.g. parental education, the language spoken at home and information on immigration status. Survey organisers used the very same questions for asking whether pupils, their mothers and fathers were born in the test country or abroad. For the purpose of this study, immigrants are defined as pupils whose both parents were born abroad. First-generation immigrants are children who were also born abroad themselves whilst second-generation immigrants were born in the host country. Children who are not immigrants and have, therefore by definition, at least one parent born in the host country are referred to as natives.

In general, the percentage of missing values for immigrant status is relatively low with an average of 3.4 percent across all countries and measures. However, immigrant status is missing for as many as 16 percent of TIMSS 4th graders in New Zealand and 10 percent of PISA 15 year olds in Canada. These pupils were not taken into account for the analysis.

For some countries, survey results on percentage of first- and second-generation immigrants differ. In Canada, the share of second-generation immigrants ranges from 9 (PISA 15 year olds and PIRLS 4th graders) to 12 (TIMSS 8th graders) and 15 percent (TIMSS 4th graders) and for first-generation immigrants from 8 (TIMSS and PIRLS 4th graders) to 11 percent (TIMSS 8th graders and PISA). In New Zealand, the percentage of first-generation immigrants ranges from 8 (TIMSS and PIRLS 4th graders) to 13 percent (PISA) while the result on percentage of second-generation immigrants is robust across surveys (7 percent). For all other countries, figures found are relatively similar.

Among the eight countries examined, in the UK the percentage of first- and second-generation immigrants is lowest with 3 and 5 percent respectively. Australia, Canada and

Switzerland are the countries with highest immigration with about 10 percent of first- and second-generation immigrants respectively.[4]

Sample sizes for each immigrant group range from 200 to 1400 pupils depending on country and survey. However, four immigrant groups have sample sizes smaller than 200: three in TIMSS 8th grader data (107 for first-generation and 166 for second-generation immigrants in UK, 148 for second-generation immigrants in Germany) and one in PIRLS data (second-generation immigrants in New Zealand with 173). Results for these groups are subject to high sampling error.

It is important to emphasise that the different surveys use different ability measures. TIMSS focuses on measuring a mastery of internationally agreed curricula. PISA measures ability by the 'life-skills' approach examining how pupils can implement their education in 'real life situations'. PIRLS organisers argue that their approach is similar to that in PISA, both being based on 'an expanded notion of literacy' (Campbell *et al*. 2001: 85). Different survey measures of ability might impact on results of average achievement and dispersion of immigrants. For example, survey measures of ability might be based on language that is differently sensitive to the culture and beliefs of immigrant groups. This might impact on immigrants' success of answering these questions. Nevertheless, at a country level mean achievement differences between immigrants and natives are highly correlated between the surveys PISA, TIMSS and PIRLS (Schnepf 2007) indicating that at least for this statistic surveys' different measures of ability yield similar results.

Since almost all country data were collected in either 2001 or 2003 survey differences are very unlikely to be due to changes in the composition of immigrants over time. [5] The same

[4] PIRLS 2001 Canada data is based on the provinces Ontario and Quebec only. For all four sources, UK data refers to England, Scotland and Northern Ireland only.
[5] For Switzerland and Germany, 8th grader data for TIMSS refers to 1995 so that comparison across cohorts might be more problematic for these both countries.

holds if we compare cross-sectional data on 4th graders collected in 2003 (TIMSS) or 2001 (PIRLS) with that of 8th graders collected in 2003 (TIMSS and PISA).[6]

The answers that a respondent gives to the questions in the surveys are summarised by the organisers into a single score for the subject concerned using an 'item response' model. Scores for each country are scaled by the survey organisers to have a mean among all persons in all participating countries (which is always a wider group than the eight countries present in the surveys that are considered here) of 500 points and a standard deviation of 100 points.

The achievement test data are recorded on a continuous scale. This suggests that in measuring immigrants' dispersion it would be possible to select from the full range of tools that have been developed to measure inequality in incomes, and the differences in this inequality across countries.

However, as discussed in Micklewright and Schnepf (2007) the nature of the achievement test data calls for caution in the use of the income inequality measurement toolbox. The choice of item response model influences the shape of the estimated proficiency distributions and can do so in ways that change the cross-country picture (see Brown et al. 2007). In addition, the focus of the following analysis is on the shape of achievement distribution which cannot be examined with a single measure of inequality.

As a consequence, in the following crude measures of educational dispersion are employed: differences in ventiles of immigrants' and natives' test score are examined as well as differences between the 95th percentile and the 5th percentile, P95–P5.

[6] While the use of cross-sectional data is generally problematic for the examination of changes over time (and longitudinal data are more appropriate) it can be argued here that compositional differences are unlikely to change greatly in a time span of four to six years.

3 Theoretical considerations and literature review

The predominant part of the literature focuses on immigrants' labour market perspectives. Immigrants' dispersion in acquiring human capital in their host country is an underexamined and important determinant for explaining diversity in labour market opportunities and chances of participating successfully in the host society.

The focus on average achievement of immigrants in the literature

Recent international reports of educational achievement show that countries differ considerably regarding the extent of the disadvantage that immigrants face (OECD 2006; Mullis et al 2004, pp.131-133). On average, immigrant disadvantage seems to be lowest in those countries where immigrants' composition is most similar to that of their native counterparts like Australia, New Zealand and Canada. Disadvantages are highest in former 'guest worker' countries like Germany and Switzerland (OECD 2006).[7]

Figure 1 presents mean achievement differences between natives and immigrants by surveys, age groups and subjects examined in this paper. In line with the literature and consistent across age groups and subject, on average immigrants' mean achievement is similar to that of natives in the three traditional countries of immigration but considerably lower in Switzerland, Germany, Sweden and the US.

Results also indicate that immigrants fare better in maths than in reading compared to natives.[8] In addition, immigrants' achievement gap is bigger for 8th graders compared to 4th graders in reading, but there is no consistent pattern for maths.

[7] There is also a growing literature available, discussing what factors determine this disadvantage, how their impact differs across countries and how differences between countries can be explained. (OECD 2006, Schnepf 2007, Marks 2005). For example, socio-economic differences between immigrants' and natives can explain countries' position in terms of immigrants' educational disadvantage found. Within countries, it is especially language skills and socio-economic status but also immigrants' distribution across schools that can explain their disadvantage.

[8] Literature shows that language skills are important for explaining immigrants' educational disadvantage. While PISA and PIRLS testing on reading achievement uses predominantly open ended questions, most of the TIMSS maths questions are multiple choice. Some of those TIMSS items require only limited language skills since they are just based on numbers and equations.

The heterogeneity of immigrants' achievement is disguised by focusing on the average

The problem of most of the existing literature and Figure 1 is that it focuses on average differences between immigrants and natives disguising thereby educational inequalities among immigrants. Figure 1 showed that on average immigrants fare similar to natives in Australia. Figure 2 presents the distribution of achievement for immigrants depending on their country of origin for this country. Each box shows the range of achievement scores lying between the 25th and 75th percentile of the groups' achievement distribution. One result of Figure 2 is obvious: immigrants' achievement is very heterogeneous and depends on immigrants' country of origin. For example, the median achievement score of a Lebanese immigrant (sample size 117) in Australia is only as high as the 35th percentile of the natives' (sample size 9,883) achievement distribution. On the other hand, 50 percent of Chinese immigrants (sample size 117) have higher achievement scores than 72 percent of natives.[9]

The research objective of this paper is to address diversity in educational achievement among immigrants within countries and hence to provide first results on educational inequalities among immigrants and its causes in a cross-national perspective.

Literature review

What factors might drive educational inequalities among immigrants?

The extent of educational inequalities among immigrants within countries

Classical assimilation theory – based on research on early waves of European immigrants to the US – predicts a single trajectory of upwards mobility of immigrants over time (Rumbaut 1997). This theory suggests that over time immigrants' education adapts to

[9] This result compares to that of existing literature, examining immigration for single countries and discussing the considerable extent of educational attainment differences among immigrants from different countries of origin (e.g. Glick and Hohmann-Marriott (2007) and Hirschman (2001) for the US, Tolsma et al. (2007) for the Netherlands).

that of natives. Hence, based on this theory we would expect that over time educational dispersion between immigrants and natives are likely to become more similar.

Segmented assimilation theory, formulated among others as a response to the wide variety of socio-economic background among new immigrants to the US, suggests that there are three very different routes of incorporation available for first- and second-generation immigrants: upwards integration into the middle class, downwards integration into an underclass (Rumbaut and Portes 2001) and advancement within the ethnic community using ethnicity as a source of social capital (Portes and Zhou 1993, Borjas 1992). Applying this theory developed in the US context to a wider country group (as done e.g. by Silberman, Alba and Fournier 2007 for France) would predict that educational dispersion among immigrants is generally considerably higher than among natives, since depending on context factors some immigrant children will perform worse and some better than their parents.

While assimilation theory and with that context factors of immigration are discussed in sociological literature the economics literature focuses on human capital theories (Becker 1964). Based on this approach, immigrant pupils' educational dispersion can be explained by differences in human capital among immigrants, such as socio-economic background of parents and languages skills. Socio-economic background is a primary determinant of children's educational outcomes and has been shown to be an important factor in explaining immigrants' disadvantage (e.g. Gang and Zimmermann 2000; Frick and Wagner 2001).

A further important factor that needs consideration is immigrants' country of origin. Political stability in the country of origin (Chiswick 1999), income inequality in the country of origin and destination (Borjas 1988) and the economic development of the country of origin (Borjas 1988) determines skill levels of immigrants.[10] If a country's immigrants originate in countries differing in these perspectives variation in parental skill levels are high and likely to translate into considerable difference in learning outcomes of immigrant

[10] See Tubergen, Maas and Flap 2004 for a detailed overview on theories on the economic incorporation of immigrants.

children. In addition, immigrants' relative positions in their country of origin in terms of educational attainment (Feliciano 2005) as well as specific relations between immigrants' origin and destination countries[11] (e.g. geographical distance) are likely to have some effect on immigrant pupils' schooling outcomes and diversity among them (Tubergen et al. 2004, Levels *at al.* 2007).

Countries' position in terms of educational inequalities among immigrants

In order to explain countries' position in terms of the extent of immigrants' dispersion immigration and educational policies are relevant. Immigration policies are very likely to impact on whether a country has a homogenous or heterogeneous intake of immigrants. Countries with strict immigration policies, such as Australia, Canada and New Zealand, are more likely to positively select immigrants with high skills (Borjas 1988). Given that parental socio-economic background is a main determinant of children's educational outcome, it could be assumed that immigrant children in these countries are performing predominantly well in school, which results in low educational inequalities among them. On the other hand, other countries like the US, Germany and Sweden allow a wider variety of immigrants: those from lower (often covered by immigration policies addressing family reunion in former guest worker countries) and higher socio-economic background. We would expect that countries with strict immigration policies experience lower educational inequalities among immigrants than countries with more liberate policies.

However, it can be argued that also the educational system and policies are important, especially once we focus on second-generation immigrants. Second-generation immigrants grew up in the country for at least 9 to 10 (PIRLS and TIMSS 4th grader data) or 14 to 15 years (PISA and TIMSS 8th grader data). They share their experience with the host countries' educational institutions throughout their lives like native pupils. In those countries where family background has a great impact on educational outcomes (countries with a high social

[11] For example, Crul and Vermeulen (2006) show that the position of second-generation Turks in terms of educational attainment varies widely between different destination countries in Europe.

gradient) like Switzerland, Germany and the US (OECD 2006) immigrants' dispersion is unlikely to change over time. Countries with low social gradients (e.g. Sweden) manage to limit dispersion in general. As a consequence, we would expect that natives' educational dispersion is positively correlated to second generation immigrants' educational dispersion across countries.

Limitations of this study

For this study not all factors important for the explanation of immigrants' educational dispersion can be taken into account. For example, contextual factors highlighted in segmented assimilation theory are not available in the data sets used. The explanation of immigrants' dispersion within countries (Section 5) will therefore take only compositional differences into account.

In addition, information on immigrants' country of origin cannot be used in this paper because this information is only available for a small set of countries in PISA data. However, for these countries, it is possible to judge on the impact of country of origin on educational dispersion found and hence to discuss in general the limitations of the study due to the lack of this variable.

Figure 2 does not only show the great heterogeneity between immigrants from different countries of origin, it also shows that still within each immigrant group achievement varies greatly. The question arises how much of the inequality among all immigrants are due to differences between immigrants from different countries of origin.

A natural way to examine this is to split the variation of immigrants' achievement into its within- and between-group components. In our case there are eight immigrant groups defined by their country of origin (immigrants from the Lebanon, the Philippines, New Zealand, EU, Vietnam, India, China and Malaysia). The Theil index is one of the indices of the Generalised Entropy (GE) class that are commonly used to decompose income inequality

into between-group and within-group components. The equation of the Theil index is as follows:

$$T = \frac{1}{N} \sum \frac{a_i}{\bar{a}} * \ln\left(\frac{a_i}{\bar{a}}\right)$$

whereby N refers to the number of immigrant students, a_i to the achievement of the immigrant i and $\bar{a}$ to their mean achievement. Decomposing this index, it results that only 8 percent of the variance[12] of immigrants' achievement derives from between group differences in Australia.[13] In the USA, Germany and Switzerland a variable on the foreign language immigrants speak at home was administered. Using this variable for the decomposition of variances, in the US 13 %, in Germany 11 % and in Switzerland 17 % of the variance of immigrants' achievement is due to between group differences (this analysis is described in greater detail in the Appendix). It can therefore be concluded that country of origin is impacting on inequality in learning among immigrants but it does not seem to be the driving force of it.

4 The extent of educational inequalities among immigrants

One concerning and consistent result of educational achievement surveys is that educational inequalities among pupils are very high in all countries examined. It is difficult to judge on the actual extent of educational disadvantages since educational achievement scores lack a natural metric. However, in this regard the design of the TIMSS survey in 1995 proves to be helpful: 7th and 8th graders were tested applying the same test instrument. As a consequence, for this year inequalities among natives and immigrants can be expressed in terms of grade progression. On average across 14 OECD countries, mean achievement

[12] The Theil index yields a value of 0.0158 which was decomposed into within (0.0159) and between group variance (0.0014).

[13] This result is robust to other indices of the GE class, like the mean log deviation (which gives most weight in the calculation to achievement differences at the bottom of the distribution) and the Coefficient of Variation (which gives most weight at the top of the distribution). If those immigrants are included (as one additional group) for whom no information on country of origin is available the between group difference decreases from 8 to 4 percent.

differences between 7th and 8th graders are 30 points in maths. Hence, one year of schooling is worth about 30 TIMSS maths scale scores. Figure 3 visualises this difference by showing a Kernel density graph of achievement for 7th and 8th graders in Germany. The achievement distribution of 7th graders is shifted to the right for 8th graders. On average, achievement differences between natives at the 5th percentile compared to natives at the 95th percentile is 246 scale scores in Germany which is equivalent to 8 times the progression from 7th to 8th grade.[14] Even though this reflects obviously a very high difference between low and high performing natives Germany's inequalities among natives are small compared to that of other countries (see discussion later on).

The second graph in Figure 3 sets this result into relation to immigrants' educational dispersion. In contrast to achievement distributions of 7th and 8th graders, the achievement distribution of first- and second-generation immigrants is not just shifted to the left of that of natives (indicating lower achievement[15]) but also immigrants' educational dispersion is higher. This is due to a greater negative skew with a long bottom tail of immigrants' achievement. The value of P95-P5 of first-generation immigrants is 293 and for second-generation immigrants 274. This is equivalent to 9 or almost 10 times one year of natives' achievement progression from 7th to 8th grade.

Another way of assessing the extent of immigrants' educational dispersion is to express immigrants' P95-P5 as a percentage of natives' P95-P5. Hence, first-generation immigrants' dispersion is 119 percent of that of natives (293/246*100) and as a consequence 19 percent higher than that of natives. Still, secondary-generations immigrants' dispersion is 11 percent higher than that of natives. For judging on these percentages it is important to remember that educational dispersion among natives is already considerably high.

[14] Micklewright and Schnepf (2007) discuss the extent of pupils' inequalities within countries in detail.
[15] 60 % of natives in 7th grade do not reach the median of natives in 8th grade. This compares to even 72 % of first-generation immigrants who do not reach the median of 8th graders and still 64 % of second generation immigrants.

While this percentage difference between immigrants' and natives' dispersion only refers to Germany and maths achievement in grade 8, Tables 1 and 2 present figures calculated in the same way for all countries, age groups and subjects separately for first- and second-generation immigrants.

The surprising result of Table 1 is that in 24 out of 27 countries and measures inequalities of first-generation immigrants are higher than those of natives. As discussed in Section 3, we could well have assumed that in countries with strict immigration laws like Australia and New Zealand immigrants perform all similarly good' which would result in low educational inequalities (hence an achievement distribution shifted to the left or right of that of natives but with a low standard deviation). In the contrary, immigrants' educational achievement is more heterogeneous than that of natives for almost all countries and measures. For some countries – among those Australia - inequalities among immigrants are even up to 20 and 30 percent higher.

One obvious pattern is that generally immigrants' dispersion is higher for maths than for reading achievement which might be explained by the fact that language skills do not matter as much for maths as for reading. Immigrants with a potential for high achievement due to e.g. favourable socio-economic background but with a lack of language skills still can perform better than other immigrants on maths items. This drives the value of P95 up and with that immigrants' dispersion.[16] For reading on the other hand, immigrants with potentially high skills cannot achieve good test results due to the lack of language skills: all immigrants are equally 'bad performers' once language skills are concerned.

The same argument holds to explain why results on PIRLS show that immigrants' educational dispersion is smaller in primary than in secondary school. Even if young immigrants' represent a heterogeneous group, all of them just arrived in the host countries and most of them will lack language skills.

[16] Indeed, Figure A1 in the Appendix shows that for a number of countries immigrants' maths achievement at P95 is higher than that for natives; this is not the case for reading achievement (see Figure 6).

Since it can be assumed that over time immigrants assimilate to natives it is likely that second-generation immigrants' dispersion becomes closer to that of natives. In order to judge on that, Tables 1 and 2 are shaded in the same way: numbers indicating that immigrants' educational dispersion is 5 to 15 percent higher than that of natives are shaded in a light grey, 16 to 30 percent with middle dark grey and over 30 percent with dark grey. Numbers below 5 percent are not shaded. The advantage of the shading is that changes between Tables 1 and 2 can be seen immediately: fewer cells are shaded and shading becomes lighter for second-generation immigrants. Nevertheless, for some countries like Switzerland, New Zealand and Germany even second-generation immigrants' dispersion remains considerably high. This might be explained by segmented assimilation theory, which predicts that some immigrants will follow the route of low performers. (This will be examined in Section 6.)

Tables 1 and 2 present immigrants' dispersion compared to that of natives for each country. How do countries compare in terms of inequalities among immigrants? First, high dispersion of immigrants expressed as that of natives might reflect that inequalities of natives are very low, so that even generally low levels of inequality among immigrants *compared to other countries* appear to be high in comparison to natives in the country. Second, countries with much higher inequality among immigrants than natives might be those countries that are generally prone to have high dispersion among *all* students (e.g. due to their educational systems). For example, in Switzerland: what does it mean that second-generation immigrants' educational inequality is 22 percent higher than that of natives? Is natives' dispersion low or is educational dispersion between pupils in Switzerland in general high?

Figure 4 sheds light on this using TIMSS maths data and PISA reading data for pupils in secondary school. It presents the value of P95-P5 as a z-score for immigrants on the y- and natives on the x-axis. A z-score of one (minus one) means that the country's P95-P5 value is one standard deviation above (below) the median of all eight countries. Figure 4 shows results only for second-generation immigrants who attended the host countries' schools throughout

their childhood. A country sample of eight is relatively small for the following discussion however there still appear some consistent patterns.

In TIMSS maths, second-generation immigrants' dispersion is more than 10 percent higher than that of natives in four countries: Switzerland, Australia, New Zealand and Germany (see Table 2). In two of these countries (Switzerland and Germany), educational inequalities of natives are small in comparison to other countries (around 1.5 standard deviation below the median of the eight countries' P95-P5). If we compare second-generation immigrants' dispersion for both countries with those of the country group they are just as high as the median P95-P5 of all countries. Hence, Table 2 indicates high educational inequalities among immigrants *in comparison to natives* for both countries, but *compared to other countries* immigrants' dispersion is just around the average. On the contrary, in Australia and New Zealand – countries with strict immigration laws - immigrants' dispersion is also higher in the cross-country comparison.

In general, countries with higher dispersion of natives' achievement are likely to have also a higher dispersion of second-generation immigrants. This might be an indicator that in the second generation immigrants' dispersion is likely to be determined by countries' educational system.

Results for PISA reading are similar for some countries (Switzerland and USA) but diverge for others (Canada and New Zealand).[17] The general pattern seems to be that second-generation immigrants' dispersion is highest in New Zealand, USA and Australia and lowest in Canada and Sweden.

[17] For a comparison of educational dispersion' of all pupils across countries using different measures of educational achievement see Micklewright and Schnepf (2007).

5 Why are immigrants' educational inequalities so high?

Tables 1 and 2 showed that immigrants' educational inequalities are for most of the countries and measures considerably higher than that of natives. Figure 2 indicated that for Germany, immigrants' educational achievement distribution is not only just shifted to the left but in addition the bottom tail of immigrants' distribution got wider. This can explain higher immigrants' educational disadvantage in Germany. Is this also true for all other countries? Or do we find in some countries that the achievement distribution gets wider at the bottom *and* at the top? Or are there even some countries where immigrants' dispersion is only higher because there are a group of immigrants performing extremely well compared to other immigrants (which would translate into a positive skew of the achievement distribution)?

These questions are of considerable importance. It can be argued, that inequality among immigrants is only then of concern if this inequality derives from very low achieving pupils. Like predicted in segmented assimilation theory this would indicate that there is a sizable group of immigrants who are likely to leave school without having acquired skills necessary for a successful integration into the host society. On the other hand, inequality deriving from a group of high achieving immigrants reflects a positive outcome and is not concerning as such.

The aim of this section is to explain immigrants' high educational inequalities by focusing on the distribution of immigrants' and natives' achievement. Figure 5 presents the means for doing so. It shows fictional results for five imaginary countries. For each country, achievement scores for immigrants and natives were calculated separately. The y-axis presents the ratio of immigrants' to natives' achievement scores at different percentiles that are given on the x-axis. A value of 1 on the y-axis means that immigrants' and natives' achievement scores are the same at a specific ventile. A value smaller than 1 means that immigrants' achievement score is lower and a value greater than 1 that it is bigger than that of natives at a specific ventile.

For country A, the ratio is 1 throughout each percentile. Hence, the educational achievement distributions of immigrants and natives are exactly the same. This means that dispersion of both groups is equal. The last statement is true for any parallel line above (immigrants fair consistently better) and below (immigrants' fair consistently worse than natives) the line for Country A. In Country B educational dispersion is greater for immigrants than for natives: at lower percentiles immigrants fare worse than natives and at higher percentiles they fare better than natives. Country C reflects higher inequalities, too. But those derive just from immigrants performing much lower than natives at the bottom of the achievement distribution. The higher the slope the greater are educational dispersions for immigrants compared to natives.

Contrary results derive from Countries D and E: immigrants have lower educational inequalities than natives since they achieve better at the bottom and for country D in addition worse at the top than natives.

Now focusing on the 'real' world: where does immigrants' inequality derive from? Figure 6 presents the ratio discussed in Figure 5 but applied to reading achievement and calculated separately for primary and secondary pupils and first- and second-generation immigrants.

What are results for pupils in primary school? Results in Tables 1 and 2 showed a relatively low educational dispersion for immigrants for PIRLS reading. Indeed, for first-generation immigrants, countries' lines are relative parallel to the line going through 1 for all percentiles. In general, achievement scores are only around 5 to 10 percent lower for immigrants compared to natives. There is a slight tendency (with the exception of New Zealand) that lines have a positive slope and hence are similar to Country C in Figure 5. Higher inequalities derive from lower achievement immigrants' at the bottom of the achievement distribution.

For second generation immigrants the lines of most countries (exception Germany and Sweden) cluster around the line of equal achievement distribution at the y-value of 1. In Canada, the US and the UK, we even find a negative slope (similar to Country E in Figure 5). Hence, for these three countries immigrants' dispersion is lower than that of natives (see Table 2) due to immigrants' better achievement scores at the bottom of the distribution.

As a consequence, 4th grader immigrants' dispersion is not greatly different to that of natives especially if we focus on second-generation immigrants. Results are very different for 15 year old students. For most of the countries, lines have a highly positive slope. For example, in Germany, Switzerland and Sweden – a country generally known for low inequalities - first-generation immigrants' educational achievement at the 5th percentile is as much as 30 percent lower than that of natives. On the other hand, achievement differences are just 10 percent lower at the 95th percentile. This reflects very clearly the example of Country C: higher educational inequalities of immigrants derive from very low achievement at the bottom of the distribution. The worst performing immigrants fall even far behind the worst performing natives in terms of their educational achievement. Hence, in most of the countries examined a group of lowest low achieving immigrants close to the age when compulsory schooling ends are struggling to meet basic learning outcomes. Proponents of the segregated assimilation theory would say that these are the immigrants who will form the underclass in the next decade.

One obvious question derives from the comparison of results for 4th graders and 15 year olds: why do we find a long bottom achievement tail for older immigrants but not for younger ones? It might be that some primary school immigrants at the bottom of the achievement distribution do not manage to keep up and subsequently fall behind over time in terms of reading achievement. Another explanation might be that those in the bottom tail of the PISA reading achievement distribution are immigrants who just migrated to the host

country. In secondary schools, immigrants differ more in terms of time spent in the country and this might well translate into high achievement gaps at the bottom of the distribution.

Nevertheless, the number of years spent in the host country cannot explain alone the long bottom tail of educational achievement among immigrants as the focus on second-generation immigrants shows. In Germany and Switzerland, the slope of the line is smaller, but still considerable. This supports the hypothesis that in both countries immigrant pupils fall behind in terms of reading achievement over time. As a consequence, some immigrants would need more learning support in order to keep up with their peers.

Results for maths achievement (see Figure A1 in the Appendix) are in general similar: there is a higher gap between immigrants and natives at lower percentiles for pupils in secondary school. However, this gap is lower for maths than for reading and less pronounced for pupils in primary school.

Table 3 summarises results of Figure 6 by presenting the ratio value for the 5^{th}, 50^{th} and 95^{th} percentile separately for first- and second-generation immigrants. In addition, it includes an average of ratios across all eight countries for different percentiles. On average, first-generation immigrants at the 5^{th} percentile have an achievement score that is 19 percent lower than that of natives. This compares to 4 percent difference only at the 95^{th} percentile. For second-generation immigrants, the great achievement gap at the 5^{th} percentile shrinks to only 7 percent and is just 5 percent points lower than that at the 95^{th} percentile.

What explains the result found that especially first-generation immigrants fall far below natives' achievement at low percentiles of the achievement distribution?

First, as discussed in Section 3 it might be that an increasing achievement gap with lower percentile reflects an increasing gap in socio-economic background between immigrants and natives across the distribution.

Second, characteristics that are more common to immigrants than to natives (like lack of language skills) might be more important for explaining achievement at the bottom than at

the top of the achievement distribution. For example, among high achieving students language skills might not matter any more for explaining achievement because tasks at this level are so difficult that language skills are just a precondition for solving them.

Third, other factors discussed in Section 3 might be of importance, which won't be examined in the following.[18]

In order to check the first and second option, quantile regressions were run for the 5th, 50th and 95th percentile of the achievement distribution. The dependent variable was pupils' achievement score. Explanatory variables were immigrant status and the following dummies: a proxy for language skills[19] (equal to 1 if the student does not speak the test language at home), family structure (single parent family and other family type; reference category is nuclear family), mothers' education (completion of secondary and tertiary education; references category not completed secondary education), the number of books at home (equal to 1 if more than 100 books) and area (equal to 1 if the school was in a rural area). Quantile regressions were run separately for each country and for two groups of children: natives and first-generation immigrants on one side and natives and second-generation immigrants on the other side.

If immigrants' socio-economic status compared to natives decreases with lower percentiles and if those characteristics more common to immigrants have a greater impact on achievement at lower percentiles we would expect that conditional on our control factors the achievement gaps between immigrants and natives become more equal for different percentiles of the achievement distribution.

[18] However, it is an interesting finding that immigrants' motivation in terms of aspired schooling outcome seems generally not to be lower than that of natives (OECD 2006).

[19] Pupils' language skills are estimated with one variable: whether pupils speak a foreign language at home. National languages or dialects different to the language of the PISA achievement test are not regarded as foreign languages. This measure cannot distinguish pupils with different levels of language skills. In addition, depending on time immigrant pupils spent in the country, they might speak fluently the host countries' language while their parents refuse or cannot do so at home. Hence, the variable 'language spoken at home' is only a crude proxy for measuring language skills.

Table 4 presents the same calculation of ratios as given in Table 3 but this time *conditional* on the variables described above. Conditional ratios were calculated in the following way: quantile regression results were used to predict achievement values at different percentiles separately for natives and immigrants. For the predictions, the characteristics controlled for were set to the mean value of all pupils in the countries' sample. The conditional achievement value for immigrants and natives refers to the mean of all predicted values for immigrants and natives at a specific percentile. The presented ratio in Table 6 provides the ratio of immigrants to natives of these conditional achievement values at the 5^{th}, 50^{th} and 95^{th} percentile.

A first glance at the average values of conditional ratios shows that indeed the achievement gap is much more equal across percentiles once it is controlled for language skills, family structure and socio-economic status. While on average the achievement score of first-generation immigrants was 15 percent points lower at the 5^{th} (0.81) compared to the 95^{th} percentile (0.96), conditional on background this shrinks to just 4 percent points (0.95; 0.99). For second-immigration immigrants, average achievement differences are similar for different percentiles. It is important to remember that a decrease of immigrants' achievement gap at the bottom of the distribution relates automatically to a reduction of immigrants' educational dispersion in this country.

Country patterns differ considerably. Ratios throughout all three percentiles are now very close to one in Canada, UK, Australia, the US and New Zealand. Hence, in these countries not only the difference in the achievement gap across the distribution disappears but immigrants' perform equally well (or even better) than natives.

In Sweden, where the increase in first-generation immigrants' achievement gap was greatest it reduces considerably to a mere 10 percent point difference between the 5^{th} and 95^{th} percentile conditional on socio-economic background and language skills. That is similar to results for Germany and Switzerland. For second-generation immigrants, in Sweden the gap

disappears and immigrants' fare equally than natives conditional on background characteristics.

It is notable that even conditional on socio-economic status and language skills, in Germany, Sweden and Switzerland the gap between low achieving first-generation immigrants and natives remains considerable.

Is the found decline of the achievement gap at the bottom of the distribution conditional on students' background due to a different impact of background characteristics at different percentiles? Table 5 that presents selected parameter estimates of the quantile regressions for the group of natives and first-generation immigrants sheds some light on this. The impact of variables can be compared between the 5^{th}, 50^{th} and 95^{th} percentile. In order to interpret the size of the coefficient it is important to remember that the standard deviation of achievement scores in one country is around 100.

For almost all countries, being a girl increases the achievement score much more at the bottom than at the top of the distribution. This indicates that there are considerable differences in educational dispersion between genders. Sweden is a notable exception. A similar trend is apparent for language skills. For students who do not speak the host countries' language at home education is considerably lower at the bottom than at the top end of the distribution. With the exception of Australia, the impact of the proxy of language skills is bigger than half of a standard deviation at the 5^{th} percentile and decreases to one third of a standard deviation or even into insignificance at the 95^{th} percentile. It is interesting to note, that there is no similar common country pattern if we focus on parental socio-economic status. The coefficients of number of books at home, mothers' secondary and tertiary education do not seem to differ consistently across different percentiles.

6 Conclusion

The aim of this study was to examine educational inequalities among immigrants in eight industrialised countries by taking immigrants' age, first- and second-generation immigration status and subject of achievement into account. Two main questions were examined: first, what is the extent of educational inequalities among immigrants? Second, why are immigrants' educational inequalities higher than that of natives?

Extent of immigrants' educational dispersion

In most of the countries and for most of the achievement measures, immigrants' educational dispersion exceeds that of natives. For some countries differences are huge. For example, in Australia, the UK and Switzerland first-generation immigrants' dispersion (measured by differences between P95-P5) is more than 20 percent higher than that of natives for maths.

Immigrants' dispersion is higher for maths than for reading. One explanation might be that immigrants with a lack of language skills are likely to achieve all similarly badly for reading tasks but might differ more for maths tasks given that not all of those require language skills.

Inequality among immigrants is considerably lower for second- than for first-generation immigrants. This indicates that high inequalities found do indeed derive from countries' intake of very heterogeneous immigrant groups.

In general, countries with higher dispersion of natives' achievement like New Zealand and Australia are likely to have also higher educational dispersion of second-generation immigrants. In countries where natives' achievement is more equal like in Canada educational inequalities among immigrants are likely to be smaller, too. This result is striking because Australia, Canada and New Zealand have similar immigration policies selecting especially highly skilled immigrants who could be assumed to be more 'equal'. It might be that educational policies are more important than the countries' intake of heterogeneous immigrants for explaining inequalities among immigrants in the second generation.

Explanations for immigrants' high educational disadvantage

We should care about immigrants' high educational dispersion because in most of the countries it derives from a considerable group of 'worst' achieving immigrants who fall considerably behind 'worst' achieving native students. A surprising pattern is that young immigrants do not fare noticeably worse than natives at the 5th percentile of the achievement distribution while older immigrants in secondary school do (especially in former 'guest worker' countries but also in the US). Since this pattern is relatively consistent for both, first- and second-generation immigrants, one explanation might be that immigrants do not manage to keep up with natives during secondary schooling and subsequently fall behind in their achievement. Quantile regression results show, that once it is controlled for language skills, family structure and socio-economic status, immigrants' achievement gap at the bottom of the achievement distribution is reduced noticeably. This is not only due to compositional differences varying at different percentiles between immigrants and natives, but language skills have a much higher impact on achievement results at the bottom than at the top of the achievement distribution.

Only a small part of the variance of immigrants' achievement can be explained by immigrants' country of origin.

References

Becker, G.S. (1964), *Human Capital*. National Bureau of Economic Research: New York.

Borjas, G.J. (1988), International Differences in the Labor Market Performance of Immigrants. Kalamazoo: Upjohn Institute for Employment Research.

Brown G., J. Micklewright, S.V. Schnepf, R. Waldmann (2007) International surveys of educational achievement: how robust are the findings? Journal of the *Royal Statistical Society, Series A.*

Campbell, J., Kelly, D., Mullis, I., Martin, M. and Sainsbury, M. (2001). *Framework and Specifications for PIRLS Assessment 2001*—2nd Edition. Chestnut Hill, MA: Boston College.

Chiswick B. (1999), Are Immigrants Favorably Self-Selected?, *American Economic Review* 89: 181-85.

Crul M. and H. Vermeulen (2006), Immigration, education, and the Turkish second generation in five European nations: A comparative study, in C.A. Parsons and T.M. Smeeding (eds), *Immigration and the Transformation of Europe*, Cambridge University Press: Cambridge.

Feliciano C. (2005), Does Selective Migration Matter? Explaining Ethnic Disparities in Educational Attainment among Immigrants' Children, *International Migration Review* 39(4): 841-871.

Frick J.R., G.G. Wagner (2001), Economic and social perspectives of immigrant children in Germany. In: Currle E., Wunderlich T (eds) *Deutschland – ein Einwanderungsland? Rueckblick, Bilanz und neue Fragen – Festrschrift fuer Friedrich Heckmann*. Lucius und Lucius, Stuttgart, pp 299 – 325.

Gang, I.N., K.F. Zimmermann (2000), Is child like parent? Educational attainment and ethnic origin. *Journal of Human Resources* 35(2000):550-569.

Glick, J.E., B. Hohmann-Marriott (2007), Academic Performance of Young Children in Immigrant Families: The Significance of Race, Ethnicity, and National Origins. *International Migration Review* 41(2): 371-402.

Hirschman, C. (2001), The Educational Enrolment of Immigrant Youth: A Test of the Segmented-Assimilation Hypothesis, *Demography*, 38(3): 317-336.

Levels M., J. Dronkers and G. Kraaykamp (2007), Educational Achievement of Immigrants in Western Countries: Origin, Destination, and Community Effects on mathematical Performance, EUI Working Papers SPS No. 2007/05, www.eui.eu.

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

Micklewright J. and S. V. Schnepf (2007), Inequality of Learning in Industrialized Countries, in: S.P. Jenkins and J. Micklewright (eds.), *Inequality and Poverty Re-Examined*, Oxford University Press: Oxford.

Mullis I., M. Martin, E. Gonzales, S. Chrostowski (2004), *TIMSS 2003 international mathematics report*. Boston College, Boston.

OECD (2006), *Where immigrant students succeed. A comparative review of performance and engagement in PISA 2003*. OECD: Paris.

Portes, A., M. Zhou (1993), The New Second Generation – Segmented Assimilation and Its Variants, *The Annals of the American Academy of Political and Social Sciences*, 530:74-96.

Rumbaut, R.G. (1997), Assimilation and Its Discontents: Between Rhetoric and Reality, *The International Migration Review* 31(4):923-960.

Rumbaut, R.G., A. Portes (2001), *Ethnicities. Children of Immigrants in America*. Russel Sage Foundation, New York.

Schnepf S. V. (2007), Immigrants' Educational Disadvantage: An Examination Across Ten Countries and Three Surveys', *Journal of Population Economics* 20(3): 527-545.

Silberman, R., R. Alba, I. Fournier (2007), Segmented assimilation in France? Discrimination in the labour market against the second generation, *Ethnic and Racial Studies* 30(1):1-27.

Tolsma J., M. Coenders and M. Lubbers (2007), Trends in Ethnic Educational Inequalities in the Netherlands: A Cohort Design, *European Sociological Review*, 23(3): 325-339.

Tubergen, F., I. Maas, H. Flap (2004), The Economic Incorporation of Immigrants in 18 Western Societies: Origin, Destination, and Community Effects, *American Sociological Review* 69: 704-727.

Appendix

Decomposition of immigrants' achievement inequality into within and between group differences

PISA data for Australia are exceptional comprising 12,451 students of which 2,568 are immigrants. In addition and in contrast to many other countries, information on immigrants' country of origin is available for about half of the immigrants. As a consequence, it was possible to estimate results for different immigrant groups for this country. It is not clear from the documentation of the data, why information of country of origin is missing for as many as 50 % of immigrants in Australia. This high item non-response is problematic. In case there are differences in learning outcomes between immigrants for whom information is available and for whom it is missing results will not only be subject to sampling error but also to considerable item non-response bias.

Information on immigrants' country of origin is not available for any other of the countries. However, some countries included a question asking immigrants students which language they speak at home. This variable could be used as crude proxy[20] for immigrants' country of origin. Again, this information is missing for about 50 % of immigrants in the US, 30 % in Germany and 15 % in Switzerland leaving us with a sample of 690, 507 and 1536 immigrants per country respectively. Results show that in Australia 8 %, the US 13 %[21], Germany 11 %[22] and Switzerland 17 %[23] of the variation of immigrants' achievement can be explained by between group differences. This confirms that country of origin does not seem to impact predominantly on immigrants' educational inequalities.

[20] Groups of immigrants constructed with the variable "language spoken at home" do not necessarily need to overlap with groups constructed with the variable "country of origin". Immigrants who speak the host countries language at home can have different nationalities but are not probable to have only recently migrated.
[21] For the US, three immigrant groups were used: English and Spanish speaking immigrants and those speaking any other language.
[22] In Germany, four groups of immigrants were constructed, those speaking Germany, a language from Central and Eastern Europe, Turkish/Kurdish or another language.
[23] In Switzerland, seven groups were used.

Figures and Tables

Figure 1: Mean achievement of natives and immigrants by age group/grade and subject

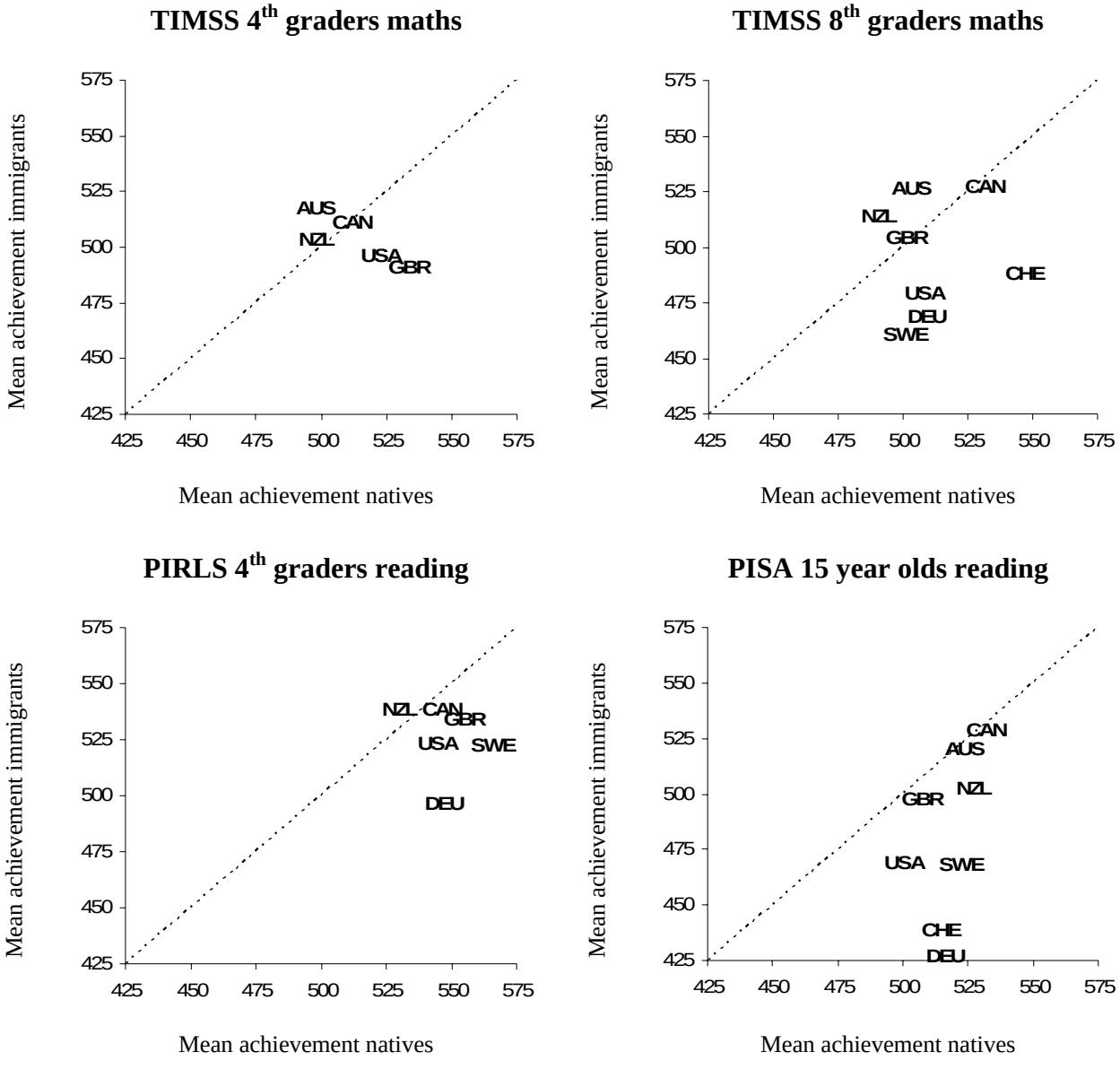
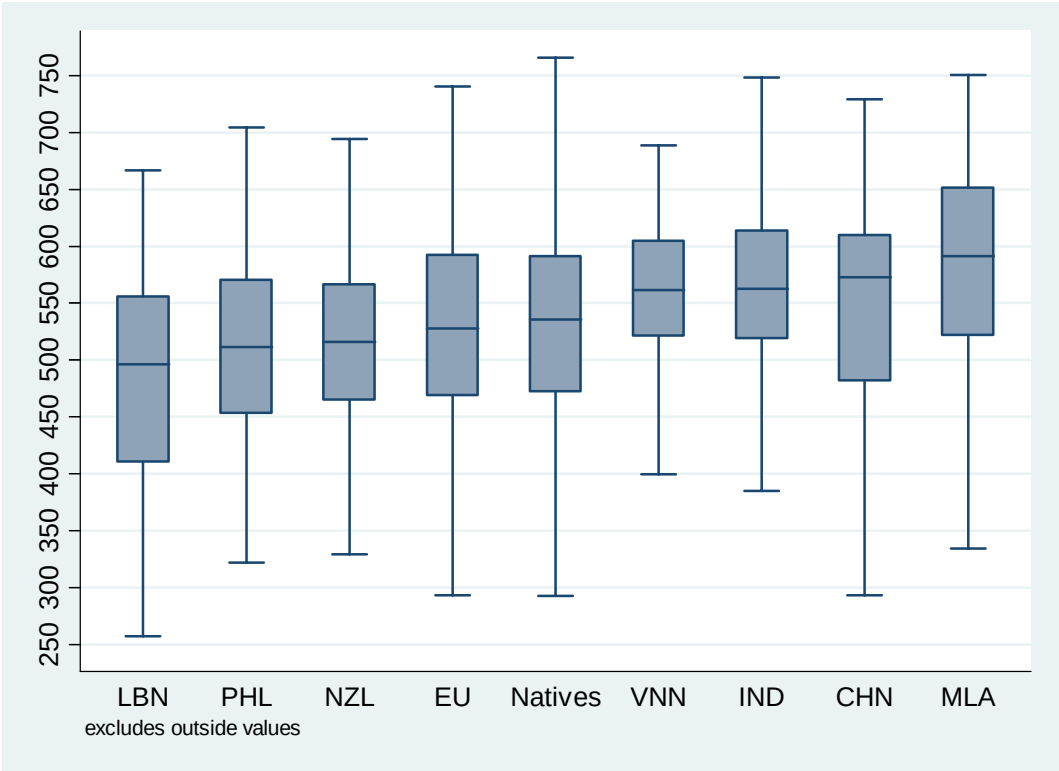
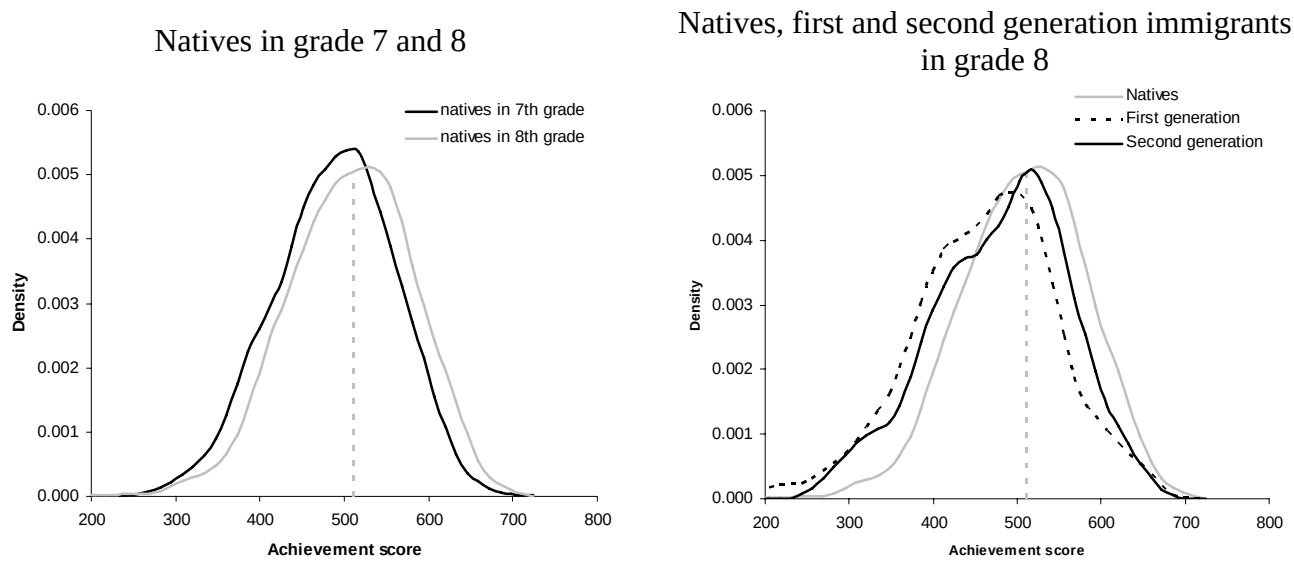


Figure 2: Box plot on educational achievement scores by immigrants' country of origin in Australia, PISA reading 15 year olds



Note: the line in the box represents the median value, the box comprises values from the 25th to the 75th percentile. The whiskers indicate the position of the lower and upper adjacent value. Sample sizes for different groups are as follows: natives 9,883; immigrants from the Lebanon 117, Philippines 79, New Zealand 135, EU 466, Vietnam 117, India 88, China 117 and Malaysia 63. Even though sample sizes are small, Malaysian immigrants' mean achievement is significantly higher (5 percent level) than that of natives and immigrants from the EU, New Zealand, the Philippines and the Lebanon (clustering of students within schools taken into account for standard error calculation).

Figure 3: Maths achievement distribution for natives in grade 7 and 8 and by immigrant status for 8th graders in Germany, TIMSS 1995



Note: Kernel density estimates. 60 percent of natives in 7th grade do not reach the median of natives in the 8th grade. The dotted lines present the median for native 8th graders in both graphs.

Figure 4: Z-scores of natives' and second-generation immigrants' P95-P5 for 8th graders in TIMSS maths and 15 year olds in PISA reading

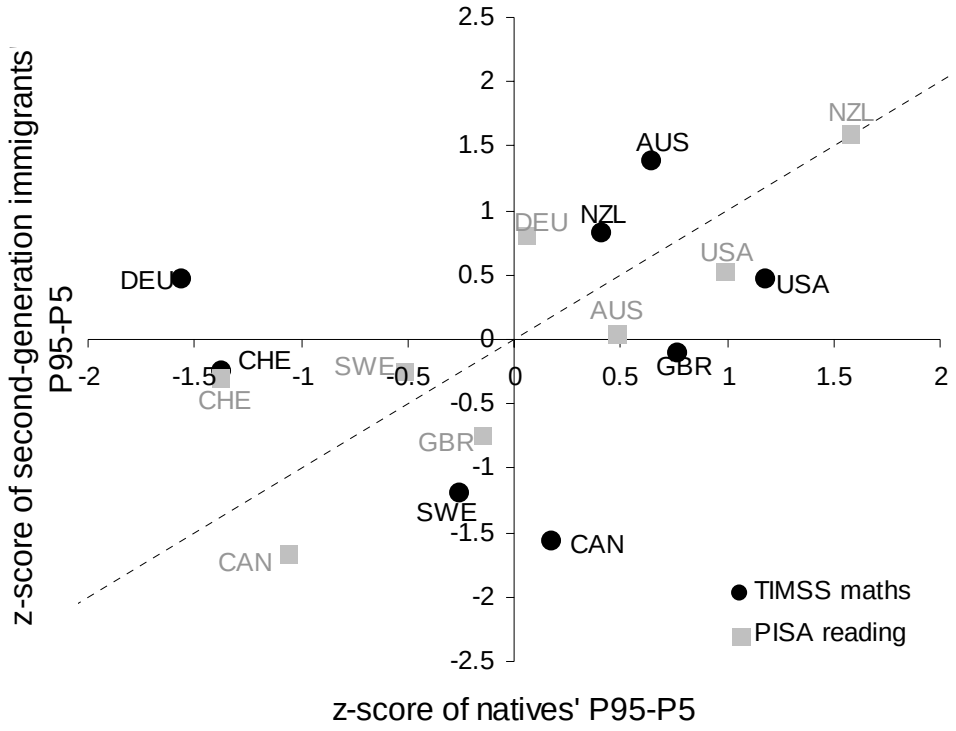


Figure 5: Examples of the ratio of immigrants' to natives' achievement score by percentile

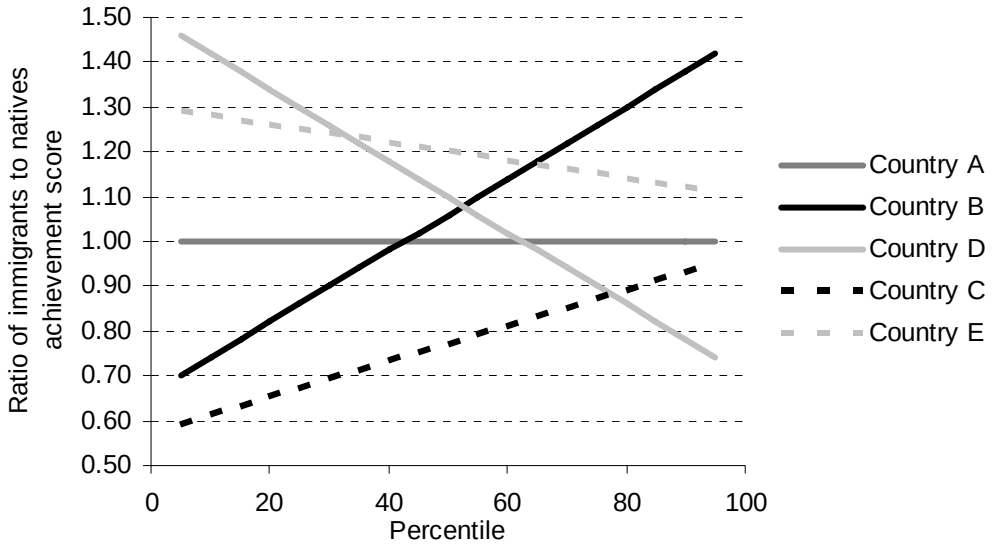
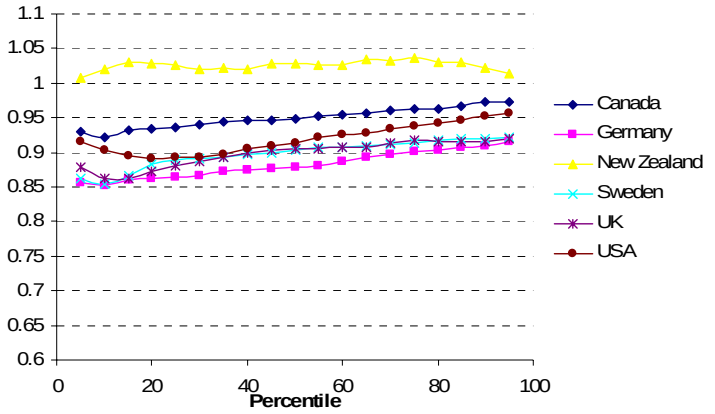
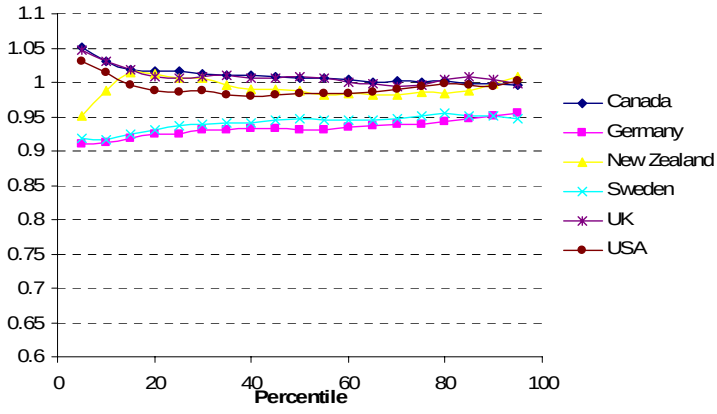


Figure 6: Ratio of achievement scores of immigrants to natives by percentile for reading for first- and second-generation immigrants and by grade/age

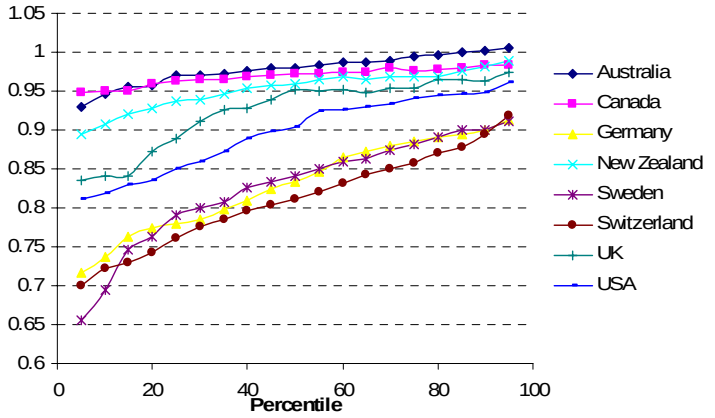
First-generation immigrants PIRLS reading



Second-generation immigrants PIRLS reading



First-generation immigrants PISA reading



Second-generation immigrants PISA reading

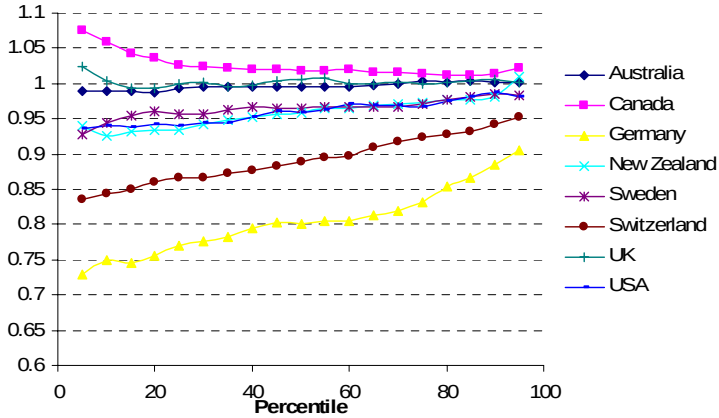


Table 1: Percent of first-generation immigrants' dispersion expressed as that of natives (measured as P95-P5 of the distributions)

	Maths		Reading		
	TIMSS 4th	TIMSS 8th	PIRLS 4th	PISA 15 year olds	Average TIMSS 8th / PISA
UK	108.4	122.5	97.6	113.0	117.7
Canada	121.2	117.2	105.1	103.0	110.1
Sweden		99.9	104.8	122.4	111.2
USA	99.1	113.2	101.6	111.2	112.2
Australia	111.2	120.0		109.0	114.5
Germany		119.0	103.6	113.6	116.3
New Zealand	106.3	115.9	102.0	108.7	112.3
Switzerland		133.0		119.7	126.4

Note: numbers indicating that immigrants' educational dispersion is 5 to 15 percent higher than that of natives are shaded in a light grey, 16 to 30 percent with middle dark grey and over 30 percent with dark grey. Countries are ordered by the average percentage of second-generation immigrants' dispersion in secondary schools (TIMSS 8th graders and PISA 15 year olds) presented in Table 2.

Table 2: Percent of second-generation immigrants' dispersion expressed as that of natives (measured as P95-P5 of the distributions)

	Maths		Reading		
	TIMSS 4th	TIMSS 8th	PIRLS 4th	PISA 15 year olds	Average TIMSS 8th / PISA
UK	97.1	102.8	93.2	97.6	100.2
Canada	105.8	107.2	89.7	95.4	101.3
Sweden		99.4	100.7	104.9	102.1
USA	99.9	105.7	96.0	102.8	104.2
Australia	107.0	120.1		101.6	110.8
Germany		111.3	104.9	110.5	110.9
New Zealand	97.4	116.3	107.7	108.1	112.2
Switzerland		122.4		109.9	116.2

Note: see note to Table 1.

Table 3: Ratio of immigrants' to natives' reading achievement at the 5th, 50th and 95th percentile for 15 year olds (PISA)

	First-generation immigrants			Second-generation immigrants		
	P5	P50	P95	P5	P50	P95
Canada	0.95	0.97	0.98	1.07	1.02	1.02
UK	0.84	0.95	0.97	1.02	1.01	1.00
Australia	0.93	0.98	1.01	0.99	0.99	1.00
USA	0.81	0.90	0.96	0.94	0.96	0.98
New Zealand	0.89	0.96	0.99	0.94	0.96	1.01
Sweden	0.66	0.84	0.91	0.93	0.96	0.98
Switzerland	0.70	0.81	0.92	0.84	0.89	0.95
Germany	0.72	0.83	0.91	0.73	0.80	0.91
Average	0.81	0.91	0.96	0.93	0.95	0.98

Note: Countries are ordered by the achievement ratio at the 5th percentile for second generation immigrants.

Table 4: Ratio of immigrants' to natives' reading achievement at the 5th, 50th and 95th percentile for 15 year olds (PISA) *conditional* on language skills, family structure and socio-economic background

	First-generation immigrants			Second-generation immigrants		
	P5	P50	P95	P5	P50	P95
Canada	1.06	1.01	1.01	1.09	1.03	1.03
UK	1.02	0.98	0.98	1.11	1.03	1.03
Australia	0.96	0.99	1.01	0.98	1.00	1.02
USA	1.02	1.00	1.02	1.04	1.03	1.02
New Zealand	0.98	1.00	1.01	0.91	1.01	1.02
Sweden	0.84	0.90	0.94	1.02	1.00	1.00
Switzerland	0.84	0.92	0.95	0.91	0.96	0.98
Germany	0.88	0.92	0.98	0.94	0.87	0.95
Average	0.95	0.96	0.99	1.00	0.99	1.00

Note: Countries are ordered by the unconditional achievement ratio at the 5th percentile for second generation immigrants. Ratios were calculated using quantile regressions (see the text for more detail).

Table 5: Selected parameter estimates from quantile regressions based on the group of natives and first-generation immigrants in five countries, PISA

	Percentile	Girl	Low language skills	More than 100 books at home	Mother completed secondary education	Mother completed tertiary education
Australia	*5*	57	-33*	39	O	31
	50	37	-18	38	O	27
	95	23	O	30	O	25
Canada	*5*	50	-59	32	24	O
	50	28	-28	33	29	13
	95	17	-23	29	O	11
USA	*5*	44	-63	46	27*	O
	50	30	-26	51	26	12
	95	13	O	39	44	0
Germany	*5*	40	-61	46	38	0
	50	34	-51	51	27	18
	95	12	-34*	40	12*	O
Sweden	*5*	34	-65	28	25	O
	50	34	O	40	29	O
	95	27	O	31	19	O

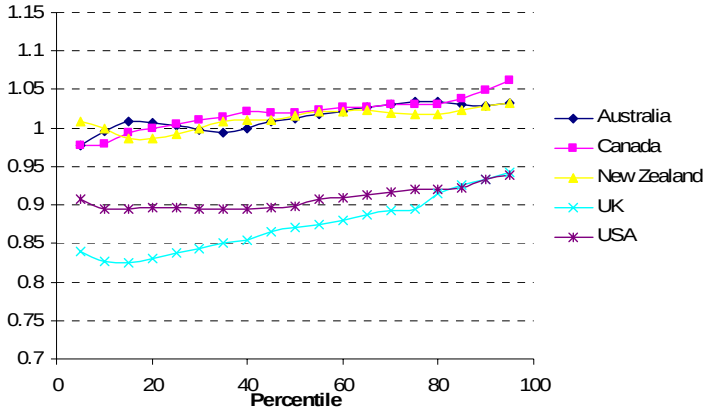
Note: “O” denotes that the coefficient is not significant at the 5 percent level. “*” denotes significance at the 5 percent level and all other coefficients are significant at the 1 percent level. Standard errors are estimated by applying the bootstrap method with 100 bootstrap replicate samples of schools.[24]

[24] That is, I repeatedly (100 times) draw samples of schools (with their PISA pupils) *with replacement* from the actual sample of schools for each country. (The sample size in each case is the same as for the original sample for each country.) I calculate the quantile regression parameters in each of these 100 samples. The standard deviations of these 100 values provide estimated standard errors of the parameters for each country and quantile.

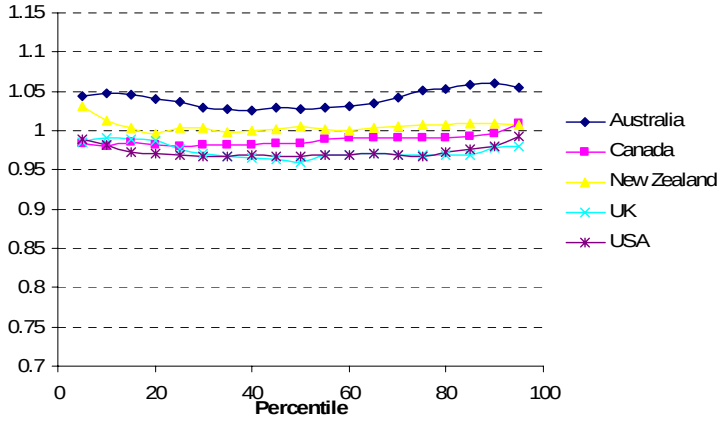
Appendix

Figure A1: Ratio of achievement scores of immigrants to natives by percentile for maths, by first- and second-generation immigrant status and grade

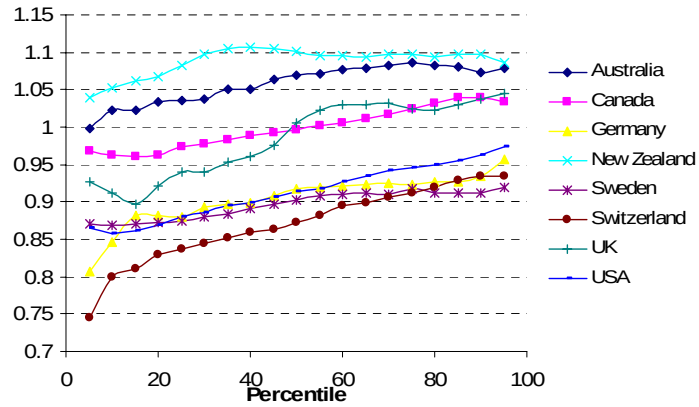
First generation immigrants TIMSS maths 4th



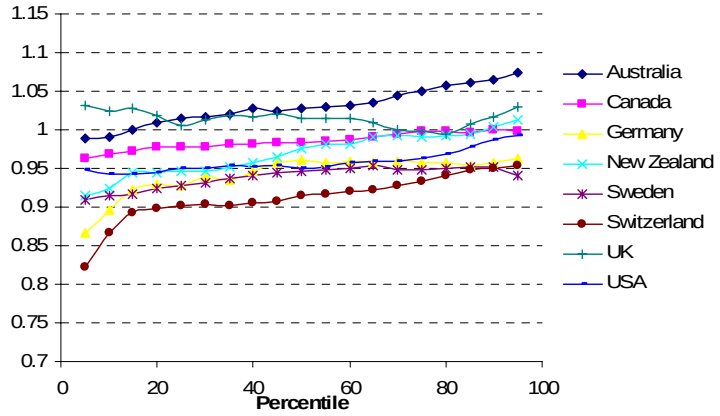
Second generation immigrants TIMSS maths 4th



First generation immigrants TIMSS maths 8th



Second generation immigrants TIMSS maths 8th



HWWI Research Papers
by the HWWI Research Programmes
"Economic Trends" and "Hamburg and Regional Development"

11. Regional Income Inequality and Convergence Processes in the EU-25
Tiiu Paas, Friso Schlitte
Hamburg, October 2007
10. Governmental activity, integration, and agglomeration
Ingrid Ott, Susanne Soretz
Hamburg, July 2007
9. Wie innovationsfähig ist Deutschland? – Ein Gesamindikator zur Messung der Innovationsfähigkeit
Henning Vöpel
Hamburg, Juli 2007
8. CDM potential of wind power projects in India
Pallav Purohit, Axel Michaelowa
Hamburg, June 2007
7. Ein makroökonometrisches Modell für Hamburg
Norbert Kriedel
Hamburg, Mai 2007
6. Managementstrategien im Fußball: „Big Push" oder Kontinuität?
Ein dynamisches Modell zum sportlichen Auf- und Abstieg von Vereinen
Henning Vöpel
Hamburg, Februar 2007
5. Ein Transfermarktmodell und Implikationen für die strategische Transferpolitik der Vereine in der Fußball-Bundesliga
Henning Vöpel
Hamburg, November 2006
4. Gender Equality in the Labour Market: Attitudes to Women's Work
Sylke Viola Schnepf
Hamburg, Oktober 2006
3. Ein „ZIDANE-Clustering-Theorem" und Implikationen für den Finanzausgleich in der Bundesliga
Henning Vöpel
Hamburg, Juli 2006
2. Doping im Radsport als kollektives Gleichgewicht
Henning Vöpel
Hamburg, Juli 2006
1. Long Waves of Economic Development and the Diffusion of General-Purpose Technologies – The Case of Railway Networks
Norbert Kriedel
Hamburg, Januar 2006

The **Hamburg Institute of International Economics (HWWI)** is an independent economic research institute, based on a non-profit public-private partnership, which was founded in 2005. The University of Hamburg and the Hamburg Chamber of Commerce are shareholders in the Institute .

The HWWI's main goals are to:

- Promote economic sciences in research and teaching;
- Conduct high-quality economic research;
- Transfer and disseminate economic knowledge to policy makers, stakeholders and the general public.

The HWWI carries out interdisciplinary research activities in the context of the following research programmes: Economic Trends, Hamburg and Regional Development, World Economy and the Migration Research Group.

Hamburg Institute of International Economics (HWWI)

Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776
info@hwwi.org | www.hwwi.org