The Effect of Immigrant Student Concentration on Native Test Scores

Evidence from European Schools

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This paper investigates the effect of non-native students on the learning attainment of the native students in the same grade. Using the PISA data of five European countries, I explore the within-school variation of first- and second-generation immigrant student concentration by conducting a fixed effect regression analysis, using school fixed effects to account for the endogenous allocation of students to schools. The results show significant and negative effects of both generation students in France, but mostly positive effects in Denmark and Switzerland. Regression analyses between subsamples of native students do not indicate a specific subgroup of students for which effects are strongest.

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I. Introduction

Designing optimal learning environments for children is a perpetual work of progress. There are many questions surrounding this topic. What is the most efficient teacher-student ratio? What should be taught in class? How do you promote student well-being? How should students and teachers be assessed? How do you keep students engaged and motivated? While these questions relate to interactions between student, teacher, and physical environment, interactions between students are also important to consider.

Student interaction can cause students to influence each other's ability to learn, and can lead to both positive and negative spill-over effects. These effects have been studied extensively, for example how specific classroom gender or ethnic compositions affect school performance (e.g. Hattie, 2002; van Ewijk & Sleegers, 2010). Studies have also been conducted on the interaction between native and non-native students. Investigating this interaction has become more and more relevant, considering the growth in globalisation and the relative ease with which people can now relocate to other countries, not to mention the recent inflow of refugees from war-torn countries. Thus, the main question that arises from this situation is whether the inflow of immigrant children in schools has any impact on native students. In recent decades, much research has been done on the potential spill-over effects of the presence of non-native students in class on the learning achievements of native students.

This paper contributes to existing literature by investigating the effects of both first- and second-generation immigrant student concentration on the learning outcomes of their native classmates in multiple countries, and focuses on whether increasing the share of immigrant students affects the test scores of native students negatively. This is in contrast to previous literature, which either estimates the effects of first-generation immigrant student shares only (Tonello, 2016; Gourd, Lavy, and Daniele Paserman, 2009; Brunello & Rocco, 2013; Bossavie, 2017), or estimates the effect of the combined share of immigrant students of both generations (Jensen & Rasmussen, 2011). In addition, this paper also adds to academic literature by comparing the effects between different countries.

I use data from the 2009 wave of the Programme for International Student Assessment (PISA) survey, which tests 15-year-old students in over 70 countries on their skills in solving real-life problems on the subjects of reading, mathematics, and science. Because this dataset includes not only the schools the students attend, but also the grades they are in, there is variation in non-native concentration within the schools, enabling the use of school fixed effects to account for possible sorting of students between schools based on school characteristics. Results from the regression analyses vary between countries. Negative effects of both types of non-native shares were found in France on the natives' reading and maths test, while estimates of the impact of the first-generation immigrant student share were positive in Denmark and Switzerland, suggesting that the inflow of immigrant children in school impacts native students from different countries in different ways.

The rest of the paper will be structured as follows. Section II presents previous literature on the interaction between natives and non-natives in school. Section III describes the data used in this research. Section IV elaborates on the methodology. Next, results of the analysis will be presented in section V. Finally, concluding remarks, limitations, and suggestions for future research will be discussed in section VI.

II. Theoretical Framework

Intuitively, it is plausible that placing immigrants in the same class as natives could increase their school performance, as they could enjoy spill-over effects of their native counterparts. Student interactions between natives and non-natives could help increase the language proficiency and learn the cultural habits of the latter group to facilitate integration. However, though the placement of non-natives in the same classes as natives could be beneficial to the non-natives, what are the effects on the natives? Since non-natives typically have lower levels of language proficiency and are only partially integrated, non-natives might take up more attention from teachers, require a slower pace of learning, or need more financial resources. For this reason, the presence of non-natives could impact native students negatively, as attention is diverted from native students to non-native students, harming the natives' learning progress and decreasing their test scores.

Ichino, Ballatore, and Fort (2018) measured the Pure Ethnic Composition (PEC) effect, which they argue indicates the causal effect of switching a native student (born to at least one native parent) for a non-native student (born to two non-Italian parents) on the test performance of the other native students. They used data on Italian primary schools (2^{nd} grade and 5^{th} grade pupils) and restricted themselves to schools with principals who manage more than one school. The principals can assign newly enrolled students to any school they manage, and predict the number of classes based on enrolment numbers and the rule that each class can only have a limited number of students. This constraint was used by Ichino et al. to formulate a Maimonides-type rule that predicts the native classroom sizes within each school. An indicator variable was then created using the theoretical class size, and subsequently used as an instrumental variable. The usage of this Maimonides rule-based instrumental variable solves the problem of sorting of non-natives based on the quality of the students already in the classes and provides the necessary variation that is needed to measure the PEC effect. The results from this regression showed significant lower test scores on both mathematical and language tests due to the PEC effect. This effect is larger (more negative) when considering the inflow of first-generation immigrants (children not born in Italy).

Another study taking place in Italy was conducted by Tonello (2016). He researched the effect of the share of non-natives (students without Italian citizenship) in a school on the learning achievements of natives. He studied this effect by applying a regression with school and year fixed effects on a dataset containing information regarding students attending junior high school in Italy. Tonello found that the share of non-natives at school has a small but significant negative effect on the natives' language test scores, but no significant effect on the maths test performance of the natives.

Jensen and Rasmussen (2011) studied the effect of non-Western immigrant concentration in schools on the language and math skills of 15-year-old students in Denmark. Due to potential endogenous non-native shares in schools due to sorting between neighbourhoods, they used the share of immigrants in the county in which a student lives as an instrumental variable. They found that the immigrant concentration in school influences the native students more strongly than the non-native students. Remarkably, the maths test scores of the native students were found to be affected the most, showing a statistically significant negative effect, while there was no significant effect for the reading test scores.

Brunello and Rocco (2013) also studied native school performance, using multiple waves of PISA test scores of students in 19 countries. Their methodology differs from the previous papers, as they

aggregate their data at a country level to estimate the cross-country pooled effect of non-native concentration. Furthermore, their analysis used country fixed effects and other country-specific time-variant control variables to control for migration between countries. They find that the share of non-native students (children of two foreign-born parents) is negatively associated with the test scores of natives. This effect was found across both genders and parental background (measured by the number of books in the household). Nonetheless, the effect was most statistically significant for female native students and native students from poor parental backgrounds. While this method resolves much of the endogeneity bias, its limitation is that it does not show how estimations can differ between countries, as an assumption was made that the effect of immigrant students is constant across the countries. This assumption was tested, and countries for which this assumption did not hold were removed from the sample.

Ohinata and van Ours (2013) investigated the effect of immigrant shares on the test results of 4th grade native Dutch pupils, using datasets from two international studies, one assessing the literacy of the children, the other judging the pupils' skills on science and maths. Immigrant students were defined as students born outside the Netherlands, with at least one foreign-born parent. Their analysis controls for endogenous student allocation between schools by adding school fixed effects. The results of the regression analyses showed no significant effect of the shares of immigrant pupils on the performance of native students, except for the maths scores in 1995, where a significant, positive effect was found.

Bossavie (2017) estimated the share of children born outside the Netherlands on the test scores of native Dutch primary school pupils, and distinguished the non-natives into two types based on how long they have been living in the Netherlands. Foreign-born children who moved to the Netherlands less than four years previously were classified as recent immigrants, while those who have been living in the Netherlands for more than four years were considered long-term immigrants. Bossavie found that native pupils scored less well on the language test when the share of recent immigrants was increased, while no effect was found when the long-term immigrant concentration is increased. A potential explanation is that long-term immigrants are more proficient in the Dutch language, resulting in fewer spill-over effects.

To further investigate the effects of language proficiency on the performance of students, Geay, McNally, and Telhaj (2013) looked at the effect of non-native speakers on the performance of native speakers in primary schools in England. The non-native speakers are pupils who do not speak English as their first language. The study used a demand shock in Catholic education for white non-native speakers as an instrumental variable, but found that the percentage of non-native speakers in a school grade does not significantly affect the performance of native speaking pupils.

While the papers above studied the short-term effect of non-native presence in classrooms, a research has also been done on the long-term effects of immigrant concentration. Gourd, Lavy, and Daniele Paserman (2009) researched whether the inflow of immigrant children during elementary school years had any effect on the educational attainment of native children years later in high school.

The setting for this research is the substantial inflow of Soviet Union children into Israel starting from 1989, which allowed the researchers to perform this quasi-experiment. Using an Israeli panel dataset, Gourd et al. performed OLS regressions to find the effect the share of non-native students on dropout and matriculation rates of native students. Their results show that there is no statistically

significant effect of the non-native share on the dropout rate. However, the share did present a negative effect on the matriculation rates. In other words, an increase in the non-native share of students decreased the passing rate of native students on their high school matriculation exam. More in-depth analysis revealed that the effect on the passing rate is driven by native students from low socio-economic backgrounds.

Two explanations for this long-term effect were proposed. First, the share of non-native students in elementary schools might be correlated to the share in high school, which in turn affects the natives' short-term learning outcomes (as supported by other papers). Second, the inflow of non-natives in elementary school could also affect achievements during high school if it interfered with the proficiency of basic learning skills of native students that were taught during elementary school years.

In short, the effect of non-native concentration on native learning attainment has been studied in various countries. Most papers show a slight negative effect on the language test scores on natives, while maths (and science) scores are less influenced. Results also show that this effect is more prominent in native students from poor social backgrounds.

In contrast to most previous literature, which analyses the effect of first-generation immigrants only, this thesis will analyse the effect of the share of first-generation immigrant students as well as the second-generation immigrant students on the reading, maths, and science test results of native students, and exploit the within-school variation in immigration shares. Moreover, the analyses will be conducted for multiple countries, such that results from each country can be compared. Based on the past studies, I expect to find small, negative effects of non-native shares on native test performance, especially on the language test.

III. Data

The data used for this thesis originates from the 2009 wave of the OECD Programme for International Student Assessment (PISA) survey data. The PISA survey is a cognitive test that is held every three years in over 70 countries, both OECD members and non-OECD countries. This thesis focuses on five European countries: Croatia, Denmark, France, Ireland, and Switzerland. In each country, a representative set of schools is selected, from which 15-year-old students are randomly chosen to participate in the survey. In the survey, the students are tested in three major subjects: mathematics, reading (language), and science. The test aims to assess how well students are able to apply their skills in real-life problems (OECD, 2018).

The PISA dataset contains the test results of each individual question on each subject. Based on these results, I calculated each student's test score, separately for reading, maths, and science, as the percentage of correct answers where I assigned full credit for correct answers, half credit for partially correct answers, and no credit for incorrect, missing, and multiple answers, as well as unreached questions. This percentage scores will be used as the dependent variable in subsequent analyses.

In addition to taking the tests, the students are also asked to fill in a questionnaire about their background, including the country of birth of the students and their parents, on which the immigration status is based. Students are considered first-generation immigrants if they and their parents were all born outside the country in which their test took place. Second-generation immigrant students are children who themselves were born in the test country, but whose parents were both born abroad. All

other students, including those born outside the test country to native parents and those with only one native parent, are considered native students.

While the students participating in the survey are all approximately the same age, they do not all belong to the same grade. The majority of students are in either the 9th or the 10th grade, although the complete sample includes some students in 7th, 8th, 11th and 12th grade as well. I will restrict my analysis to the students in 9th and 10th grade in order to minimise measurement error in the immigrant shares due to the presence of other-aged students in the same grade who were not allowed to participate in the PISA survey and thus not represented in the sample.

Table 1: Descriptive Statistics of Student Test Scores and Shares of Non-Native Students; per Country.

	Average Reading Score			Average Maths Score			Average Science Score			Share of	Share of
Country	Native	First-Gen.	Second-Gen.	Native	First-Gen.	Second-Gen.	Native	First-Gen.	Second-Gen.	First-Gen.	Second-Gen.
Croatia	0.54	0.49	0.52	0.38	0.35	0.36	0.50	0.44	0.46	3.54%	7.25%
Denmark	0.61	0.47	0.46	0.49	0.36	0.34	0.55	0.39	0.37	4.22%	16.06%
France	0.60	0.47	0.50	0.48	0.34	0.35	0.55	0.40	0.41	2.75%	9.96%
Ireland	0.61	0.54	0.61	0.45	0.41	0.49	0.56	0.52	0.55	6.14%	1.46%
Switzerland	0.63	0.51	0.54	0.59	0.43	0.46	0.60	0.47	0.48	7.31%	13.72%

Table 1 shows the average test scores in each country on the three test subjects for natives, first-generation immigrants, and second-generation immigrants. All three subgroups of students appear to have performed best on the reading test. Overall, for every subject, the average native test scores are higher than the average test scores of the both first- and second- generation immigrant students, with differences up to 16 percentage points. Test scores between first- and second-generation immigrants do not differ much, with differences up to 7 percentage points, although the scores of second-generation immigrants appear to be almost equal or slightly higher.

Apart from the test scores, Table 1 also shows the percentage of native and non-native students in the sample. The share of first-generation immigrant students is highest in Switzerland, over 7 percent, while lowest percentage is found in France at slightly below 3 percent. On the other hand, the share of second-generation immigrant students is highest in Denmark at approximately 16 percent. The lowest percentage of second-generation immigrant students is found in Ireland at almost 1.5 percent.

IV. Methodology

The effect of non-native student shares on native test performance will be tested using ordinary least squares (OLS) and fixed effects regressions with standard errors that are clustered by school. For each country, the OLS regression will be used as a benchmark to which the fixed effects regression will be compared. Each OLS regression model is characterized by the following equation:

$$y_{igs}^{N} = \beta_0 + \beta_1 P_{gs}^{F} + \beta_2 P_{gs}^{S} + \beta_3 D_g + \beta_4 X_{igs}^{N} + \varepsilon_{igs}$$

where y_{igs}^{N} refers to the test score of the student i in grade g of school s; P_{gs}^{F} and P_{gs}^{S} correspond respectively the percentage shares of first- and second-generation immigrant students in the same grade and school as the native student; D_g represents the grade dummy, and X_{igs}^{N} is the set of student characteristics that are used as additional explanatory variables. Specifically, these characteristics are student i's gender, whether the student speaks the test language at home, how many times the student

has repeated a grade in primary or secondary school, and the number of books in the student's household. The number of book is used as an indicator of parental background (based on similar research by Jensen & Rasmussen, 2011; and Brunello & Rocco, 2013), where more books imply a better background.

However, even including the additional explanatory variables, it is likely that the regression model is still biased, due to endogeneity of the immigrant shares in the schools. This could be the case when allocation of students between schools is not random, but based on factors that are not included in the regression model. For example, non-natives tend to settle in areas that are relatively more densely populated with fellow immigrants (Zavodny, 1999), and thus might send their children to schools nearby that have relatively high shares of non-native students. Moreover, the phenomenon of 'native flight' has been documented in research, where native parents are more likely to send their children to a private school as the concentration of immigrant children increases in the area (Betts & Fairlie, 2003; Gerdes, 2013). As a consequence of this 'native flight', it is possible that the native students that attend schools with high immigrant concentrations are badly performing students and/or students from poor backgrounds, who are unable to attend private schools. This causes biased estimates as high immigrant shares will appear to deteriorate native student performance more than it actually does, due to the presence of endogenous sorting.

To control for this potential bias due to selective sorting of students across schools, I take advantage of the fact that the PISA dataset includes not only the school, but also the grade the student is in. Because students are selected from different grades, there is variation in the non-native shares within the schools. Due to this variation, it is possible to apply school fixed effects to the regression analyses. This will control for all observable and unobservable school-related variables that might influence the allocation of students across schools. The application of school fixed effects adds the element f_s as an additional factor to the regression model, such that the new regression equation becomes:

$$y_{igs}^{N} = \beta_0 + \beta_1 P_{gs}^{F} + \beta_2 P_{gs}^{S} + \beta_3 D_g + \beta_4 X_{igs}^{N} + f_s + \varepsilon_{igs}$$

While the within-school variation in non-native concentration allows the use of school fixed effects, the source of this variation is unclear. More specifically, it is unknown whether the students are randomly allocated between the grades or if allocation is based on some mechanism. Hence, it is possible using school fixed effects does not solve all endogeneity bias, if sorting between school grades is also endogenous. The fixed effects regression model above assumes there is no endogenous sorting between grades. This assumption can be tested by regressing the share of non-native students on the grade dummy after accounting for school fixed effects. The variation in student concentration can be considered random if it is not statistically significantly influenced by the grade dummy. The results of this regression analysis suggest that the variation is indeed not significant (Table A.1 and A.2 in appendix A).

Finally, I will estimate the effects of immigrant shares within subgroups of native students by running separate regression analyses for each subgroup. More specifically, I will test if the estimates and significance vary between male and female students. In addition, I will compare results between students from "poor" and "good" parental backgrounds, where the distinction is made based on whether the students have fewer or more books at home than the mean in the country in which they reside.

V. Results

OLS Benchmark

Tables B.1 - B.3 in appendix B show the OLS regressions of the effect of immigrant student shares on the native reading, mathematics, and science scores. Table B.1 shows mostly negative coefficients for the shares of first-generation and second-generation immigrant students, indicating a negative effect on the reading scores of natives. The coefficients of the share of first-generation immigrant students is statistically significant in Denmark only and is estimated at -0.16, suggesting that an increase in the first-generation immigrant student share of 1 percentage point decreases the native reading score by 0.0016 percentage points. On the other hand, the share of second-generation immigrant students is significant in Ireland and Switzerland, yet the sign of the estimated effects differs between the two countries. Whereas in Switzerland, the effect is estimated to be negative at -0.10, the estimated effect in Ireland is positive at 0.31. This suggests that increasing the concentration of second-generation non-native students decreases the reading scores natives in Switzerland, but increases the scores in Ireland.

Table B.2, the regression table of the effect on the maths scores, shows significant and negative effects of both immigrant shares in Denmark, France, and Switzerland. In each of the three countries, the effect of the first-generation immigrant students is estimated to be larger than the second-generation shares at respectively -0.16, -0.29, and -0.22, whereas the effect of second-generation non-native shares is slightly lower at -0.07, -0.13, and -0.20. This indicates that while increasing either generation student share impacts the native mathematics score negatively, the presence of first-generation immigrant students affects the scores more.

Table B.3 displays the results on the science scores of natives. The table shows that the effect of the share of first-generation non-native students is estimated to be significant and negative in Denmark and Switzerland, at -0.19 and -0.25, respectively, suggesting that an increase in the share of 1 percentage point decreases the science scores by 0.0019 and 0.0025 percentage points. In contrast, the effect of the second-generation immigrant students is significant in three out of five countries, France, Ireland, and Switzerland. In France and Switzerland, the effect is negative at -0.10 in both countries, while the effect in Ireland is (similar to the effect on the reading score) positive at 0.47.

Fixed Effects Results

In tables B.4-B.6, the complete fixed effect regression models are shown for each test subject, including the coefficients for the control variables. Unsurprisingly, students in 10^{th} grade have higher test scores than students in 9^{th} grade. The effect of being in a higher grade on the reading and maths scores is significant in all countries, while the effect on the science scores is significant in Croatia, France, and Ireland. This effect is strongest in France, where the coefficient is estimated at 0.2 and above in all three subjects, which means that the mean score of the 10^{th} grade students is more than 0.2 percentage points higher than the mean score of 9^{th} grade students.

The student characteristics also appear to play a role in the test performance. For all countries, female students appear to perform better on the reading test, while performing worse than boys on the subjects of mathematics and science. Furthermore, native students who speak a foreign language at home tend to perform worse than those who speak the test language, though this effect is only significant for the reading and science scores in France and Switzerland. Negative effects are also found for children who have repeated a grade, though this effect is less prominent for repetitions in secondary

school. Students who have repeated two or more grades experience more negative effects than those who have only repeated a grade once. Lastly, the number of books is also a significant influencer of test scores. On every subject, the magnitude of the positive effect on the test scores increases as the number of books does as well.

The most noteworthy difference between these regressions and the OLS benchmark regressions is that, overall, few of the regression coefficients of the immigrant student share remain statistically significant. Whereas in the OLS regressions, the coefficients would be significant in each regression model for up to three countries, the fixed effects regression models show much fewer significant effects, even none at all for the effect of the share of first-generation immigrant students on the science scores, which were previously significant for two countries. The only exception is the effect of first-generation migrants on the reading scores, which remains significant for Denmark, but also becomes significant in France and Switzerland.

Apart from the statistical significance of the coefficients, the magnitudes of the effects have also changed. Compared to the OLS regression on reading scores, the absolute values of the significant estimates in fixed effects regression of reading scores are much larger (see table B.4). In Denmark and Switzerland, the effect of first-generation migrant shares respectively changed from -0.16 to 0.79 and from -0.08 to 0.26 after adding school fixed effects, suggesting that increasing the migrant share actually increases the performance of native students on reading tests. Given the unstable effects for either non-native share, the results suggest endogenous sorting between schools is indeed present. This increase in the coefficients indicates an overestimation of the negative effect of immigrant concentration, which is consistent with the previous literature on 'native flight'. However, the opposite effect was found in France, where the estimates of both generation immigrant student shares become more negative. The effect of first-generation immigrant shares changed from 0.01 to -0.60, while the effect of second-generation migrant concentration changed from -0.06 to -0.57. Though these estimates are inconsistent with the theory on 'native flight', they do support the hypothesis that the presence of non-native students impacts native test scores negatively.

The effects of the immigrant shares on the maths scores are also influenced by the addition of fixed effects. Out of the significant effects of both generation immigrant shares in the OLS regressions in Denmark, France, and Switzerland, only the first-generation share in Denmark and the second-generation share in France remain significant (see table B.5). Similar to the results on the reading tests, the effect of the first-generation immigrant share in Denmark was estimated to be positive at 0.97, indicating that a 1 percentage point increase in the share leads to an increase of the native maths scores by 0.0097 percentage points. In France, the second-generation immigrant student share also affects the maths scores similarly compared to the native reading tests. The effect on the maths score increases in magnitude from -0.13 in the OLS regression to -0.31, indicating a negative relationship between second-generation concentration and native maths scores.

The regression results on the native science scores were found to be least significant (see table B.6). While most estimates of the effect of first-generation immigrant shares remain negative, the effects are no longer statistically significant in any country, including Denmark and Switzerland, where the OLS regression estimated significant effects. Moreover, the only significant effect of second-generation immigrant student shares was found in Switzerland, where a positive effect of 0.17 was estimated. Like the effects on the native reading scores found in Switzerland, the coefficient increased and the sign of the effect reversed after accounting for school fixed effects.

Subsample Analyses

Appendix C displays the regression results of immigrant student concentration on each subject per gender for each country. The native reading scores experience significant effects from both first- and second-generation immigrant shares for native French males and native Swiss females (see table C.1). Of the significant effects, the estimate of the first-generation immigrant student share is negative in France at -1.49, but positive at 0.34 in Switzerland. On the other hand, the estimates of the second-generation immigrant student share are negative in both France and Switzerland at -0.85 and -0.17, respectively. Effects for the French females and Swiss males were insignificant, suggesting that the significant effects found on the reading scores of the whole sample of natives are driven by the male French students and female Swiss students.

Results per gender on the outcomes on the maths tests are shown in table C.2. A significant positive effect of first-generation shares on Danish female natives was found, as well as a significant negative effect of the share of second-generation immigrants on French male natives. These effects correspond to the significant effects found in the regression on the complete sample in Denmark and France, but are larger in magnitude. Additionally, significant negative effects of the second-generation share were found in the female Danish subgroup and the male Irish subgroup.

Regression estimates on the science scores also show differences between genders (see table C.3). In Denmark, the effects of both immigrant shares on males were significant and positive, while for females the effects were both negative and only significant for the first-generation share. Furthermore, in France, the effect of first-generation shares is negative for males, yet positive and much larger in magnitude at 10.78 for females. This would suggest that increasing the share of first-generation immigrant students by 1 percentage point increases the maths scores of girls by almost 0.11 percentage points. Lastly, positive effects of the second-generation share were found for both genders in Switzerland, but slightly stronger for the male students at 0.25, compared to 0.19 for the female students.

Table C.4-C.6 report the regression results separated by the students' parental background. The effects found on the natives' reading scores appear to be driven mostly by students with poor parental backgrounds. Nonetheless, the sign of the effects does differ between countries, as reading scores are influenced positively in Denmark and Switzerland, but negatively in France and Ireland. The effects on the maths scores of the students show very little significance, even after separating the sample by parental background. The maths scores of both groups of French students were found to be significantly and negatively influenced by the share of second-generation immigrant students, although the effect is stronger for students from good parental backgrounds (at -1.98, compared to -0.26). The share of second-generation immigrant students also impacts the maths scores of students with poor parental backgrounds in Ireland negatively at -0.76. This negative effect was also found on the science tests of the same group of students, though slightly larger at -0.94. However, most of the significant effects on the science scores occur in the group of students with good parental backgrounds. In Denmark, the shares of both generations affect the students positively, whereas in France, the effects are negative. Nevertheless, while the signs of the estimates are opposite, in both countries, the effect of the first-generation immigrant student share is stronger than the second-generation share.

VI. Conclusion & Discussion

This thesis analysed the effect of non-native presence in school on the test outcomes of native students in five countries. Using the 2009 wave of the PISA study, which assesses the skills of students on various subjects, I regressed the shares of both first- and second-generation immigrant students on

the attained test scores of the native students. School fixed effects were used to control for any sorting of students between schools due to school characteristics.

The regressions show significant effects only in some estimates in Denmark, France, and Switzerland, whereas no effect was found in Croatia and Ireland. While I expected to find negative effects for both immigrant shares, the results only partially support this hypothesis. They suggest that the first-generation immigrant shares have a positive effect on the reading and maths scores of native Danish students and on the reading scores of native Swiss children, but a negative effect on the reading scores of native French students. The second-generation immigrant concentration impacts the reading and maths scores negatively in France, whereas a positive effect was found on the science tests in Switzerland. An explanation regarding the opposite directions of the effect could be that, when the share of immigrant students in class increases, some teachers pay more attention to immigrant students than to native students, hindering the learning progress of native students, whereas other teachers explain key concepts more thoroughly, such that native students also increase their understanding of the material and perform better on tests. Apart from the analysis on the whole sample, separate analyses per subgroup also yield mixed results. While the significant effects in the overall sample tend to be driven by only one gender, the gender that yields the significant effect varies between countries and even between test subjects within each country. The same holds for subsamples based on the parental background of the students.

The most significant limitation of this regression analysis is the data itself. While the PISA data includes many observations from a large set of countries, within each school, only a random set of students is chosen to participate in the PISA survey. A consequence thereof is that the exact composition of native/non-native students in each school grade is unknown, and can only be approximated using the students participating in the survey. Because the percentage shares can only be approximated, it is possible that there are measurement errors that bias the estimators and decrease the accuracy of the regression analyses.

Another limitation is that while grades are observed in the dataset, the individual classrooms are not, even though this study environment might be relevant to the achievements of students. Students in the same classroom might impose more spill-over effects on each other, compared to other students in the same grade, but outside of the class. It is therefore possible that the results in this analysis are biased toward zero because it is impossible to distinguish students from the same class.

While I focused on the effects of immigrant students on native students in 9^{th} and 10^{th} grade, as well as subsamples of native students by gender and parental background, in future research, more attention could be paid to the various subgroups of immigrants that may affect the learning environment of native students. Effects could vary based on the origin of the immigrants, such that it might be fruitful to distinguish Western and non-Western immigrants. Moreover, the effects of non-native shares at school might be also affected by the time the immigrant has spent in the test country, the age at which the immigrant moved, or the native language of the immigrant. Additional research regarding various subsets of immigrant students is necessary to better understand the interaction between native and non-native students.

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Appendix A: Test for Endogeneity

Table A.1: Fixed Effects Estimates of School Grade on First-Generation Immigrant Concentration

Dependent Variable: Share of First-Gen.	(1) Croatia	(2) Denmark	(3) France	(4) Ireland	(5) Switzerland
Grade (Ref.: 9th Grade)					
- 10th Grade	0.002	0.030	-0.002	0.002	-0.003
	(0.01)	(0.04)	(0.01)	(0.01)	(0.02)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	4941	4882	3894	3144	9720

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table A.2: Fixed Effects Estimates of School Grade on Second-Generation Immigrant Concentration

Dependent Variable: Share of Second-Gen.	(1) Croatia	(2) Denmark	(3) France	(4) Ireland	(5) Switzerland
Grade (Ref.: 9th Grade)					
- 10th Grade	0.016	0.026	0.021	-0.006	0.011
	(0.01)	(0.05)	(0.03)	(0.01)	(0.02)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	4941	4882	3894	3144	9720

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Appendix B: Fixed Effect Regression Results

Table B.1: Partial OLS Estimates of Immigrant Student Shares on Native Reading Scores

Dependent Variable: Reading Score	(1) Croatia	(2) Denmark	(3) France	(4) Ireland	(5) Switzerland
Share of Immigrant Students					
- First Generation	-0.19	-0.16**	0.01	-0.02	-0.08
	(0.15)	(0.07)	(0.14)	(0.07)	(0.05)
- Second Generation	-0.03	-0.03	-0.06	0.31**	-0.10***
	(0.09)	(0.03)	(0.06)	(0.14)	(0.04)
Student Characteristics	Yes	Yes	Yes	Yes	Yes
Fixed Effects	No	No	No	No	No
Number of Observations	4229	3619	2871	2614	6885

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table B.2: Partial OLS Estimates of Immigrant Student Shares on Native Maths Scores

Dependent Variable: Mathematics Score	(1) Croatia	(2) Denmark	(3) France	(4) Ireland	(5) Switzerland
Share of Immigrant Students					
- First Generation	-0.15	-0.16*	-0.29**	0.05	-0.22***
	(0.14)	(0.09)	(0.11)	(0.07)	(0.06)
- Second Generation	0.01	-0.07**	-0.13**	0.15	-0.20***
	(0.09)	(0.03)	(0.06)	(0.15)	(0.04)
Student Characteristics	Yes	Yes	Yes	Yes	Yes
Fixed Effects	No	No	No	No	No
Number of Observations	2928	2484	1975	1822	4757

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table B.3: Partial OLS Estimates of Immigrant Student Shares on Native Science Scores

Dependent Variable: Science Score	(1) Croatia	(2) Denmark	(3) France	(4) Ireland	(5) Switzerland
Share of Immigrant Students					
- First Generation	-0.20	-0.19**	-0.10	0.03	-0.25***
	(0.14)	(0.08)	(0.14)	(0.07)	(0.06)
- Second Generation	0.01	-0.02	-0.10*	0.47***	-0.10**
	(0.09)	(0.03)	(0.06)	(0.17)	(0.04)
Student Characteristics	Yes	Yes	Yes	Yes	Yes
Fixed Effects	No	No	No	No	No
Number of Observations	2923	2514	1986	1827	4785

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table B.4: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Reading Scores

	(1)	(2)	(3)	(4)	(5)
Dependent Variable: Reading Score	Croatia	Denmark	France	Ireland	Switzerland
Share of Immigrant Students					
- First Generation	-0.10	0.79**	-0.60**	-0.12	0.26**
	(0.08)	(0.39)	(0.29)	(0.09)	(0.12)
- Second Generation	0.04	-0.13	-0.57***	-0.14	-0.06
	(0.05)	(0.26)	(0.09)	(0.15)	(0.07)
Grade (Ref.: 9th Grade)					
- 10th Grade	0.07***	0.05*	0.20***	0.04***	0.02**
	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)
Female (0/1)	0.05***	0.05***	0.03***	0.04***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Foreign Language at Home (0/1)	0.01	-0.01	-0.05**	-0.03	-0.02**
	(0.02)	(0.04)	(0.02)	(0.04)	(0.01)
No. of Books (Ref.: 0-10 Books)					
- 11-25 Books	0.02***	0.06***	0.03***	0.04**	0.04***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
- 26-100 Books	0.05***	0.10***	0.06***	0.11***	0.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
- 101-200 Books	0.07***	0.15***	0.09***	0.15***	0.10***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
- 201-500 Books	0.07***	0.18***	0.09***	0.19***	0.12***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
- More than 500 Books	0.08***	0.17***	0.12***	0.19***	0.14***
	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
Repeat in Primary (Ref.: None)					
- Once	-0.08	0.00	-0.04	-0.07***	-0.08***
	(0.05)	(0.06)	(0.03)	(0.02)	(0.02)
- Twice or More		-0.33***	-0.15***	-0.54***	0.32***
		(0.01)	(0.03)	(0.06)	(0.07)
Repeat in Secondary (Ref.: None)					
- Once	-0.00	-0.20**	0.04	-0.01	-0.03*
	(0.04)	(0.10)	(0.03)	(0.06)	(0.01)
- Twice or More			-0.23***		-0.13*
			(0.07)		(0.07)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	4229	3619	2871	2614	6885

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table B.5: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Maths Scores

Dependent Variable: Mathematics Score	(1) Croatia	(2) Denmark	(3) France	(4) Ireland	(5) Switzerland
Share of Immigrant Students					
- First Generation	0.02	0.97**	-0.12	-0.10	-0.03
	(0.11)	(0.39)	(0.34)	(0.13)	(0.14)
- Second Generation	0.05	-0.26	-0.31**	-0.34	-0.06
	(0.09)	(0.39)	(0.14)	(0.21)	(0.10)
Grade (Ref.: 9th Grade)					
- 10th Grade	0.07***	0.14***	0.25***	0.04***	0.03*
	(0.01)	(0.04)	(0.03)	(0.01)	(0.01)
Female (0/1)	-0.06***	-0.05***	-0.07***	-0.03**	-0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Foreign Language at Home (0/1)	-0.03	-0.05	-0.01	-0.04	-0.02
	(0.03)	(0.05)	(0.03)	(0.06)	(0.01)
No. of Books (Ref.: 0-10 Books)					
- 11-25 Books	0.02*	0.07***	0.04***	0.05***	0.05***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)
- 26-100 Books	0.05***	0.10***	0.05***	0.11***	0.08***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
- 101-200 Books	0.06***	0.13***	0.07***	0.16***	0.11***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
- 201-500 Books	0.09***	0.18***	0.11***	0.18***	0.14***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
- More than 500 Books	0.08***	0.19***	0.12***	0.18***	0.14***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Repeat in Primary (Ref.: None)					
- Once	-0.05	0.10	0.03	-0.08***	-0.09***
	(0.06)	(0.11)	(0.03)	(0.02)	(0.02)
- Twice or More		-0.57***	-0.00	-0.36***	0.09
		(0.02)	(0.03)	(0.04)	(0.09)
Repeat in Secondary (Ref.: None)					
- Once	-0.05	-0.03	0.10***	-0.01	-0.02
	(0.05)	(0.08)	(0.03)	(0.04)	(0.02)
- Twice or More			0.08		-0.19**
			(0.14)		(0.09)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	2928	2484	1975	1822	4757

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table B.6: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Science Scores

Dependent Variable: Science Score	(1) Croatia	(2) Denmark	(3) France	(4) Ireland	(5) Switzerland
Share of Immigrant Students					
- First Generation	-0.10	-0.51	-0.71	-0.09	0.16
	(0.10)	(0.48)	(0.58)	(0.11)	(0.17)
- Second Generation	0.08	0.03	-0.07	-0.11	0.17**
	(0.07)	(0.16)	(0.14)	(0.23)	(0.08)
Grade (Ref.: 9th Grade)					
- 10th Grade	0.05***	0.03	0.22***	0.04***	0.02
	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)
Female (0/1)	-0.02***	-0.03***	-0.04***	-0.02	-0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Foreign Language at Home (0/1)	-0.02	-0.06	-0.05**	-0.00	-0.03**
	(0.03)	(0.04)	(0.02)	(0.06)	(0.01)
No. of Books (Ref.: 0-10 Books)					
- 11-25 Books	0.02**	0.06***	0.02	0.04**	0.03**
	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)
- 26-100 Books	0.05***	0.11***	0.05***	0.13***	0.07***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
- 101-200 Books	0.08***	0.15***	0.09***	0.17***	0.10***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)
- 201-500 Books	0.08***	0.18***	0.12***	0.21***	0.13***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
- More than 500 Books	0.09***	0.20***	0.13***	0.19***	0.12***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Repeat in Primary (Ref.: None)					
- Once	-0.07	0.02	0.01	-0.08***	-0.09***
	(0.08)	(0.09)	(0.02)	(0.02)	(0.02)
- Twice or More		-0.45***	-0.07		-0.31***
		(0.02)	(0.05)		(0.10)
Repeat in Secondary (Ref.: None)					
- Once	-0.02	-0.16	0.07***	-0.03	-0.03*
	(0.07)	(0.11)	(0.02)	(0.07)	(0.02)
- Twice or More			-0.06		-0.09
			(0.13)		(0.10)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Number of Observations	2923	2514	1986	1827	4785

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Appendix C: Subsample Analyses

Table C.1: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Reading Scores; per Gender

	(1)		(2)		(3)		(4)		(5)	
Dependent Variable: Reading Score	Croatia		Denmark		France		Ireland		Switzerland	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Share of Immigrant Students										
- First Generation	-0.18	0.02	-5.45	0.57	-1.49**	-0.22	-0.12	-0.05	0.18	0.34*
	(0.12)	(0.09)	(5.68)	(0.55)	(0.73)	(1.86)	(0.12)	(0.13)	(0.12)	(0.17)
- Second Generation	0.06	-0.03	1.28	-0.15	-0.85***	-0.20	-0.21	0.42	0.14	-0.17*
	(0.06)	(0.09)	(1.05)	(0.33)	(0.26)	(0.33)	(0.18)	(0.34)	(0.11)	(0.09)
Grade (Ref.: 9th Grade)										
- 10th Grade	0.08***	0.06***	0.14***	0.03	0.23***	0.16***	0.04***	0.05***	0.03**	0.02**
	(0.01)	(0.01)	(0.05)	(0.05)	(0.04)	(0.06)	(0.01)	(0.02)	(0.02)	(0.01)
Foreign Language at Home (0/1)	0.02	-0.01	-0.03	-0.07	-0.06*	-0.04	-0.06	-0.02	-0.01	-0.03*
	(0.02)	(0.04)	(0.05)	(0.05)	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)	(0.02)
No. of Books (Ref.: 0-10 Books)										
- 11-25 Books	0.02	0.03**	0.07***	0.05***	0.03**	0.03	0.03	0.05*	0.04***	0.04**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
- 26-100 Books	0.04***	0.07***	0.09***	0.09***	0.06***	0.05***	0.11***	0.11***	0.07***	0.08***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
- 101-200 Books	0.06***	0.08***	0.14***	0.14***	0.09***	0.08***	0.17***	0.14***	0.11***	0.10***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
- 201-500 Books	0.06***	0.08***	0.18***	0.17***	0.10***	0.09***	0.19***	0.19***	0.12***	0.13***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
- More than 500 Books	0.03	0.13***	0.18***	0.17***	0.11***	0.12***	0.18***	0.21***	0.13***	0.15***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
Repeat in Primary (Ref.: None)										
- Once	-0.08	-0.08*	0.11**	-0.04	0.01	-0.08	-0.06*	-0.08**	-0.08***	-0.09***
	(0.06)	(0.05)	(0.05)	(0.10)	(0.04)	(0.05)	(0.03)	(0.03)	(0.02)	(0.02)
- Twice or More			-0.33***		-0.13**	-0.19***	-0.44***		0.37***	
			(0.02)		(0.05)	(0.04)	(0.12)		(0.07)	
Repeat in Secondary (Ref.: None)										
- Once	0.03	-0.01	-0.13***	-0.24**	0.06*	0.02	-0.08	0.04	-0.02	-0.03
	(0.05)	(0.01)	(0.05)	(0.12)	(0.03)	(0.05)	(0.12)	(0.06)	(0.02)	(0.02)
- Twice or More					-0.21*				-0.16**	0.05**
					(0.11)				(0.07)	(0.02)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	2222	2007	1702	1917	1336	1535	1293	1321	3364	3521

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table C.2: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Maths Scores; per Gender

	(1)		(2)		(3)		(4)		(5)	
	Croatia		Denmark		France		Ireland		Switzerland	
Dependent Variable: Maths Score	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Share of Immigrant Students										
- First Generation	-0.08	0.16	-3.32	1.47***	-1.40	2.61	-0.21	0.02	-0.25	0.17
	(0.13)	(0.20)	(6.59)	(0.33)	(0.94)	(2.06)	(0.23)	(0.13)	(0.17)	(0.23)
- Second Generation	0.08	0.05	-0.04	-0.66***	-1.06***	-0.60	-0.51**	-0.30	-0.14	-0.00
	(0.10)	(0.13)	(1.31)	(0.11)	(0.29)	(0.43)	(0.23)	(0.34)	(0.15)	(0.12)
Grade (Ref.: 9th Grade)										
- 10th Grade	0.08***	0.08***	-0.02	0.21***	0.27***	0.21***	0.05***	0.03*	0.05**	0.01
	(0.01)	(0.01)	(0.08)	(0.05)	(0.06)	(0.05)	(0.02)	(0.01)	(0.02)	(0.02)
Foreign Language at Home (0/1)	-0.03	-0.02	-0.11**	-0.04	-0.02	-0.00	-0.10	0.13***	0.01	-0.05**
	(0.04)	(0.05)	(0.05)	(0.10)	(0.04)	(0.05)	(0.07)	(0.03)	(0.02)	(0.02)
No. of Books (Ref.: 0-10 Books)										
- 11-25 Books	0.02	0.02	0.10***	0.05**	0.05**	0.02	0.04*	0.08***	0.05***	0.06***
	(0.02)	(0.01)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
- 26-100 Books	0.05***	0.05***	0.10***	0.09***	0.04*	0.05**	0.12***	0.13***	0.08***	0.09***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
- 101-200 Books	0.05**	0.07***	0.15***	0.12***	0.05**	0.08***	0.17***	0.18***	0.11***	0.13***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
- 201-500 Books	0.10***	0.08***	0.20***	0.17***	0.08***	0.11***	0.19***	0.20***	0.12***	0.16***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
- More than 500 Books	0.06**	0.11***	0.19***	0.20***	0.08***	0.15***	0.19***	0.21***	0.14***	0.16***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Repeat in Primary (Ref.: None)										
- Once	-0.05	-0.03	0.08***	0.14	0.05	0.00	-0.12***	-0.05*	-0.12***	-0.08***
	(0.06)	(0.06)	(0.01)	(0.15)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
- Twice or More			-0.48***		-0.00	0.04	0.06		0.14***	
			(0.03)		(0.06)	(0.03)	(0.05)		(0.05)	
Repeat in Secondary (Ref.: None)										
- Once	-0.02	-0.09***	0.03	-0.08	0.10*	0.07**	-0.05	0.01	-0.00	-0.02
	(0.06)	(0.00)	(0.03)	(0.08)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.02)
- Twice or More					0.11				-0.18***	
					(0.11)				(0.05)	
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1536	1392	1150	1334	921	1054	904	918	2306	2451

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table C.3: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Science Scores; per Gender

	(1)		(2)		(3)		(4)		(5)	
	Croatia		Denmark		France		Ireland		Switzerland	
Dependent Variable: Science Score	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Share of Immigrant Students										
- First Generation	-0.15	0.04	3.49***	-0.69*	-0.95*	10.78***	-0.09	-0.04	0.13	0.16
	(0.17)	(0.13)	(0.60)	(0.39)	(0.51)	(1.12)	(0.14)	(0.15)	(0.16)	(0.32)
- Second Generation	0.11	-0.01	0.44***	-0.12	0.01	-2.33***	-0.27	0.32	0.25**	0.19**
	(0.11)	(0.09)	(0.08)	(0.21)	(0.18)	(0.25)	(0.31)	(0.49)	(0.12)	(0.09)
Grade (Ref.: 9th Grade)										
- 10th Grade	0.07***	0.04***	0.11***	-0.00	0.20***	0.25***	0.05***	0.04**	0.02	0.02
	(0.01)	(0.01)	(0.03)	(0.04)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)	(0.01)
Foreign Language at Home (0/1)	-0.03	-0.04	-0.11**	-0.05	-0.06	-0.03	-0.01	0.07	-0.05**	-0.01
	(0.03)	(0.05)	(0.05)	(0.07)	(0.04)	(0.03)	(0.07)	(0.09)	(0.02)	(0.02)
No. of Books (Ref.: 0-10 Books)										
- 11-25 Books	0.02	0.04***	0.07**	0.04*	0.03	0.02	0.04	0.05*	0.04*	0.03
	(0.01)	(0.01)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
- 26-100 Books	0.04***	0.07***	0.12***	0.11***	0.06**	0.05**	0.14***	0.14***	0.07***	0.07***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
- 101-200 Books	0.07***	0.10***	0.16***	0.14***	0.09***	0.07***	0.17***	0.19***	0.10***	0.09***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
- 201-500 Books	0.08***	0.09***	0.21***	0.16***	0.12***	0.12***	0.17***	0.24***	0.12***	0.13***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
- More than 500 Books	0.05*	0.14***	0.19***	0.21***	0.13***	0.12***	0.15***	0.26***	0.12***	0.12***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Repeat in Primary (Ref.: None)										
- Once	-0.06	-0.21***	0.13	-0.02	-0.00	0.02	-0.09***	-0.07**	-0.09***	-0.08***
	(0.11)	(0.04)	(0.08)	(0.12)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)
- Twice or More			-0.33***		-0.06	-0.11***			-0.24**	
			(0.03)		(0.07)	(0.04)			(0.11)	
Repeat in Secondary (Ref.: None)										
- Once	-0.05	0.14	-0.31***	-0.15	0.05**	0.08**	-0.06	0.00	-0.03	-0.01
	(0.10)	(.)	(0.08)	(0.16)	(0.02)	(0.03)	(0.13)	(0.08)	(0.03)	(0.02)
- Twice or More					-0.06				-0.14	-0.07***
					(0.11)				(0.11)	(0.02)
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1517	1406	1175	1339	923	1063	901	926	2334	2451

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table C.4: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Reading Scores; per Parental Background

	(1)		(2)		(3)		(4)		(5)	
	Croatia		Denmark		France		Ireland		Switzerland	
Dependent Variable: Reading Score	Poor	Good	Poor	Good	Poor	Good	Poor	Good	Poor	Good
Share of Immigrant Students										
- First Generation	-0.18	-0.05	0.66*	0.68	-0.17	-3.18	-0.30**	0.02	0.50*	0.17
	(0.12)	(0.12)	(0.38)	(0.66)	(0.28)	(3.58)	(0.12)	(0.11)	(0.29)	(0.10)
- Second Generation	0.05	0.05	-0.38	0.19**	-0.50***	-1.93	-0.54*	0.07	0.03	-0.11
	(0.10)	(0.07)	(0.39)	(0.08)	(0.10)	(1.51)	(0.29)	(0.18)	(0.14)	(0.10)
Grade (Ref.: 9th Grade)										
- 10th Grade	0.09***	0.05***	0.02	0.10	0.21***	0.19*	0.05***	0.03***	0.01	0.03***
	(0.01)	(0.01)	(0.04)	(0.07)	(0.04)	(0.10)	(0.02)	(0.01)	(0.02)	(0.01)
Female (0/1)	0.04***	0.05***	0.05***	0.05***	0.04***	0.02**	0.05***	0.03**	0.06***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Foreign Language at Home (0/1)	0.03	-0.01	-0.02	-0.05	-0.06**	0.03	-0.02	0.00	-0.02	-0.03
	(0.02)	(0.04)	(0.05)	(0.05)	(0.03)	(0.05)	(0.06)	(0.06)	(0.02)	(0.02)
Repeat in Primary (Ref.: None)										
- Once	-0.10	-0.09	0.08**	-0.07	-0.04	-0.09**	-0.05**	-0.11***	-0.06***	-0.10***
	(0.07)	(0.06)	(0.03)	(0.12)	(0.03)	(0.04)	(0.02)	(0.04)	(0.02)	(0.02)
- Twice or More		0.05		-0.31***	-0.16***	-0.09**	-0.44***			0.20***
		(0.04)		(0.01)	(0.03)	(0.04)	(0.06)			(0.00)
Repeat in Secondary (Ref.: None)										
- Once	0.01	0.00	-0.32***	-0.06	0.05	0.03	-0.05	0.13***	-0.02	-0.03
	(0.07)	(0.04)	(0.09)	(0.15)	(0.03)	(0.04)	(0.06)	(0.04)	(0.02)	(0.02)
- Twice or More					-0.08***	-0.50***			-0.18**	
					(0.02)	(0.04)			(0.08)	
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1914	2350	2087	1625	1614	1287	1437	1209	3546	3387

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table C.5: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Maths Scores; per Parental Background

	(1)		(2)		(3)		(4)		(5)	
Dependent Variable: Maths Score	Croatia		Denmark		France		Ireland		Switzerland	
	Poor	Good	Poor	Good[C]	Poor	Good	Poor	Good	Poor	Good
Share of Immigrant Students										
- First Generation	-0.04	0.03	0.49	0.00	0.43	-3.90	-0.20	0.01	-0.20	-0.10
	(0.13)	(0.18)	(0.58)	(.)	(0.67)	(2.38)	(0.14)	(0.20)	(0.56)	(0.10)
- Second Generation	0.06	0.06	-0.20	0.00	-0.28*	-1.98**	-0.76***	-0.14	-0.11	-0.02
	(0.14)	(0.13)	(0.37)	(.)	(0.14)	(0.95)	(0.27)	(0.25)	(0.26)	(0.08)
Grade (Ref.: 9th Grade)										
- 10th Grade	0.09***	0.06***	0.10	0.22***	0.27***	0.23**	0.04***	0.03*	0.01	0.04***
	(0.01)	(0.01)	(0.08)	(0.03)	(0.04)	(0.10)	(0.01)	(0.02)	(0.04)	(0.01)
Female (0/1)	-0.05***	-0.07***	-0.05***	-0.04***	-0.07***	-0.07***	-0.03	-0.05**	-0.06***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Foreign Language at Home (0/1)	-0.00	-0.03	-0.06	-0.05	-0.03	0.03	0.10	-0.15*	-0.03	-0.03
	(0.04)	(0.04)	(0.07)	(0.06)	(0.04)	(0.06)	(0.07)	(0.08)	(0.02)	(0.02)
Repeat in Primary (Ref.: None)										
- Once	-0.05	-0.03	0.21**	0.04	0.02	0.00	-0.05*	-0.14***	-0.08***	-0.08**
	(0.05)	(0.05)	(0.11)	(0.16)	(0.04)	(0.07)	(0.03)	(0.04)	(0.02)	(0.03)
- Twice or More		-0.11**		-0.51***	-0.02	0.00	-0.14**			-0.14***
		(0.04)		(0.01)	(0.03)	(0.07)	(0.06)			(0.01)
Repeat in Secondary (Ref.: None)										
- Once	-0.07	-0.03***	-0.07	0.01	0.10***	0.06	-0.08	0.07	0.01	-0.04
	(0.04)	(0.01)	(0.11)	(0.15)	(0.03)	(0.06)	(0.05)	(0.13)	(0.03)	(0.03)
- Twice or More					-0.11***	0.27***			-0.32***	
					(0.02)	(0.07)			(0.02)	
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1328	1625	1440	1115	1094	903	1012	837	2440	2349

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01
[C] Effects unable to be estimated due to collinearity.

Table C.6: Fixed Effect Estimates of the Effect of Immigrant Student Shares on Native Science Scores; per Parental Background

	(1)		(2)		(3)		(4)		(5)	
	Croatia		Denmark		France		Ireland		Switzerland	
Dependent Variable: Science Score	Poor	Good	Poor	Good	Poor	Good	Poor	Good	Poor	Good
Share of Immigrant Students										
- First Generation	-0.07	-0.12	-1.09	1.04**	-0.19	-5.48***	-0.19	-0.09	0.11	0.12
	(0.19)	(0.14)	(0.69)	(0.44)	(0.59)	(0.68)	(0.13)	(0.21)	(0.42)	(0.17)
- Second Generation	0.22*	-0.05	-0.20	0.23***	-0.02	-1.72***	-0.94***	0.37	0.20	0.09
	(0.13)	(0.10)	(0.25)	(0.05)	(0.18)	(0.25)	(0.31)	(0.28)	(0.23)	(0.09)
Grade (Ref.: 9th Grade)										
- 10th Grade	0.06***	0.05***	-0.08	0.11**	0.22***	0.22***	0.05***	0.04**	0.01	0.02**
	(0.01)	(0.01)	(0.06)	(0.05)	(0.03)	(0.06)	(0.02)	(0.02)	(0.03)	(0.01)
Female (0/1)	-0.03**	-0.02	-0.03**	-0.02	-0.03***	-0.05***	-0.02	0.01	-0.03***	-0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Foreign Language at Home (0/1)	-0.05	0.02	-0.08	-0.08**	-0.05	-0.07*	0.10	-0.04	-0.05***	-0.03*
	(0.03)	(0.04)	(0.06)	(0.03)	(0.03)	(0.04)	(0.08)	(0.10)	(0.02)	(0.02)
Repeat in Primary (Ref.: None)										
- Once	-0.11	0.01	0.12*	0.02	-0.00	-0.03	-0.08**	-0.12***	-0.07***	-0.10***
	(0.09)	(0.06)	(0.06)	(0.09)	(0.03)	(0.05)	(0.03)	(0.04)	(0.02)	(0.03)
- Twice or More				-0.41***	-0.11*	-0.18***				-0.34***
				(0.01)	(0.06)	(0.05)				(0.00)
Repeat in Secondary (Ref.: None)										
- Once	0.01	-0.06	-0.29***	0.20***	0.07***	0.02	-0.07	0.11	-0.02	-0.04
	(0.08)	(0.04)	(0.06)	(0.01)	(0.02)	(0.05)	(0.08)	(0.11)	(0.02)	(0.03)
- Twice or More						0.13***			-0.19	
						(0.05)			(0.12)	
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	1313	1634	1458	1116	1133	875	993	855	2466	2355

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01