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Migration inflow and the school performance of incumbent students[a]

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Abstract: We examine how exposure to recent migrants affects the academic performance of Swedish students. To identify the effect, we exploit variation in exposure to recent migrants between grades in a given school and year, between siblings and over time for the same individuals. We find a positive effect on native students in schools with high levels of exposure and in rural areas. At the same time, the effect is negative in large cities. Analyses of mechanisms suggest that school responses to reduce class size play a role in generating net positive effects of migrant exposure. Findings are similar when considering the more acute exposure of the 2015-2016 refugee crisis.

Keywords: schooling, peers, migration
JEL-codes: I21,I24,J15

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1 Introduction

Growing migration and refugee flows have consequences for receiving host community labor markets and schools.[1] Immigration is often associated with poor school results and increasing school segregation as migrant students are disproportionately accommodated in disadvantaged schools and because the performance of migrant students generally lags that of their native peers (Card, 2009). Yet, causal evidence on the effects of exposure to migrants on incumbent students is inconclusive, with results ranging from negative (Ballatore, Fort, and Ichino, 2018; Gould, Lavy, and Daniele Paserman, 2009; Jensen and Rasmussen, 2011) to limited (Bossavie, 2020; Brandén, Birkelund, and Szulkin, 2019; Figlio and Özek, 2019; Geay, McNally, and Telhaj, 2013; Green and Iversen, 2022; Morales, 2022; Ohinata and Van Ours, 2013) to positive effects (Figlio et al., 2023; Tumen, 2021). Levels of exposure, policy responses and context likely matter, but also the extent to which studies are able to account for non-random sorting of both migrants and incumbent student. This motivates us to provide evidence from Sweden for a period of rapid increase in refugee migrant exposure, and where a number of contextual factors, policy responses and sorting can be studied explicitly.

Exposure to migrants and newly arrived refugees potentially affect student outcomes because the student composition of schools and peer effects matter for student outcomes (Coleman, 1988; Hoxby, 2000), identity formation (Akerlof and Kranton, 2002) and teacher turnover (Karbownik, 2020). Competition for resources, classroom disruptions, and reorientation of teaching activity are possible reasons (Card, 2009; Lazear, 2001; Sacerdote, 2011), as are impacts on students' rank in the classroom (Dadgar, 2022; Delaney and Devereux, 2021, 2022) and effects of relative grading. Needless to say, characteristics of the migrants likely matter. Changes to the student composition due to migration flows may also affect students' school choices and cause families to change neighborhoods or schools, which further alters the student composition of receiving schools (Aldén, Hammarstedt, and Neuman, 2015; Böhlmark, Holmlund, and Lindahl, 2016; Böhlmark and Willén, 2020; Clotfelter, 1976, 2001; Tumen, 2019).[2] Depending on the initial student composition, the nature of the migrant influx, families' school choice decisions, and the ability of schools to obtain more resources and/or respond organizationally, the net effect of these different channels may well be negative, neutral, or positive. Uncovering which mechanisms are present is thus important for the development of appropriate policy responses.

In this paper, we study the effect of exposure to recent migrants and acute refugee influx in Swedish compulsory schools on incumbent students' compulsory school performance.[3] We focus on the academic years 2008/09–2021/22, a period characterized by

[1] See Borjas (2014), Brell, Dustmann, and Preston (2020), and Dustmann, Schönberg, and Stuhler (2016) for reviews of the literature on the impact of immigrants and refugees on labor market outcomes.

[2] Even modest preferences for similarity can lead to high levels of segregation (Schelling, 1971).

[3] Incumbent students are defined as students born in Sweden. Recent migrants are defined as students born abroad who were granted a residence permit within the last four years or students who are in the asylum process and have not yet received a residence permit.

an increasingly high migrant and refugee exposure which put communities and schools under stress, especially during the European refugee crisis 2015. We follow the strategy of Brandén, Birkelund, and Szulkin (2019) and Figlio et al. (2023) and exploit i) within-school variation in migrant exposure across cohorts and over time and ii) within-sibling variation in exposure to migrants to account for non-random sorting of both migrant and native students to schools. We further follow Figlio et al. (2023) and estimate the effects of both contemporaneous migrant exposure during the year in which we measure outcomes and cumulative migrant exposure which averages exposure over students' school history. The reason for including these two measures of exposure is that it is theoretically possible that student performance in a given year is shaped both by the quality of earlier learning experiences in a process where skill begets skill and by contemporary experiences and disruptions.[4] To account for within-family selection, we study school changes directly and examine if families selectively change schools for their children or place younger siblings in a different school in response to the migrant influx. We then instrument younger sibling exposure with the exposure that they would have experienced had families placed younger children in the same school as their older child. We also estimate the model with individual fixed effects. Moreover, as an alternative strategy to estimate the effects of acute refugee exposure on incumbent students, we use the substantial variation in how schools were affected by the 2015 refugee crisis in an event study approach. This strategy allows us to capture broader school-level effects.

Our analysis is based on administrative student registers with information on school and class assignments throughout compulsory school grades (0 to 9) for academic years 2008/09–2021/22 for the universe of Swedish compulsory school students, including asylum seekers. School performance is measured by results on national tests in grades 3 (only Swedish and Mathematics) and grades 6 and 9 (Swedish, Mathematics and English). Test score outcomes are complemented with teacher assessments/grades in grades 6 and 9, and high school track choices. We link student data to school-level data, and to population and tax registers containing information on family links, birth records, migration background, and parental education and earnings.

The recent Swedish experience offers an excellent opportunity to study how exposure to recent immigrants affects incumbent students. The average share of foreign-born students in Swedish schools almost doubled from 7 to 13 percent from 2008 to 2019, which is high compared to the US and other European countries. The fraction of recent immigrant students rose rapidly during the Syrian conflict and reached a peak of 6.4 percent of all students in 2018, just after the 2015 European refugee crisis. This can be compared to the 2018 European average share of foreign-born students, which was 5–6 percent. In 2015 alone, Sweden received some 70,000 refugee minors, half of whom were unaccompanied, of mainly Afghan origin (Bunar, 2017). In addition, the distribution of migrants

[4]Figlio et al. (2023) explore weighting which discounts distant relative to recent exposure, but settle for a measure with equal weights. Contemporaneous exposure refers to the fraction of recent migrant students in the student's grade and school in a given year, while cumulative exposure averages the student's recent migrant exposure in each school year up until the present.

across schools is very uneven. While many schools were unaffected by the rapid influx of asylum seekers, other schools, typically in rural areas, saw their student body increase dramatically.

Our results suggest that the negative association between migration and school performance stems from the significant negative sorting of migrants and incumbent children to exposed schools. Once we account for this sorting, we find that both contemporaneous and cumulative exposure on average have a small positive effect on native students' test scores. At the same time, we find the opposite but insignificant effects for students from an immigrant background and evidence of negative effects in large cities. An analysis of heterogeneous effects shows that the positive results are driven by the effect on male students' Swedish and English test scores. A closer examination of effects across the performance distribution shows that while boys in the middle and top of the distribution benefit, academically weak girls also benefit.

We also explore the effects of exposure to different types of migrants. It seems that the positive effects on test scores of recent migrant exposure are driven by exposure to migrants from non-Western and low-income countries as well as asylum seekers. We further find that school performance of those with an immigrant background is suggestively negatively affected by cumulative exposure to non-Western migrants and migrants from low-income countries. In contrast, exposure to recent migrants from rich countries has no impact on scores. We also find that contexts matter. While the positive results are driven by schools with high levels of exposure and there are positive effects of migrant exposure on native students in rural areas, our estimates are negative for students in large cities. These results are consistent with previous evidence of more negative effects of migrant concentration on migrant students (Jensen and Rasmussen, 2011; Schneeweis, 2015).

When exploring mechanisms behind the observed effects, we find evidence that schools in rural areas respond more to migrant inflow by increasing resources, as in Özek (2021) and Morales (2022). In particular, we find reductions in class size for both native students and students of foreign background in rural areas, while there are smaller reductions in class size for native students in large cities and no evidence of compensatory resource increases for foreign background students in large cities. We further find increases in the fraction of native students who participate in home language classes as they are exposed to recent migrants. The analysis of the 2015 refugee crisis, which increased exposure dramatically, in particular, in rural areas, confirms the result of a modest positive effect on test scores of being exposed to recent migrants for native students. Again, effects on class size responses suggest that increased resources in response to migrant inflow have a role in explaining the positive results, consistent with Figlio and Özek (2019).

We contribute to two main strands of empirical literature. The first one studies the effect of different facets of peer composition in school on educational outcomes more broadly (e.g., Balestra, Eugster, and Liebert, 2022; Bietenbeck, 2020; Brenøe and Lundberg, 2018). The other strand focuses on host country effects of migration and more specifically on the effects of exposure to migrant peers on the school performance of incumbent students. It provides mixed evidence of the effect. A number of those studies

find a null to a small positive effect of the exposure across different countries, including the US (Figlio et al., 2023; Figlio and Özek, 2019; Morales, 2022; Werf, 2021), Scandinavia (Brandén, Birkelund, and Szulkin, 2019; Green and Iversen, 2022; Hassan et al., 2023), several other European countries (e.g., Ohinata and Van Ours, 2013; Schneeweis, 2015), and Turkey (Tumen, 2021). Several other studies, however, detect a mild to moderate negative effect of migrant influx (Ballatore, Fort, and Ichino, 2018; Frattini and Meschi, 2019; Gould, Lavy, and Daniele Paserman, 2009; Jensen and Rasmussen, 2011). We contribute to the existing literature in several ways. Firstly, rich administrative data allows us to address the issue of selection into schools by comparing the exposure within families, as do Brandén, Birkelund, and Szulkin (2019) and Figlio et al. (2023), and also compare the same individuals over time. Secondly, our study focuses on a period of rapidly rising primarily refugee migrant exposure, which culminated during the European refugee crisis of 2015 and affected schools and areas previously unexposed to migration. To our knowledge one previous study covers this tumultuous period (see Tumen, 2021) while the studies of Hassan et al. (2023) and Green and Iversen (2022) use data ending with the crisis. Third, we are able to provide evidence on effects in different contexts and on school responses to migrant exposure, which sheds light on the connection between compensatory resource spending and school results.

In what is perhaps the contextually closest study, Brandén, Birkelund, and Szulkin (2019) find limited effects of exposure to migrants in Sweden on the local students' compulsory school leaving grades for the period 1998–2012, before the rapid increase in migrant exposure. We expand this previous evidence in several directions. First we consider a later period that involves a more sudden and intense exposure spurred by the 2015 refugee crisis. Second, we use standardized national test results for grades 3, 6, and 9, which are more objective measures of student performance, compared to grades given by the teacher in the final year of compulsory school (Vlachos, 2019). Access to student registers also allows us to measure both contemporaneous and cumulative exposure to recent migrants (including asylum seekers) over incumbent students' complete school history. Furthermore, we are able to study school responses. While our findings also show limited effects on students' grades, we show that there are overall positive effects on test scores, and that the positive effects can be linked to increased resources. In another recent study, very close to ours methodologically, Figlio et al. (2023) show positive effects of exposure to foreign-born students of a similar magnitude to our findings. Yet our context of rapidly rising exposure to predominantly refugee migration is very different from their US context of rather stable shares of foreign born students. Our event study of the 2015 refugee crisis is a further contribution to the literature focusing more specifically on refugee migration and the European refugee crisis, e.g., Figlio and Özek (2019), Green and Iversen (2022), Hassan et al. (2023), Morales (2022), and Özek (2021), in that we are able to show that positive effects on incumbent students also can extend to an event that put substantial pressure on receiving communities, provided there are adequate policy responses.

2 Background and data

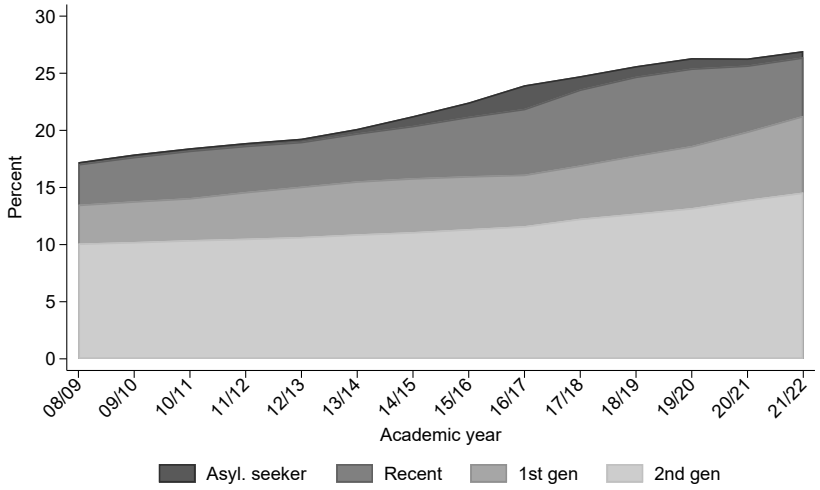
2.1 Refugee immigration in Sweden

Immigration, in a European and Swedish context, is signified by refugee migration, which contrasts the US setting, where refugee immigration is of less importance. The inflow of migrants during the refugee crisis in the mid-2010s was exceptionally high from a historical perspective, and about one million refugees (mainly from Syria) came to Europe within a couple of years. However, in the European context, only a few papers (e.g., Green and Iversen, 2022; Hassan et al., 2023; Tumen, 2021) focus on this setting and only Tumen (2021) uses data covering the crisis. Moreover, even within Europe, Sweden is somewhat of an outlier. Sweden had until 2016 (when migration policy changed radically) the highest per capita refugee inflow in Europe. Compared to other European countries, Sweden thus has a relatively high fraction of foreign-born (20 percent in 2020) and the highest number of refugees per capita (9 percent in 2020). In the past two decades, refugees from the Middle East and Northeast Africa have constituted the majority of the immigrant inflow.

In Figure 1, we show how the share of students with migrant backgrounds as a fraction of the total student population has evolved in Swedish compulsory schools since the academic year 2008/2009. Over that period, the fraction of native students with at least one parent born in Sweden has declined from approximately 82 percent to around 72 percent. There is a steady increase in the fraction of second-generation immigrant students from about 10 percent in 2008/2009 to some 13 percent in 2021/2022. At the same time, the total group of first-generation immigrant students (comprised of foreign-born students with more than four years of residency, recently arrived with at most four years of residency, and asylum seekers) doubled from about 6 percent to over 12 percent. Although asylum seekers make up a small share of the overall student population, there was a clear peak during the crisis years around 2015–2017. As these students become residents, the group of recent migrants grows. Over time, a growing fraction of first-generation immigrant students also accumulate more than four years of residency.

These average numbers hide significant heterogeneity in the fraction of migrant students across schools and also in the exposure to migrant students by incumbent students' migration background. Figure 2 therefore takes a closer look at migrant exposure, i.e the fraction of recent migrant students in schools. The top panel of Figure 2 shows the evolution of the distribution of contemporaneous (a) and cumulative (b) exposure, where contemporaneous exposure is the fraction of recent migrants in the present academic year measured at the school and cohort level and cumulative exposure is the mean contemporaneous exposure over each student's school history including the present grade and year. While 25 percent of students remain largely unexposed to immigrant students in a given year throughout the study period, median contemporaneous exposure rises by a few percentage points from 1 to 4 percent during the refugee crisis. At the other end, the 75^{th} and 90^{th} percentiles of the distribution, migrant exposure rises from just below 5 and

Figure 1: Stock of compulsory school students by migration background



Note: The figure shows the share of foreign-born and foreign background (two foreign born parents) students for the 2008–2022 period, by migrant status. "Asylum seekers" are non-resident students with asylum seeking status, "Recent" includes foreign-born students with at most four years of residency, "1st gen" are foreign-born students with more than four years of Swedish residency, and "2nd gen" are students born in Sweden to two foreign-born parents.

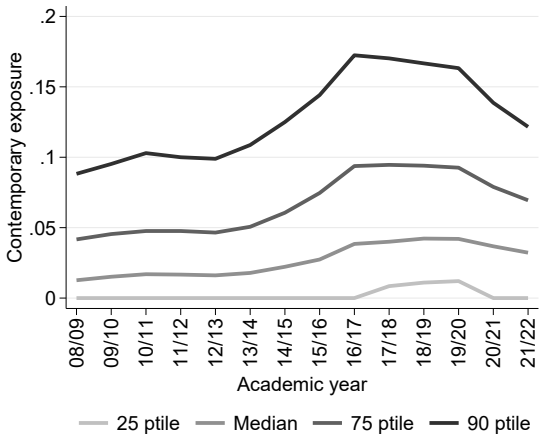
10 percent, respectively to just below 10 percent and some 17 percent during the peak of the 2015 refugee crisis. The evolution of cumulative exposure is less dramatic and somewhat less unevenly distributed. At the 25th percentile, there is low but non-zero exposure from 2014/2015, and at the 90th percentile, cumulative exposure peaks at 15 percent in 2019/2020.

The bottom panel shows (c) the overall distribution of cumulative exposure for native and immigrant background students for the 2008–2022 period and (d) the time trend in average cumulative exposure for native and immigrant background students. The figures reveal a much higher spike at zero exposure for native students than for students of immigrant background and that native students have more mass at low levels of exposure. While average native student exposure to recent migrants rises from some 2.5 percent in 2008/2009 and peaks at around 6 percent during the refugee crisis years, immigrant background students have 5 percentage points (or approximately 100 percent) higher exposure to recent immigrants and asylum seekers, rising from a bit over 7 percent in 2008/2009 to 11 percent during the crisis.

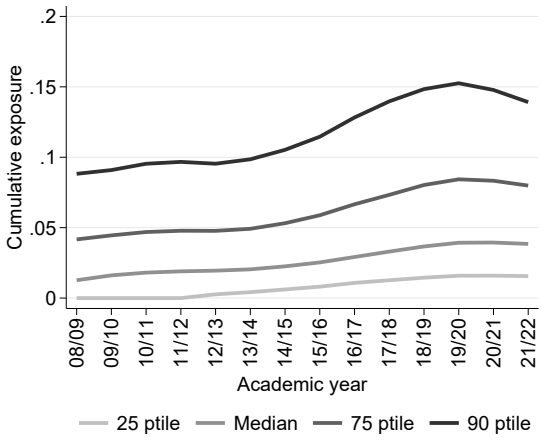
These patterns are evidence of the clustering of immigrant background students in certain schools but also of the fact that the refugee crisis actually did not increase segregation: exposure increased similarly for native and immigrant background students. A reason for this is that during the crisis years, many refugees were received in small rural municipalities where accommodation was available but who had little previous experience of immigration.[5]

[5]The ability of schools to accommodate the large influx of refugee children led to political debates in Sweden and many other European countries about the strain the crisis put on host communities. In Sweden, the government introduced both general support programs to improve refugee reception in schools and

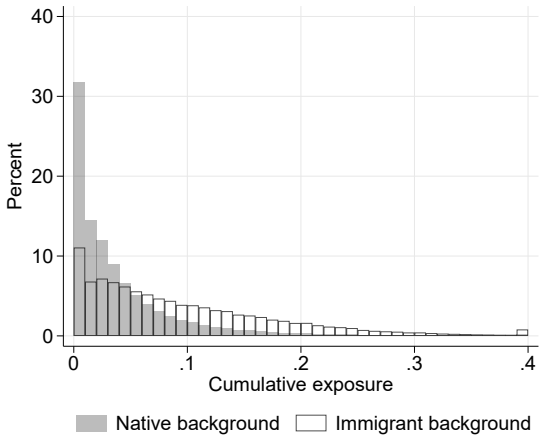
Figure 2: Exposure to recent immigrant and asylum seeking students



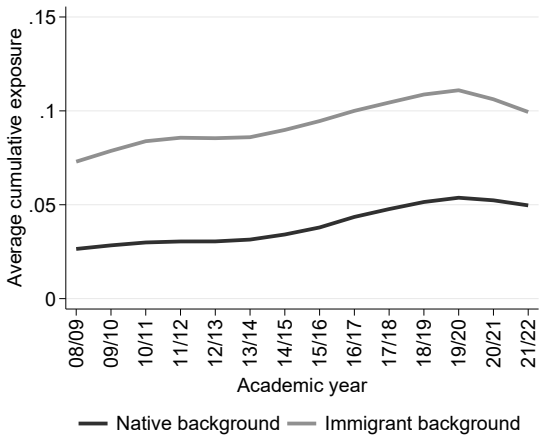
(a) Contemporaneous exposure by percentile



(b) Cumulative exposure by percentile



(c) Distribution of cumulative exposure by background



(d) Cumulative exposure by background

Note: The figures (a) and (b) show trends in the distribution of School by grade level contemporaneous and cumulative exposure to asylum seekers and recent migrant students at different percentiles of the distribution in Sweden between 2008/2009 and 2021/2022. Contemporaneous exposure is the fraction of recent immigrants and asylum seekers at the school and grade level. Cumulative exposure is the mean of students' contemporaneous exposure over their school history including the present grade/year. Figure (c) shows the distribution of cumulative exposure for natives and immigrant background students and Figure (d) shows trends in cumulative exposure by migration background.

Our estimation strategies exploit 1) the year-to-year variation in exposure across grades within schools and 2) the variation in exposure to recent migrants in across schools and grades resulting from the refugee crisis. Arguably, variation in exposure across grades and years *within* schools should be as good as random because the age composition of recent immigrants in a particular municipality and school will vary in a plausibly random way, although there is non-random sorting of migrants to municipalities and schools. Moreover, the sudden nature of the refugee crisis and the need to rapidly accommodate new students also introduces an element of exogeneity in exactly which schools were more and less exposed depending on the availability of housing and refugee accommodation facilities.

We have argued that the Swedish context is one of refugee migration. Table A1 shows the composition of students in Swedish compulsory schools by country or region of origin in the years 2008–2022. In this table, the origin of students is defined by the county of birth of the student or the student's mother. The immigrant student population is very diverse, with no single group exceeding two percent of the student body. The largest groups are immigrants from former Yugoslavia and Bosnia and Herzegovina, Northeast Africa, Middle East and North Africa, and Iraq.[6]

2.2 The Swedish school system

Sweden requires resident children aged 6 to 16 to attend compulsory school and offers schooling to refugee children during the asylum process. Since the early 1990s, the Swedish school system is rather decentralized. There is a national curriculum, but municipalities are responsible for financing schools, both municipal-run schools and independent schools. The latter are entitled to funding, provided they follow the national curriculum and do not charge fees to students (see e.g., Holmlund, Sjögren, and Öckert, 2019). Municipal schools are responsible for providing school placements for all students in the municipality, while independent schools can choose how many students to admit.

There is school choice in the sense that families can wish for a specific school, independent or municipal. Still, the school choice and placements are typically not coordinated between municipal and independent schools. Independent schools can choose to admit students based on residential proximity or queue time (in queues they administer themselves) while giving priority to siblings. Municipal schools are instead restricted to admitting students based on residential proximity and are required to provide slots within a reasonable distance from the home for all school-age children arriving in the municipality at any time during the year, including refugee children (Björklund et al., 2004). Hence, children moving to a new municipality during their school years (including recent migrants) are typically received in municipal schools due to these different rules regarding school assignments. According to Mörtlund (2020), a minority of municipalities actively try to counteract school segregation when assigning refugee children to schools.

targeted support to heavily affected municipalities (see e.g., Bunar, 2017; Mörtlund, 2020).

[6]Table A2 presents the details of the country and region classification.

Increased residential segregation and school choice have contributed to rising school segregation since the 1990s (Böhlmark, Holmlund, and Lindahl, 2016). Holmlund, Sjögren, and Öckert (2019) show that some 70 percent of the increase in the intra-school correlation in a composite measure of student background was due to rising residential segregation and the remainder due to school choice. However, the analysis in Holmlund, Sjögren, and Öckert (2019) also shows that school segregation in the immigrant/native dimension actually declined during the 2015 refugee crisis, the reason being that the fraction of all native schools, mostly in rural areas, declined. Grönqvist and Niknami (2017) document the school performance of refugee children in Swedish since the 1990s and find a substantial performance gap to native students. However, they also show that much of the gap is accounted for by socioeconomic background and neighborhood effects.

Compulsory school is organized into three school stages, comprising the lower stage from the pre-school year (grade 0) to 3rd grade, the middle stage from 4th to 6th grade, and the upper stage from 7th to 9th grade.[7] At the end of each stage, students take mandatory national tests in the core subjects (Mathematics and Swedish in grades 3, 6, and 9 and English in grades 6 and 9).[8] These national tests are locally graded at the school using national guidelines. In 6th and 9th grade, they serve as guidance when teachers set the end-of-year grades.[9] In 9th grade, the national tests are high-stakes for students since they influence the final compulsory school grades, which determine high school eligibility. They also determine the student's ability to compete for admission to popular schools and high school programs. In 3rd grade there are no teacher set grades, instead the tests are used to screen if students are at risk of falling behind. [10] grade tests have however been criticized since many students at risk pass the tests. In this paper, we use the average of the student's grades on the national tests in Mathematics, English, and Swedish in grades 3, 6, and 9 as our main measure of student outcome once the test grades in each subject have been standardized within grade and test year in the incumbent student population. We also use as outcomes the test scores in the individual subjects and the teacher set grades in 6th and 9th grade.

[7]The grade configuration of schools varies. At the beginning of our study period, about 60 percent of schools with 9th grade were 0th to 9th grade schools, 20 percent were 7th to 9th grade schools, 18 percent were 6th to 9th grade schools, and the remainder were 4th to 9th grade schools. There are also feeder schools with grade configurations from 0th to 3rd or 0th to 6th grade (Holmlund, Sjögren, and Öckert, 2019). This means that many students need to change schools in either 4th, 6th, or 7th grade. Because there are fewer 6th to 9th grade schools, it is less frequent to change schools in 6th grade. We will thus take this into account when creating measures for school changes.

[8]In 9th grade, there are national tests also in one of the social science subjects (Geography, History, Religion, Social science) and one of the natural science subjects (Biology, Chemistry, Physics), which subject is randomized at the school level.

[9]Vlachos (2019) shows that although the test grades are subject to teacher subjectivity, they are more objective measures of student performance than the teacher set end-of-year grades.

[10]The 3rd

2.3 Data and measurement

Our main body of data comes from the Student Register (Elevregistret), which includes the universe of compulsory school students (grundskola) in Sweden in each grade from grade 0 to grad 9 that they attended between 2008 and 2022, which defines our study period. Using this data, we can establish peer composition at the school-cohort level and, for a majority of the students, also at the classroom level. To this data, we match the national test scores in Swedish, English (only 6^{th} and 9^{th} grade), and Mathematics at the end of each school stage, i.e., in grades 3, 6, and 9, which come from the National Exams Register (Nationella provregistret). These data are available from 2010 (grade 3), 2012 (grade 6), and since 2003 (grade 9). We also add information on teacher assessments/grades in grades 6 and 9, school-level information on teachers and information of students' track choices in high school. We link students to parents and siblings and match on background information using population registers (Flergenerationsreg and RTB) containing information on family links, birth records, and country or region of origin and immigration year of parents and children. Socioeconomic information on parents, i.e., education and earnings data, come from the LISA register based on the Income and Tax Register (Inkomst- och Taxeringsregistret) and the Education Register (Utbildningsregistret).

In our sample of incumbent students, we include native students for whom we can observe the national test results in at least one of the three grades (3, 6, or 9) and who have a sibling for whom we can observe a test score outcome. This restriction allows us to include family-fixed effects. It leaves us with a panel of approximately 2.7 million student-by-year observations over fourteen years, during which we can measure exposure to recent migrants and outcomes in terms of national test scores. Table A3 shows how our sibling sample compares to the full sample.

As our main outcome variable measuring school performance, we use the students' average results on the national tests in Mathematics, English, and Swedish. Test grades are first standardized at the test year and grade level within the incumbent population. This standardization is done to avoid trending results in the native populations as the fraction of recent migrants increases over time. During the pandemic years (academic years 2019/20 and 2020/21), national tests were not mandatory, and results were not collected. To include these years in our study, we have imputed the test scores from teacher assessments/grades in the corresponding subjects (Mathematics, English, and Swedish).[11] To ensure that systematic differences in our imputation do not drive our results, we also re-run our analysis on sub-samples without imputations.

As mentioned, we use two measures of exposure to recent migrants: contemporaneous and cumulative exposure. Contemporaneous exposure is the share of recent immigrants, i.e., immigrants who were granted resident status within the last four years and asylum seekers, in a given grade, school and year. Because school performance in a given year

[11] Furthermore, in 2018, the 9th grade national test in Mathematics leaked beforehand, and results on replacement tests were not collected for a large body of students. Again, we have imputed the missing test scores in Mathematics from teacher assessment/grades for that cohort.

Table 1: Summary statistics for students in grades 3, 6, and 9 with a sibling in the sample 2008/09–2021/22

	Native background		Immigrant background		Recent arrival	
	Mean	SD	Mean	SD	Mean	SD
Male	0.51	0.50	0.51	0.50	0.53	0.50
Birth order	1.89	0.94	2.28	1.34	1.97	1.21
Age in months	152.06	29.36	150.81	29.38	155.14	30.49
Mother income ptile	55.04	24.16	34.51	25.44	9.13	15.50
Father income ptile	72.22	24.01	47.81	30.30	18.53	23.90
Mother yrs education	13.20	2.21	11.52	2.63	11.04	2.99
Father yrs education	12.56	2.33	11.54	2.66	11.41	3.06
Predicted test score	0.04	0.37	-0.27	0.41	-0.87	0.46
Actual test score	0.05	0.97	-0.25	1.04	-0.93	1.19
Change school	0.06	0.23	0.09	0.28	0.10	0.31
Contempor. exposure	0.04	0.06	0.09	0.09	0.16	0.13
Cumulative exposure	0.04	0.05	0.09	0.08	0.17	0.13
Observations	2435790		311270		184751	

Notes: Summary statistics for the key background and outcome variables, and exposure measures for students in grades 3, 6, and 9, by student category. Native background student are born in Sweden and have at least on Swedish born parent, immigrant background students are born in Sweden and have two foreign born parents. Recent arrivals are students with Swedish residency who immigrated within the last four years. Parental income is percentile ranked within the childbirth cohort.

is likely to depend not only on the current teaching environment and peers but also on previous experiences, we also follow Figlio et al. (2023) and compute a measure of the student's cumulative exposure. For each student i, in school s, in grade g, and in academic year t, we average exposure to recent immigrants over the students' school history (grades 0 to 9) using the following equation:

$$\text{Cumulative Exposure}_{isgt} = \frac{1}{g} \sum_{g'<g} \text{Contemporaneous exposure}_{isg't}.$$

We also compute the corresponding measures at the classroom level. But, since schools might reorganize classrooms in response to migrant inflow, we use grade-level exposure as our main exposure measure. Also, families may respond to migrant exposure and change schools for their children. Sibling fixed effects partly account for this. Still, if parents respond by placing younger siblings in response to older sibling's exposure, there may be selection effects also within sibling pairs. Therefore, we also compute measures of expected exposure, which assumes that younger siblings attend the same school in a given grade as their older siblings.

Table 1 presents summary statistics for the population of students with Swedish residency, i.e., excluding asylum seekers for whom there is no information other than sex and

age. The native population includes Swedish-born students with at least one Swedish-born parent. Students with immigrant backgrounds are Swedish-born students with two foreign-born parents. Recent immigrants are students who immigrated, i.e., gained residency, within the last four years. The incumbent population is comprised of the first two groups.[12] In Table A3 we compare the sample of incumbent students who have siblings to the full sample of students, revealing only small differences.

Notably, there are some interesting differences between the groups of students presented in Table 1. Higher birth orders for students of immigrant background suggest they have more siblings, on average. It is also clear that both mothers' and fathers' income percentiles and years of education are higher in the native population. Standardized test scores are higher among natives, and while children with immigrant backgrounds have test scores around 0.30 below the native population, recent immigrants do much worse. The measure of predicted test scores, which is a summary measure of the student's characteristics and family background, naturally reflects the differences in student performance.[13] The indicator for changing school from one grade to the next, excluding mechanic school changes due to the grade configuration of the school, shows that students of immigrant background and recent immigrants are more likely to change schools than native students. As we saw in Table 2, the exposure to recent immigrants also varies substantially across the groups.

3 Empirical strategy

There are a number of challenges that need to be overcome, given our aim to estimate the causal effect of being exposed to recent migrants on incumbent student school performance. First, exposure to migrants is unlikely to be random across schools since migrants and refugees are more likely to move to or be placed in some areas than others, even within municipalities. Newly arrived students are more likely to be assigned to schools where there are free slots or where the municipality can more readily arrange new places. Secondly, because of residential segregation and school choice, native and other incumbent students are not randomly distributed across schools. Better-informed and more resourceful families are more likely to have exercised school choice, and their children are thus more likely to go to oversubscribed schools, which are less likely to accommodate new students. Thirdly, some families may react to the inflow of migrants and refugees and switch schools and/or seek out a different school for their younger child if an older child's school is exposed to the migrant influx. Finally, schools might respond to migrant inflow by reorganizing classrooms, creating special migrant classes, or becoming more or less lenient in exempting students from national testing or in their grading policies.

[12] Note that we do not include foreign-born students with more than 4 years of residency in our sample of incumbent students, as this group keeps changing as recent immigrants accumulate time in the country and as some of them go from being part of the exposure to being exposed.

[13] The measure is based on a prediction of test scores based on the student's sex, birth order, age, years since immigration, and parental background.

In our main analysis, we follow a strategy proposed by Brandén, Birkelund, and Szulkin (2019) and Figlio et al. (2023) to overcome these identification problems related to student and migrant sorting. First, we use the within-school cohort-to-cohort variation in migrant exposure to address the fact that exposure is not random at the school level. Second, we account for the non-random selection of native and other incumbent students to schools by controlling for family-fixed effects. We further account for possible selection also within families, should families selectively choose schools differently for their children depending on how they judge the child would be harmed by or benefit from exposure to migrant children. We do this by explicitly examining school changes and if siblings are placed in a different school in response to older sibling's exposure. We also instrument younger sibling exposure by the predicted exposure based on the school placement of the older sibling. As a robustness check we also estimate the model using individual fixed effects. Furthermore, we examine test-participation, exploit classroom exposure, and the presence of immigrant classes to verify that our model convincingly captures effects of migrant exposure.

In Section 5, we present an alternative estimation strategy where instead of using year-to-year variation in exposure within schools, we use an event study approach to compare outcomes of students in schools more or less impacted by the 2015 refugee crisis. Estimates based on this event-study strategy include any school-wide effects or spillover effects of migration influx across grades and years, which are otherwise captured by school-by-year fixed effects in our main identification strategy.

3.1 Main specification

We estimate the following main specification:

$$\begin{aligned} Y_{igst} = \beta_1 \times \text{Migrant exposure}_{igst} + \alpha_{\text{school} \times \text{year}} \\ + \delta_{\text{grade} \times \text{year}} + \sigma_{\text{fam}} + X_i\gamma' + e_{isgt} \end{aligned} \tag{1}$$

Y_{igst} is the average test score for incumbent student i in grade g in school s in calendar year t. The explanatory variable, migrant exposure$_{igst}$, is either the contemporaneous exposure or the cumulative exposure to recent migrants and asylum seekers of student i attending grade g in school s in calendar year t.

In our preferred specification, $\alpha_{\text{school} \times \text{year}}$ denotes school-by-year effects, $\delta_{\text{grade} \times \text{year}}$ grade-by-year fixed effects, and σ_{fam} family fixed effects. X_i is a vector of individual characteristics, i.e., sex, birth order, age in months, and parental characteristics reflecting the student's socio-economic background based on available parental data. For comparative purposes, we also estimate the simple OLS and specifications that only include school-by-year and grade-by-year fixed effects, as well as individual and family controls. We cluster standard errors on the school-by-cohort level and by family, thus allowing students' outcomes to correlate within their respective school-cohort and within sibling pairs.[14] β_1

[14] Adding sibling clusters, however, makes little difference.

represents the coefficient of interest, measuring the effect of going from no exposure to an all-recent migrant class.

When analyzing peer effects at the school-by-cohort level, the primary threat to identification lies in the potential sorting of students. While the inclusion of school-by-year and grade-by-year fixed effects addresses the potential non-random placement of migrants to schools, it is still plausible that incumbent students sort into different schools based on a number of observable and unobservable characteristics. To address this, in our preferred specification, we include family fixed effects. This inclusion allows us to compare the outcomes of siblings who were exposed to different shares of recent migrants in their school. This strategy allows us to absorb selection into schools that occur based on family socio-economic characteristics and unobserved family characteristics. This is a demanding strategy, but we verify that there is indeed sufficient variation in exposure also within families in Figure B1, which shows the the distribution of residual variation in our exposure measures when controlling for school by year and grade by year fixed effects and when additionally controlling for family fixed effects in our model.

Such a strategy, however, still leaves the possibility that families send siblings to different schools based on their scholastic performance and react differentially to inflows of migrants to their children's school cohorts. We address this in three ways. First, we examine school changes explicitly, both school changes in response to the student's own experiences of migrant influx and younger sibling school placements in response to an older sibling's exposure.[15] Second, we estimate our family fixed effects specification using the student's expected, rather than actual, exposure to recent migrants, where the expected contemporaneous exposure is measured by assigning the contemporaneous exposure to the student it would have had the student been placed in the same school as the older sibling in the corresponding grade.[16] Finally, we also estimate a specification that includes individual fixed effects. This specification is more restrictive in its econometric setup as it only allows us to compare individuals across time and not in the cross-section in the same calendar year. This model reassuringly yields results similar to our preferred specification, suggesting that the latter successfully accounts for selection (see Section 4 and Table A7 for more detail).

3.2 Threats to identification and balance tests

In order to examine if our identification strategy successfully accounts for the non-random sorting of incumbent students and recent migrant exposure, we estimate the model using predicted test scores as the outcome variable. The predicted test score of student i in grades $g = 3, 6, 9$ of compulsory school is based on the following model:

$$Y_{igt} = \beta \times X_{igt} + e_{igt} \tag{2}$$

where Y_{igt} is the test score of student i in grade g and X_{igt} is a vector of predetermined

[15] See Tables A4 and A5

[16] See Tables A6

individual and family characteristics of the student, i.e., indicators for sex, birth order, being a first or second generation immigrant and country/region of origin dummies, age in months, indicators for mother's and father's years of schooling, and measures of their incomes' position in the earnings distribution. Naturally, family fixed effects will account for any differences in predicted test scores common to the siblings. Still, if families choose schools for their children depending on scholastic aptitude and in a way that is correlated with characteristics that differ across siblings, we might see that exposure to recent migrants is correlated with predicted test scores, even when controlling for family fixed effects. Table A8 presents the results. The first three columns show that there is considerable negative sorting of students to schools and even to cohorts within schools that are exposed to recent immigrants. In the fourth column, which controls for family fixed effects, there is no longer any correlation between individual predicted test scores and cumulative exposure. However, it appears that within sibling pairs, contemporaneous exposure is positively associated with predicted scores. This suggests that even within sibling pairs, the child with characteristics associated with better school performance, i.e., girls, firstborns, and children born early in the year, is more likely to experience high recent migrant exposure and that our model with contemporaneous exposure does not fully account for selection. This motivates including individual characteristics as controls. Note, however, that the magnitude of the estimate is small: a 10 percentage point increase in contemporaneous exposure, which corresponds to moving a bit more than from the 25th to the 75th percentile in the distribution during the crisis years (see Figure B2), is associated with less than 0.002 of a standard deviation increase in predicted test scores.

As discussed, one further threat to identification could come from the students' selecting different schools as a response to exposure to recent migrants. In that case, our estimates could be reflecting compositional changes across schools as opposed to the true effect of the exposure. To address this concern, we can directly empirically test for evidence of such behavior by estimating our model using an indicator for whether a student changes schools between grade g, year t and grade $g+1$, year $t+1$. The results of this exercise are shown in Table A4. We do find such evidence in our sample, both for students with native and immigrant backgrounds. This suggests a flight behavior of students in response to exposure to recent immigrants. Again, it needs to be pointed out that the effects are rather small: a 10 percentage point increase in the exposure to migrants leads to an increase in the likelihood of moving schools by 0.21 percentage points, or 4.5 (0.21/0.047) percent among native students and by 0.3 percentage points, or 3.8 (0.3/0.079) percent among students with immigrant background. These modest responses may reflect that families do not worry much about inflow and/or that families are reluctant to change schools for a child because of the costs in terms of disrupted social contacts and routines.

Such costs are lower when choosing a new school for a younger sibling. We thus examine if younger siblings are placed in a different school than the sibling in response to an older sibling's exposure to an immigrant influx. The results are presented in Table A5. The estimated effect sizes are much larger. A 10 percentage point increase in

the older sibling's exposure to recent migrants causes a 0.024 percentage point or a 14 (0.024/0.17) percent increase in the likelihood of native families enrolling the younger sibling in a different school. The corresponding increase is 24 (0.058/0.245) percent for immigrant background families. These results suggest that families do react to migrant inflow although they are reluctant to have their children change schools. This implies that within-family selection is an issue that we need to take into account. We do this by estimating our model while replacing the younger sibling's migrant exposure with a measure of predicted exposure, i.e. the exposure it would have experienced had it been enrolled in the same school as the older sibling in a given grade. The results are presented in Table A6. The results suggest that the positive main effects are stronger when using the predicted sibling exposure. IV estimates are much larger in magnitude, but it is clear that the exclusion restriction does not hold since older sibling exposure could very well affect younger sibling exposure in other ways than through the effects of the younger sibling's own migrant exposure.

Another threat to identification would be if schools exempted students from national testing differently depending on how exposed the grade is to migrants. In that case the sample of students with test scores would be selected. We examine if migrant exposure predicts having a test score from the national tests. Results are presented in Table A9 and show that there is some evidence that Mathematics test participation and full test participation decline in cohorts that are exposed to recent migrants. However, the effects are negligible: a 10 percentage point increase in migrant exposure leads to a 0.23 and 0.21 percentage point declines in Mathematics test participation and full test participation, respectively. Reassuringly, there is no no effect of cumulative exposure on test taking.

We have established that our empirical strategy, including both school by year and family fixed effects, successfully eliminates the correlation between predetermined characteristics and exposure to migrants over a student's school history, but that some evidence of positive selection is present from contemporaneous exposure. Moreover, we have established that families do choose schools for their children in response to inflows of migrants, but that the effects are small when it comes to changing schools for a particular child and larger in choosing a new school for a sibling. The direction of results suggest that resourceful families are more likely to respond. We have further ruled out that our outcome measure, test scores from national tests, is biased due to the effects of migrant exposure on test taking.

4 Results

4.1 Main results

Table 2 presents our main results and illustrates the importance of accounting for sorting of both migrant and incumbent students to schools and also that contemporaneous, short-run exposure does not necessarily have the same effects as long-run, cumulative exposure. The estimates in the first column show that the association between exposure and

test scores within schools and across cohorts is negative. This introduction of controls for individual characteristics and family background noticeably reduces the negative estimates further, illustrating that there is a negative sorting of incumbent children to schools that have more migrant exposure.

Finally in column (4), we instead control for family fixed effects, accounting for unobservable characteristics shared by siblings. This introduction of fixed effects appears to address further the issue of negative selection. It was verified in Table A8, that family fixed effects successfully eliminate any correlation between predicted test scores and cumulative exposure. The estimates for both contemporaneous and cumulative exposure then become marginally positive. A 10 percentage point increase in the share of recent migrants, about 2–3 new migrant students per classroom or a move from the 25th to the 75th percentile of the exposure distribution, appears to increase the incumbents' test scores by approximately 0.007 – 0.009 standard deviations.[17] While the estimates are statistically significant, the magnitude of the effect appears relatively small, given that the standard deviation in exposure is 5–6 percent. For comparison, a 10 percentage point increase in the share of girls in Swedish compulsory schools decreases boys' scores by approximately 0.14 standard deviations (Getik and Meier, 2024). Both the pattern and the magnitude of the results are comparable to the findings of Figlio et al. (2023) in Florida schools, suggesting that the effect is similar in the Swedish context.

As discussed, there is evidence that families react to migrant exposure when placing younger siblings in schools. We address this by instrumenting the exposure measures with the exposure younger siblings would have had if families put younger sibling in the same school as older ones. Results, presented in Table A6, suggest even stronger positive effects, consistent with a pattern where resourceful families avoid exposed schools when enrolling their younger children. To further examine the issue of negative selection, we also run a specification that includes individual fixed effects for the students for whom we observe test scores at least twice during their ten years of compulsory schooling (approximately 60% of our sample). We thus compare how a student's performance changes across school stages with the variation in migration exposure. As shown in Table A7, our estimates are somewhat larger, but remain qualitatively very similar, compared to the ones in the preferred specification with family fixed effects for both types of exposure. This further supports that the negative relationship at the school-cohort level is likely driven by selection.

One remaining potential concern is that grade-level measurements of exposure do not reflect actual classroom exposure if schools with high migrant exposure are more likely to segregate students by forming recent migrant or reception classes. As is illustrated when comparing panel (a) to (b) in Figure B2, there are indeed more classrooms without recent migrants than there are school-cohorts. There are also a number of classrooms that exclusively contain recent migrants. From panel (d), it is also clear that classrooms containing more than 90 percent of recent migrants tend to be very small. Hence, in Table A10, we present the results when the model is instead estimated with the measure

[17] Panel c) of Figure B2 shows a modal class room size of around 25.

Table 2: Effect of Exposure to Recent Migrants on Test Scores

Exposure:	Standardized scores			
Contemporaneous	-0.241***	-0.182***	-0.042	0.065**
	(0.033)	(0.033)	(0.032)	(0.030)
Cumulative	-1.482***	-1.100***	-0.338***	0.091***
	(0.035)	(0.034)	(0.030)	(0.035)
Grade x Year FE	X	X	X	X
School x Year FE	X	X	X	X
Individual controls		X	X	X
Family controls			X	
Family FE				X
Mean LHS	0.014	0.014	0.014	0.014
SD LHS	0.984	0.984	0.984	0.984
Observations	2,747,060	2,747,060	2,747,060	2,747,060
R-squared	0.142	0.165	0.257	0.624

Notes: The dependent variable is the standardized average test score of a student across the subjects. For a comparison of results depending on the variable of academic performance, see Table A12. The regressions are run separately for contemporaneous and cumulative exposure. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Incumbent students are defined as students born in Sweden. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

recent migrant exposure at the classroom level. Results are very similar to our main results, although somewhat larger in magnitude. In a further check, we examine to what extent the positive effects of migrant exposure are driven by schools and cohorts in which migrants are segregated into special classes. Again, focusing on column 4 of Table A11, the main results hold. The overall positive effects are slightly weaker, 0.06 of a standard deviation and only marginally significant, but still present when the cohort does not have a special class, but stronger for students in schools where there is a special class. How classrooms are organized within a school thus seems to matter. Still, there is no evidence that the positive effects of migrant exposure that we find are entirely driven by schools that isolate native students from exposure to their migrant peers.

Having found a small positive effect on average test scores, we examine different subjects separately as well as performance measured by teacher set grades. In Table A12, we re-estimate model 1 with our preferred specification from column 4 in Table 2, with standardized teacher assessment grades in 6th and 9th grade and test scores from each subject separately (without imputations for missing scores).[18] As can be seen, the positive results in Table 2 are driven by positive effects for test scores in English and Swedish. There are no positive effects on Mathematics test scores. Moreover, with the exception of English, there are, on average, no significant effects on teacher assessment grades. These results are in line with Brandén, Birkelund, and Szulkin (2019) who find insignificant effects on 9th-grade school grades. Our results also suggest the same ordering of results as in Green and Iversen (2022) who find zero effects for Norwegian and English and negative effects in Mathematics. Our results further suggest that migration inflow affects the way teachers set grades in relation to test scores. We explore this explicitly in Table A13 by estimating the model on the difference between teacher assessments and test scores. We find that grades in Swedish and English are set less generously relative to national test scores for students who have higher cumulative exposure to migrants.

Next, we examine if the effects of migrant exposure differ across school stages. Note that our estimation strategy is then more restrictive since it requires a sibling with a school result from the same grade. Our sample thus becomes much smaller. In Table A14, we show the results for our preferred specification, estimated for each grade separately with standardized scores (including imputed scores when test scores are missing) and standardized assessment grades as outcomes. The results show that there are no significant effects of migrant exposure on test scores in 3rd grade when children are 10 years old. However, the magnitude of the estimated effect of cumulative exposure is similar to our main result.[19] Instead, the positive effects on test scores of migrant exposure, present in 6th and 9th grades, are somewhat stronger. With this more restricted sample, we also find positive effects on teacher assessment grades. It is worth noting that this estimation strategy, for 9th grade, is very close to the one estimated by Brandén, Birkelund, and Szulkin (2019). The main difference is that we study a period of higher, and rising migrant

[18] Note that teachers assessment grades are not given in grade 3.

[19] It is possible that the limited variating in 3rd grade test scores have a role in explaining lack of significance.

exposure.

We also examine whether exposure to migration has an effect on incumbents' further educational choices.[20] To establish the effect, we measure contemporaneous and cumulative exposure of grade 9 students, since this is when students make the relevant decision.[21] Our dependent variable is a dummy for each of the program categories (academic, vocational, or introductory) as well as for the natural sciences track. The estimates are shown in Table A15. Consistently with our main results, showing no effects on teacher assessment grades, we do not find a significant effect of migrant exposure in specifications including family fixed effects, with the exception of a negative effect of contemporaneous exposure on the probability of choosing the vocational track. However, the estimate is no longer significant when using cumulative exposure instead. Exposure to migrants during compulsory schooling, hence had no substantial effect on subsequent track choices.

We have established that cumulative exposure to recent migrants during students' school history has a small but significantly positive effect on test scores. We proceed to investigate if effects of recent migrant exposure are the same across different types of students and school environments, and if the nature of the migrant inflow matters. We also study school responses to migration inflow.

4.2 Effect for different student groups

In this subsection, we first investigate if the effects of exposure to recent migrants are similar for boys and girls, by socioeconomic status (as measured by high and low predicted test scores), by student migration background, and across the test score distribution.

To examine gender effects, we introduce an interaction term between female students and exposure to avoid restricting the analysis to same-sex siblings. For the other background categories, we estimate split sample regressions. The results are presented in Table 3. We also provide the reduced form results when we use sibling exposure as an instrument in Table A16. The first column shows the effects for natives, the second column for students with immigrant backgrounds, the third and fourth columns for students with low and high predicted test scores, capturing differences in family socioeconomic background, and the fifth and sixth columns for girls and boys, respectively.

First, Table 3 shows that the small positive effect of exposure to recent immigrants is only present for natives. There is a negative but insignificant point estimate for cumulative exposure for immigrant background students. Columns 3 and 4 suggest that the effects of

[20] After completing compulsory schooling, students proceed to a high school (gymnasieskolan). While it is not mandatory, an overwhelming majority of students choose to do so (e.g., approximately 99% in our sample). Students apply for a combination of a given high school and the track they want to pursue. There are currently 18 national high-school programs to choose from: 6 academic, and 12 vocationally oriented. There is also an introductory program for students who leave compulsory school with insufficient qualifications to be eligible for an academic or vocational program. Graduation from an academic program provides the necessary basic qualification to enter university. In the vocational programs, there is a possibility to fulfil extra requirements to attend university if the student chooses a sufficient load of academic courses.

[21] We estimate it for the sub-sample of students who were in grade 9 between 2011 and 2019, the period when our high school entry data is available.

Table 3: Effect of exposure to recent migrants on test scores for different groups of students

	Standardized scores					
Exposure:	Native	Immigrant background	Low PS	High PS	Female	Male
Contemporary	0.081**	0.000	0.063	0.035	0.058*	0.073**
	(0.032)	(0.067)	(0.039)	(0.040)	(0.032)	(0.032)
Cumulative	0.116***	-0.090	0.098**	0.061	0.018	0.160***
	(0.039)	(0.073)	(0.045)	(0.052)	(0.038)	(0.038)
Grade x Year FE	X	X	X	X	X	X
School x Year FE	X	X	X	X	X	X
Individual controls	X	X	X	X	X	X
Family FE	X	X	X	X	X	X
Mean LHS	0.049	-0.253	-0.349	0.382	0.126	-0.091
SD LHS	0.971	1.039	1.002	0.820	0.952	1.002
Observations	2,434,990	300,654	1,334,713	1,316,606	2,747,060	2,747,060
R-squared	0.627	0.643	0.608	0.620	0.624	0.624

Notes: The regressions are run separately for contemporary and cumulative exposure and using split samples for columns 1-4, but with an interaction in columns 5-6. Note that Mean and SD of LHS and Obs in columns 5-6 refer to male and female students. Observations are the number of incumbent students, including only students with at least one sibling in the sample. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

exposure do not differ greatly between students with different family background. There are limited positive effects for both groups of contemporary exposure. The effects of cumulative exposure are positive, but significanlty different from zero for students with low predicted test scores. We can further note that for the incumbent population as a whole, columns 5 and 6 suggest that the effects of contemporaneous exposure are positive for boys and girls but that the positive impact of cumulative exposure is substantially larger for boys than for girls and only significantly positive for boys. Table A16 shows positive point estimates also for immigrant background students, and generally shows larger positive estimates for other groups, just as we saw in Table A5.

We also explore effect heterogeneity across the test score distribution. Figure B3 shows the separate point estimates for the effects of cumulative exposure on the probability of obtaining test scores above a given percentile in the test score distribution. The top panel shows that for the overall incumbent population, there are significant positive effects of exposure in the middle (25^{th} percentile and 50^{th} percentile) and the top (90^{th} percentile) of the distribution. Hence, the weakest students do not seem to gain. This pattern is confirmed in the middle panel for students with a native background. However, for students with an immigrant background, there are instead negative point estimates throughout the distribution, and it seems that the weakest immigrant background children may, in fact, be harmed by recent immigrant exposure. The bottom panel shows the results for girls and boys. The differences are stark, and boys, in general, gain from being exposed (with

the exception of the weakest boys). For girls, the pattern is different, with scholastically weaker girls gaining while high-performing girls suffer. These patterns suggest that relative position in the classroom may matter for how students are affected, and possibly also that the classroom composition may affect how the teachers adapt their instruction.

4.3 Effect of exposure to different types of migrants

A possible reason for differential results between students with a native and immigrant background could be that they are, in fact, exposed to different types of migrants. In Figure B4, we investigate if there are significant differences in the type of recent migrants that natives and students with immigrant background are exposed to by plotting the distribution of predicted and actual test scores of the recent migrants that comprise the exposure of the respective groups. The evidence suggests that there are no systematic differences in these summary measures of background characteristics relating to scholastic aptitude of the recent migrants that native and immigrant background students are exposed to. Instead, differential effects of exposure could be the result of different responses to the exposure.

Yet, other aspects of background may matter. We therefore examine how exposure to different types of recent migrants affects incumbent student outcomes. Based on the country or region of birth of the migrant students and their parents, we compute separate exposure measures for exposure to recent migrants from non-Western countries, exposure to migrants from high-income and low-income countries, and one measure for exposure to asylum-seeking students. The classification of high-income and low-income countries is, naturally, somewhat arbitrary but designed with the idea of capturing differences in the migrant students' language skills and aspects of school preparedness.[22] We also classify countries/regions by the educational performance of students who come from the respective countries/regions. The results, presented in Table 4, show that native students benefit from exposure to non-Western recent migrants, and the positive effect of exposure to asylum seekers is substantial, as is the impact of exposure to migrants from low-income countries. As for immigrant background students, the sample size is much smaller, and standard errors are large. Yet, it is worth noting that there are insignificant negative effects of cumulative exposure to non-Western recent immigrants and immigrants from low-income countries, but a positive point estimate for exposure to asylum seekers.

4.4 Effect across different school environments

Another reason for different effects of recent migrant exposure for native and migrant background students could be that effects of migrant exposure are different at different

[22]Europe, Northern America, Chile, East Asia, and Oceania are classified as high-income regions of origin. MENA countries, Africa, South and South East Asia, and Latin America (excluding Chile) are classified as low-income regions of origin. While being an asylum-seeking student, there is no information on the country of origin in the data. Still, during the period studied, many of these students come from Iraq, Iran, Afghanistan, Syria, and the Horn of Africa.

Table 4: Effects of exposure to migrants from different regions

	Standardized scores	
Cumulative exposure:	Native background	Immigrant background
Non-Western immigrants	0.166***	-0.121
	(0.043)	(0.076)
Asylum seekers	0.514***	0.252
	(0.134)	(0.320)
Low-income countries	0.223***	-0.141
	(0.051)	(0.087)
High-income countries	-0.072	-0.015
	(0.068)	(0.145)
Grade x Year FE	X	X
School x Year FE	X	X
Individual controls	X	X
Family FE	X	X
Observations	2,434,990	300,654
R-squared	0.63	0.64

Notes: Europe, Northern America, Chile, East Asian and Oceania are classified as high-income regions of origin. MENA countries, Africa, South and South-East Asia and Latin America (excluding Chile) are classified as low-income regions of origin. While being an asylum seeking student, there is no information of country of origin in the data, but during the time period studied, many of these students come from Iraq, Iran, Afghanistan, Syria, the Horn of Africa. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

levels of exposure. Figure 2 indeed shows that migrant background students are much more exposed to recent immigrants than natives. Because there is more scope for school segregation in cities, and hence differences in exposure between native and foreign background students, and also because we know that the refugee crisis of 2015–2016 led to high levels of exposure in particular in rural areas, there are also reasons to believe that the impacts of exposure may differ between city and country side schools.

We first examine the presence of non-linear effects by estimating a piece-wise linear regression model, with levels of exposure corresponding to the bottom half of the distribution, between median and the the 75th percentile, between the 75th percentile and the 90th percentile and the top decile. The estimates for contemporaneous and cumulative exposure are plotted in Figures B5 and B6 respectively. Focusing on the effects of cumulative exposure, the top two panels of Figure B6 show that the positive effects of recent migrant exposure on natives are driven by school environments with high levels of exposure. The third panel shows a very different pattern for immigrants, who instead experience a positive but marginally significant effect of exposure at low levels. Results for contemporaneous exposure suggest negative effects at low levels and small positive effects at high levels of exposure.

We next investigate the regional context of the school environment. We do this by interacting the exposure measures with indicators for the regional context. The results, for cumulative exposure presented in the first column of Table A18, reveal that there are stark differences in the effects of migrant exposure between schools in different regional contexts.[23] While the effects of migrant exposure are negative and significant in the large cities, the effects are significantly positive in rural areas. Effect sizes for the rural areas are substantially larger than estimates for the smaller cities, which are more in line with the overall estimates for the country as a whole.

In columns 2 and 3 of Table A18 we split the sample by natives and migrant background students. The effects for natives qualitatively mimic those for the full population: i.e. negative effects in large cities, positive effects in rural areas, and smaller positive effects in smaller cities. The effects for foreign background students, also reveal significant negative effects in the big cities, but smaller positive and insignificant effects in the smaller cities and rural areas.

4.5 School responses

We have so far found that native students gain marginally from being exposed to recent migrants but that immigrant background students do not. We have also found that there are differences between large cities and rural areas. It is possible that school responses have a role in explaining the results. One mechanism suggested in the previous literature is that schools respond to the migrant influx by increasing resources, as in Özek (2021) and Morales (2022). We investigate this possibility by estimating the effect of recent migrant exposure on class size, which we can measure at the individual student level. We also investigate if exposure to recent migrants make incumbent students more or less likely to participate in home language classes. Students who speak another language than Swedish at home are by law entitled to instruction to learn and develop this language. Lack of teachers and too few students eligible for classes in the language in question are reasons why students are not provided home language classes. Moreover, participation is voluntary, which also means that students' motivation and parents' demands matter for participation. Also native students have a right to home language classes if at least one of the parents in the household speaks a language other than Swedish.[24]

The overall effects of recent migrant exposure on class size are presented in columns (4)–(6) of Table 5. Our main results are reproduced in columns (1)–(3). We can see that there is no clear association between class size and contemporaneous migrant exposure overall (column 4). However, when measuring longer run cumulative exposure, there is a clear negative effect on class size over all, which is driven by the native student population, while the estimate for the migrant background population is smaller and insignificant. This result suggests that schools do respond to migrant exposure by reducing class size. In the short run, however, we do not see clear effects of contemporaneous exposure, perhaps

[23] The results are qualitatively similar for contemporaneous exposure, see Table A17.

[24] Our definition of native students follows the SNAE definition of at least one Swedish born parent.

because accommodation of migrants is more likely to take place in a small school cohort because there is room or that there is not capacity to immediately reorganize classrooms. We also saw in Table A11 that some schools place new migrants in small migrant only reception classes. Nevertheless, the magnitudes of the effects of migrant exposure on class size are very small relative to mean class sizes: an increase in cumulative exposure by 10 percentage points implies a class size reduction of 0.24 for natives, i.e. typically less than 1 percent, given a modal class size of 25 students.[25]

In Table A19, we re-estimate our main results, including class size as a control, well aware that this is an endogenous control. The results suggest that the responses in terms of reduced class size, at first glance, are not significant enough to account for the improvement in test scores. However, we can also relate our estimates to the 0.032 – 0.047 standard deviations decrease in cognitive ability per one-student increase in class size found in Fredriksson, Ockert, and Oosterbeek (2013). Given their estimate, the average 0.198 decrease in class size would result in improved abilities by 0.0063 (0.032*0.198) – 0.0093 (0.047*0.198) standard deviations. This is well in line with our findings, reproduced in the first column of Table 5 and suggests that class size reductions are an important mechanism in explaining positive effects of migrant exposure for the native student population, and absence of positive effects for migrant background students.

Columns (7) – (9) of Table 5 display the results for participation in home language classes. While exposure to recent migrants leads native students to significantly increase their involvement in home language classes, effects are not significant immigrant background students. The initial level is, naturally, much higher for immigrant background students, where 42 percent take such classes, as compared to 5 percent among native students. These results suggest that native students actually gain access to teaching resources: there is more than a doubling of the fraction of native students taking these classes. For immigrant background students, the effects are less clear. The reasons for changed participation could be changing access, i.e., if the class is offered because of more students with the same language, or positive or negative changes in motivation or encouragement to take the class if more peers are speaking the language in the school.

[25] See Figure B2.

Table 5: Mechanisms: Effects of recent migrant exposure

	Test Scores			**Class Size**			**Home Language**		
	All	Native	Foreign	All	Native	Foreign	All	Native	Foreign
Contemporaneous	0.065**	0.081**	0.000	-0.213	-0.292	0.313	0.091***	0.144***	0.036
	(0.030)	(0.032)	(0.067)	(0.323)	(0.349)	(0.585)	(0.027)	(0.031)	(0.046)
Cumulative	0.091***	0.116***	-0.090	-1.983***	-2.423***	-0.605	0.061***	0.088***	0.053
	(0.035)	(0.039)	(0.073)	(0.261)	(0.300)	(0.452)	(0.018)	(0.018)	(0.041)
Year FE	X	X	X	X	X	X	X	X	X
School FE	X	X	X	X	X	X	X	X	X
Individual controls	X	X	X	X	X	X	X	X	X
Family FE	X	X	X	X	X	X	X	X	X
Mean LHS	0.014	0.049	-0.253	22.640	22.611	22.970	0.091	0.050	0.426
SD LHS	0.984	0.971	1.039	5.839	5.860	5.576	0.288	0.218	0.494
Observations	2,747,060	2,434,990	300,654	2,459,042	2,176,049	272,313	1,791,009	1,589,862	190,463
R-squared	0.624	0.627	0.643	0.811	0.818	0.780	0.769	0.776	0.722

Notes: The table shows the effect of contemporaneous and cumulative recent migrant exposure on test scores, class sizes, and home language participation by municipality type and the student's migration background. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Because we found stark differences in the effects of migrant exposure in cities and rural areas, we also explore effects on class size and participation in home language classes in large cities, small cities and rural areas. We focus on the results for cumulative exposure, which are presented in Table A18.[26] First, note in column (4) that while classroom size is significantly reduced in rural areas and smaller cities, there is only a marginally significant reduction in large cities. While column (7) shows that there is a significant increase in the fraction of students taking home language classes in response to high migrant exposure in rural areas, the effects are smaller and only marginally significant in cities. This pattern of results suggests that failure to increase resources in response to migrant exposure could be part of the explanation for negative effects in the larger cities.

We also investigate differential effects on school responses separately for natives and students of migrant background. The results, in column (6) in Table A18 show that for foreign background students in rural areas, there is a significant reduction in class size, but no reduction of class size for foreign background students in cities. For natives, there are reductions in class size both in cities and in rural areas, but the reduction is more important in rural areas.[27] As for participation in home language classes, native children appear to gain access to these in all types of municipalities. For foreign background students, estimates are not significantly different from zero due to large standard errors.

Our analysis of school responses, suggests that compensatory reductions in class size may be an important measure to prevent negative effects and even turn of migrant exposure into a positive experience in schools. The pattern for home language classes is less clear. Although there is evidence that any increased resources for home language teaching disproportionately benefit native students.

5 European migration crisis

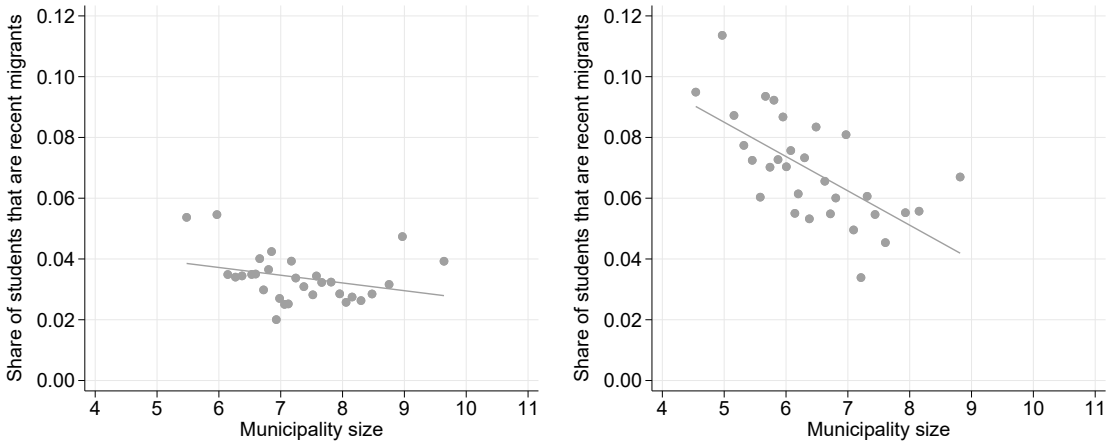
In this section, we focus more specifically on the effect of the 2015 migration shock that came in the form of a large immigration flow into Europe. During that year, Sweden admitted the largest number of migrants per capita: over 160 thousand relative to the then population of 10.5 million. This inflow was an acute and largely unexpected shock to the infrastructure of the country, including the schooling system.

Due to the acute nature of the shock, many refugees were accommodated in schools located in smaller and more rural municipalities where accommodation was more readily available (National Agency for Education, 2016). This led to higher exposure to asylum seekers in more rural schools that had previously seen relatively low shares of foreign students. We illustrate this in Figure 3. As can be seen in the figure, schools in smaller municipalities received a proportionally higher share of asylum-seeking students, and there was little correlation between previous refugee exposure and the exposure resulting from the crisis. These circumstances, therefore, create a suitable institutional framework for disentangling the effect of a sudden and significant inflow of refugee students.

[26] See Table A17 for contemporaneous exposure.

[27] The effects on test scores controlling for class size for cities and rural areas are presented in Table A20.

Figure 3: Share of recent migrants in schools by municipality size



(a) 2008–2014 (b) 2015–2017

Note: The figure shows the share of recent migrants in schools by municipality size grade 9 for years 2008–2014 (left) and 2015–2017 (right), respectively. Municipality size is given by the natural logarithm of the number of students in that municipality and are binned into a group of 30 bins. For underlying distribution of exposure on the municipality level, see Figure B7.

Based on the pattern shown in the top panel of Figure 2, which clearly shows when the crisis was most acute, we create a measure of crisis exposure at the grade and school level as measured by the average share of recent migrants, i.e., asylum seekers and immigrants with less than four years of residency, in the school and grade during the school years 2015/2016 to 2017/2018. This exposure measure is used as a continuous treatment variable. We then estimate the following event study equation with the school year 2014/2015 as the reference year:

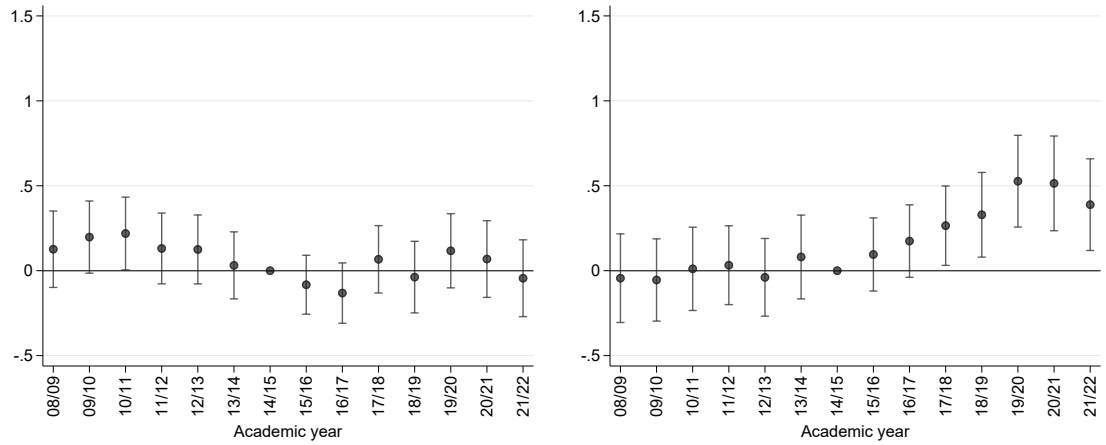
$$y_{igst} = \beta_t \times \sum_{k=2008}^{2021} 1_{t=k} \times \text{ Recent migrant share}_{gs2015-2017} + \alpha_{\text{school s}} + \delta_{\text{year t}} + \sigma_{\text{fam}} + X_i\gamma' + e_{isgt} \tag{3}$$

We also summarize the effect of crisis exposure by estimating the following continuous difference-in-differences specification:

$$Y_{igst} = \beta_1 \times \text{Recent migrant share }_{gs2015-2017} \times \ 1[\text{year} > 2014] + \alpha_{\text{school}} + \delta_{\text{year}} + \sigma_{\text{fam}} + X_i\gamma' + e_{isgt} \tag{4}$$

where Recent migrant share$_{gs2015-2017}$ is a continuous variable indicating the share of students who are recent migrants, i.e., either newly arrived (at most four years) or who are asylum seekers (with a pending asylum case) in school s and grade g during 2015–17 and $1[\text{year} > 2014]$ is an indicator variable for the period from 2015 onward. Similarly to Equation 1, the other terms represent the respective fixed effects and the vector of individual controls. This identification strategy hinges on the recipient schools facing similar trends in school outcomes prior to the crisis. We show that to be the case in panel (b) of Figure 4, which displays the results of estimating Equation 3, while accounting for

Figure 4: Effects of crisis exposure on test scores of incumbent students



(a) Without Family FE

(b) With Family FE

Note: The figure shows the estimated coefficient of crisis exposure on student outcomes for incumbent students. Incumbent students are defined as students born in Sweden and immigrant background as native students with two foreign-born parents. The dependent variable is our main measure of academic performance in school. See Section 5 for a description of the identification. Estimates for immigrant background incumbent students are presented in Figure B8.

the selection of students to school using family fixed effects. We observe no relationship between test score development prior to the crisis and the exposure to recent migrants during the crisis, with none of the pre-crisis estimates being statistically significant at the 5 percent level.

Panel (a), which does not control for family-fixed effects, shows that test scores were on a decline in schools that later became exposed to the crisis. Since the negative trend disappears when family fixed effects are included in the model, it seems that this trend is related to deteriorating but unobserved family characteristics. Panel (b) shows evidence of improved test scores in schools that were more exposed to the crisis. As of the academic year 2017/2018, estimates are positive and significant. In Figure B8 we estimate the events study separately for incumbent students with immigrant background. While exposed incumbent student test scores improve, estimated effects are of somewhat smaller magnitude and not significantly different from zero for students with immigrant background.

We show the results of estimating the continuous difference-in-difference equation 4 in Table A21. In the first column, we restrict the follow-up treatment period to 2018, the year by which the migration crisis was no longer acute. In the second column, we use the entire post-crisis period when data is available to identify the effect. This adjustment does not appear to influence our results substantially. A 10 percentage point increase in the exposure to recent migrant students increases the test scores of the incumbent students by approximately 0.018 of a standard deviation. The magnitude of the effect is somewhat larger, although comparable to our estimates from the previous analysis. Thus, we observe a positive and statistically significant, albeit mild, impact of the shock experienced by

Swedish schools during the 2015 refugee crisis.

5.1 School responses to the refugee crisis

As in our main analysis, we are interested in understanding how schools respond to migrant exposure. It is of particular interest to examine how schools responded to the refugee crisis, which was arguably more salient than year-to-year variation in exposure of different cohorts in a school. We do this by estimating how class size and the fraction of students taking home language classes were affected. Results are presented in Table B9. Panel (a) shows that there was an initial increase in class size in exposed schools the first year of the crisis but that class sizes were significantly reduced a few years into the crisis. There is also evidence that the fraction of children taking home language classes gradually declined after the crisis in exposed schools. While the effects on class sizes seem to corroborate our previous findings, although the estimated effect sizes are more in line with our previous estimated effects on class size for rural areas. The results on home language classes diverge.

6 Conclusion

In this paper, we study the effect of exposure to recent migrant peers on incumbent students. We use data on the universe of compulsory school students in Sweden between 2008 and 2022, a period characterized by high levels of global and local immigration. To account for the non-random sorting of migrant and native students to schools, we rely on a combination of school-fixed and family-fixed effects to account for non-observable family characteristics.

Our findings suggest that the negative association between migration and school performance stems from the significant negative sorting of migrants and incumbent children to schools. Once we account for this sorting, we find that exposure to recent migrants have a small positive effect on the outcomes of native students. This positive effect is however not present for students of foreign background. The magnitudes of our estimates suggest that a substantial 10 percentage point increase in the fraction of recent migrant students increases test scores by 0.009 of a standard deviation. This corresponds to 2-3 more migrant students in the classroom, or moving from no exposure, which was the situation for over a quarter of students before the 2015 refugee crisis, to the 90th percentile of the pre-crisis distribution. This magnitude is similar to the effects found in Figlio et al. (2023). An analysis of regional differences reveals that the positive effects of migrant exposure on school performance are present, and larger (0.038 standard deviations for a 10 percentage point increase in exposure) in rural areas, but that the impact is negative (-0.028) in larger cities.

Exploring mechanisms we find evidence that schools reduce classroom sizes in response to high recent migrant exposure, and that these responses are of a magnitude large enough to have caused the overall improvements in results, given previous causal esti-

mates of class size effects in Fredriksson, Ockert, and Oosterbeek (2013). Moreover, we find that class size adjustments are larger in rural areas, where our positive effects on school performance are larger, while class size reductions are not significant in the cities, where test scores decline. Taken together, we interpret this pattern to imply that compensatory increases in resources are important in generating net positive effects of migrant exposure, while effects of migrant exposure may well be negative absent compensatory increases in resources. Our analysis of the 2015-2016 refugee crisis corroborates our main findings of positive effects on test scores (in rural areas) and also support the importance of compensatory reductions in class size.

Our results add to the evidence of the positive effects of exposure to migrant students and also support that resource allocation matters. Of particular importance is that we find a small positive effect in a context with high refugee migration and also during a crisis that put significant pressure on the receiving schools. The presence of negative effects of recent migrant exposure in large cities and among students with immigrant backgrounds points to a risk that compensating resource allocation does not sufficiently reach these groups of students.

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Appendix A: Additional tables

Table A1: Country/region of origin of Swedish students, 2008–2022

	Frequency	Percent	Cumulative
Sweden	2,435,790	88.67	88.67
Finland	6,788	0.25	88.92
Denmark	1,793	0.07	88.98
Norway and Iceland	1,647	0.06	89.04
Bosnia and Herzegovina	21,030	0.77	89.81
Former Yugoslavia	36,954	1.35	91.15
Poland	6,352	0.23	91.38
UK and Ireland	735	0.03	91.41
Germany	2,975	0.11	91.52
Mediterranean Europe	1,520	0.06	91.57
The Baltic states	1,576	0.06	91.63
E Europe, Caucasia, C Asia	9,897	0.36	91.99
Czechia, Slovakia, Hungary	1,632	0.06	92.05
Continental Europe	1,399	0.05	92.10
US and Canada	548	0.02	92.12
Mexico and Central America	1,828	0.07	92.19
Chile	6,704	0.24	92.43
South America	4,416	0.16	92.59
Northeast Africa	31,920	1.16	93.75
Middle East and N Africa	55,137	2.01	95.76
West, Central, South Africa	7,739	0.28	96.04
Iran	13,461	0.49	96.53
Iraq	44,972	1.64	98.17
Turkey	21,121	0.77	98.94
East Asia	3,794	0.14	99.08
Southeast Asia	11,288	0.41	99.49
South Asia and Mongolia	13,456	0.49	99.98
Oceania	108	0.00	99.98
Unknown	480	0.02	100.00
Total	2,747,060	100.00	

Notes: Country/region composition of 3rd, 6th and 9th grade students with a sibling in the sample.

Table A2: Country and region classification

1.	Sweden	
2.	Finland	
3.	Denmark	
4.	Norway and Iceland	
5.	UK and Ireland	
6.	Germany	
7.	Mediterranean Europe	Greece, Italy, Malta, Monaco, Portugal, San Marino, Spain
8.	Continental Europe	Andorra, Austria, Belgium, France, Liechtenstein, Luxembourg, The Netherlands, Switzerland
9.	US and Canada	
10.	Bosnia and Herzegovina	
11.	Former Yugoslavia	Croatia, Kosovo, Macedonia, Serbia, Montenegro, Slovenia, Yugoslavia
12.	Poland	
13.	The Baltic states	Estonia, Latvia, Lithuania
14.	E Europe, Caucasus and C Asia	Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Romania, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan
15.	Czechia, Slovakia and Hungary	
16.	Mexico and Central America	
17.	Chile	
18.	South America	Argentina, Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela
19.	Northeast Africa	Djibouti, Eritrea, Ethiopia, Somalia, South Sudan, Sudan
20.	Middle East and North Africa	Algeria, Bahrain, Cyprus, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, Yemen
21.	West, Central, South Africa	Angola, Benin, Botswana, Burkina Faso, Burundi, Cabo Verde, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Ivory Coast, Egypt, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Tanzania, United Republic of Togo, Uganda, Zambia, Zimbabwe
22.	Iran	
23.	Iraq	
24.	Turkey	
25.	East Asia	China, Hong Kong, Japan, Korea, Taiwan
26	Southeast Asia	Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam
27.	South Asia and Mongolia	Afghanistan, Bangladesh, Bhutan, Brunei, Cambodia, India, Maldives, Mongolia, Nepal, Oman, Pakistan, Sri Lanka, Timor-Leste
28.	Oceania	Australia, New Zealand, Fiji, Kiribati, Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu

Notes: The table shows the countries included in regions used in the analysis. Institute for Evaluation of Labour Market and Education Policy (IFAU) classification, based on the number of immigrants from each region.

Table A3: Summary statistics for all 3rd, 6th, and 9th grade students and for the subsample of students with siblings

	Population		Sample	
	Mean	SD	Mean	SD
Male	0.51	0.50	0.51	0.50
Birth order	1.85	1.00	1.93	1.00
Age in months	151.62	29.64	151.92	29.36
Mother income ptile	52.15	25.28	52.72	25.16
Father income ptile	68.34	26.48	69.51	25.94
Mother education	12.96	2.33	13.01	2.32
Father education	12.40	2.39	12.45	2.39
Predicted score	0.00	0.39	0.01	0.39
Actual score	0.00	0.99	0.01	0.98
Change school	0.06	0.24	0.06	0.24
Contemporary exposure	0.05	0.07	0.05	0.07
Cumulative exposure	0.04	0.05	0.04	0.05
Observations	3,570,199		2,747,060	

Notes: This table presents summary statistics for the key variables in the paper. Population includes all students in 3rd, 6th, and 9th grade of compulsory school during our main study period. Sample includes incumbent students with at least one sibling that we can observe in the school registers.

Table A4: Effect of own exposure to recent migrants on the propensity to change school

	Change school		
Exposure:	Native background	Immigrant background	Total
Contemporaneous	0.021***	0.030***	0.024***
	(0.004)	(0.008)	(0.004)
Grade x Year FE	X	X	X
School x Year FE	X	X	X
Individual Controls	X	X	X
Family FE	X	X	X
Mean LHS	0.047	0.079	0.051
SD LHS	0.211	0.269	0.220
Observations	8,488,970	1,242,856	9,738,417
R-squared	0.196	0.242	0.196

Notes: The dependent variable is a binary variable equal to one if the students changed school in the following year, and zero otherwise. Immigrant background is defined as both parents being born outside Sweden. Observations are the number of native students, including only students with at least one sibling in the sample. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A5: Effect of older sibling's exposure to recent migrants on the propensity to enroll younger sibling in a different school

	Change school		
Exposure:	Native background	Immigrant background	Total
Contemporaneous	0.235***	0.580***	0.311***
	(0.018)	(0.031)	(0.017)
Grade x Year FE	X	X	X
School x Year FE	X	X	X
Individual Controls	X	X	X
Family controls	X	X	X
Mean LHS	0.171	0.245	0.179
SD LHS	0.377	0.430	0.383
Observations	2,878,712	308,159	3,196,822
R-squared	0.201	0.225	0.192

Notes: The dependent variable is a binary variable equal to one if student starting a new school stage in school year t+1 is enrolled in a different school compared to the older sibling and zero otherwise. Exposure is the older sibling's recent migrant exposure in year t. Immigrant background is defined as both parents being born outside Sweden. Observations are the number of native students, including only students with at least one sibling in the sample. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A6: Effect of exposure to recent migrants on test scores, instrumenting exposure with older sibling exposure

	Standardized scores		
Exposure:	IV	Red. form	OLS
Contemporaneous	0.236***		0.110***
	(0.057)		(0.035)
Contemporaneous predicted		0.081***	
		(0.020)	
Cumulative	0.415***		0.157***
	(0.064)		(0.046)
Cumulative predicted		0.203***	
		(0.035)	
Grade x Year FE	X	X	X
School x Year FE	X	X	X
Individual controls	X	X	X
Family FE	X	X	X
Mean LHS	0.091	0.091	0.091
SD LHS	0.952	0.952	0.952
Observations	1,702,186	1,702,186	1,702,186
R-squared	0.019	0.672	0.672

Notes: The tables shows the results when the exposure to recent migrants that the student would have had going to the same school and grade as their older sibling is used as an instrument. First column shows the 2SLS coefficient, second column the reduced form coefficient, and third column the OLS coefficient. The dependent variable is our main measure of academic performance in school. When student has taken the (obligatory) national tests in mathematics, Swedish, and English, the outcome is the average of the scores from these tests standardized on an annual level. If student has missed one of the tests we instead use the course grade in the same subject standardized on the annual level. Exposure is measured at the school-by-grade level. Observations are student-by-year. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort level.

Table A7: Effect of recent migrant exposure on test scores, including individual FEs

Exposure:	Standardized scores				
Contemporary	-0.230***	-0.190***	-0.094**	0.024	0.017
	(0.047)	(0.047)	(0.046)	(0.045)	(0.046)
Cumulative	-1.764***	-1.311***	-0.390***	0.178***	0.177**
	(0.049)	(0.047)	(0.041)	(0.061)	(0.080)
Grade x Year FE	X	X	X	X	X
School x Year FE	X	X	X	X	X
Individual controls		X	X	X	
Family controls			X		
Family FE				X	
Individual FE					X
Mean LHS	0.032	0.032	0.032	0.032	0.032
SD LHS	0.960	0.960	0.960	0.960	0.960
Observations	1,606,827	1,606,827	1,606,827	1,606,827	1,606,827
R-squared	0.159	0.182	0.275	0.709	0.817

Notes: The regressions are run separately for contemporaneous and cumulative exposure. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Incumbent students are defined as students born in Sweden. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A8: The correlation between exposure to recent migrants and natives' predicted test scores

Exposure:	Predicted standardized scores			
Contemporaneous	-1.302***	-1.337***	-0.171***	0.016***
	(0.012)	(0.012)	(0.009)	(0.005)
Cumulative	-1.828***	-1.845***	-1.150***	0.008
	(0.016)	(0.016)	(0.016)	(0.007)
Grade x Year FE		X	X	X
School x Year FE			X	X
Family FE				X
Mean LHS	0.008	0.008	0.008	0.008
SD LHS	0.390	0.390	0.390	0.390
Observations	2,747,060	2,747,060	2,747,060	2,747,060
R-squared	0.063	0.065	0.230	0.891

Notes: Observations are the number of native students, including only students with at least one sibling in the sample. Native students are defined as students born in Sweden. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A9: Effects of exposure to recent migrants on participation in national testing

	Taken national test			
Exposure:	**Math**	**Swedish**	**English**	**All**
Contemporary	-0.023***	-0.005	-0.005	-0.021*
	(0.008)	(0.006)	(0.011)	(0.011)
Cumulative	0.000	-0.001	0.002	0.003
	(0.008)	(0.006)	(0.010)	(0.009)
Grade x Year FE	X	X	X	X
School x Year FE	X	X	X	X
Individual controls	X	X	X	X
Family FE	X	X	X	X
Mean LHS	0.963	0.984	0.974	0.612
SD LHS	0.189	0.124	0.160	0.487
Observations	2,366,209	2,445,801	1,589,462	2,445,801
R-squared	0.398	0.451	0.529	0.892

Notes: The dependent variable is a dummy variable for whether the student has taken the national test or not. The fourth column is a binary variable for whether the student has taken all tests. National tests in mathematics and Swedish are taken in grades 3, 6, and 9, while national tests in English is taken in grades 6 and 9. Exposure is measured at the school-by-grade level. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A10: Effect of exposure to recent migrants on test scores: classroom exposure

Exposure:	Standardized scores			
Contemporaneous	-0.200***	-0.138***	-0.008	0.080***
	(0.020)	(0.020)	(0.018)	(0.015)
Cumulative	-1.192***	-0.880***	-0.258***	0.131***
	(0.030)	(0.029)	(0.026)	(0.028)
Grade x Year FE	X	X	X	X
School x Year FE	X	X	X	X
Individual controls		X	X	X
Family controls			X	
Family FE				X
Mean LHS	0.014	0.014	0.014	0.014
SD LHS	0.984	0.984	0.984	0.984
Observations	2,747,060	2,747,060	2,747,060	2,747,060
R-squared	0.142	0.165	0.257	0.624

Notes: The dependent variable is our main measure of academic performance in school. When the student has taken the national tests in mathematics, Swedish, and English, the outcome is the average of the scores from these tests standardized within the cohort of incumbents. If the student has missed one of the tests, we instead use the teacher set grade in the corresponding subject (also standardized within the cohort of incumbents). The regressions are run separately for contemporaneous and cumulative exposure. We do not have complete coverage on classroom identifiers, which means that there are slightly fewer observations in this regression compared to our main analysis. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Incumbent students are defined as students born in Sweden. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A11: Effects of recent migrant exposure in schools with and without special recent migrant classes

Exposure:	Standardized scores			
Contemporaneous	-0.256***	-0.193***	-0.047	0.064**
	(0.035)	(0.035)	(0.034)	(0.032)
Special class	-0.015	-0.015	-0.015	-0.016
	(0.011)	(0.011)	(0.011)	(0.010)
Contemporaneous × Special class	0.118	0.098	0.073	0.056
	(0.081)	(0.080)	(0.079)	(0.071)
Cumulative	-1.533***	-1.155***	-0.379***	0.066*
	(0.037)	(0.035)	(0.032)	(0.036)
Special class	-0.025***	-0.033***	-0.031***	-0.025***
	(0.010)	(0.010)	(0.009)	(0.008)
Cumulative × Special class	0.402***	0.440***	0.338***	0.220***
	(0.087)	(0.084)	(0.078)	(0.070)
Grade x Year FE	X	X	X	X
School x Year FE	X	X	X	X
Individual controls		X	X	X
Family controls			X	
Family FE				X
Mean LHS	0.014	0.014	0.014	0.014
SD LHS	0.984	0.984	0.984	0.984
Observations	2,747,060	2,747,060	2,747,060	2,747,060
R-squared	0.142	0.165	0.257	0.624

Notes: The dependent variable is our main measure of academic performance in school. A special class is defined as a classroom consisting of at least 90% recent migrants. See Figure B2 for the distribution of recent migrants across classrooms. The regressions are run separately for contemporaneous and cumulative exposure. Observations are student-by-year and includes incumbent students with at least one sibling that we can observe in the school registers. Incumbent students are defined as students born in Sweden. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A12: Effect of exposure to recent migrants on teacher assessment grades and test scores in different subjects

	Standardized grades				Standardized test scores			
Exposure:	Math	Swedish	English	All	Math	Swedish	English	All
Contemporaneous	-0.007	0.066	0.021	0.034	0.020	0.149***	0.072	0.089***
	(0.046)	(0.048)	(0.047)	(0.045)	(0.033)	(0.033)	(0.046)	(0.031)
Cumulative	-0.014	0.033	0.107**	0.053	0.013	0.123***	0.137***	0.105***
	(0.044)	(0.045)	(0.047)	(0.044)	(0.038)	(0.038)	(0.049)	(0.037)
Grade x Year FE	X	X	X	X	X	X	X	X
School x Year FE	X	X	X	X	X	X	X	X
Individual controls	X	X	X	X	X	X	X	X
Family FE	X	X	X	X	X	X	X	X
Mean LHS	0.026	0.015	0.001	0.016	0.024	0.011	-0.004	0.014
SD LHS	0.997	0.992	0.993	0.994	0.988	0.981	0.997	0.984
Observations	1,725,411	1,725,411	1,725,411	1,725,411	2,290,813	2,405,432	1,541,451	2,419,567
R-squared	0.695	0.694	0.676	0.723	0.603	0.562	0.683	0.628

Notes: The regressions are run separately for contemporary and cumulative exposure. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A13: Effect of exposure to recent migrants on assessment grade generosity in relation to test scores

	Grade generosity relative to test scores			
Exposure:	Math	Swe	Eng	All
Contemporaneous	0.069*	-0.167***	-0.026	-0.062**
	(0.037)	(0.039)	(0.032)	(0.031)
Cumulative	0.032	-0.116***	-0.074**	-0.051*
	(0.032)	(0.037)	(0.029)	(0.027)
Grade x Year FE	X	X	X	X
School x Year FE	X	X	X	X
Individual controls	X	X	X	X
Family FE	X	X	X	X
Mean LHS	0.069	0.037	0.047	0.032
SD LHS	0.447	0.538	0.423	0.394
Observations	1,209,395	1,335,861	1,328,293	1,347,952
R-squared	0.503	0.476	0.488	0.516

Notes: The dependent variable is the difference in the standardized grade and the standardized test score. A higher positive value means that the grade is relatively higher than the performance on the national test. Exposure is measured at the school-by-grade level. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A14: Effect of exposure to recent migrants on standardized scores and teacher assessments grades in grades 3, 6, and 9.

	Standardized scores			Standardized grades	
Exposure:	Grade 3	Grade 6	Grade 9	Grade 6	Grade 9
Contemporaneous	0.017	0.064**	0.033	0.084**	0.017
	(0.042)	(0.032)	(0.031)	(0.035)	(0.031)
Cumulative	0.078	0.085*	0.167***	0.104**	0.105**
	(0.051)	(0.044)	(0.048)	(0.050)	(0.049)
Year FE	X	X	X	X	X
School FE	X	X	X	X	X
Individual controls	X	X	X	X	X
Family FE	X	X	X	X	X
Mean LHS	0.030	0.014	0.017	0.023	0.020
SD LHS	0.945	0.995	0.996	0.993	0.993
Observations	660,362	819,340	896,151	598,641	893,278
R-squared	0.644	0.708	0.736	0.741	0.736

Notes: The regressions are run separately for each grade. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Incumbent students are defined as students born in Sweden. Including family-fixed effects means that we only include observations where we have data on siblings in the same grade. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A15: Effect of exposure to recent migrants on high school track choice

Program type:	**Academic**	**Vocational**	**Intro**	**Stem**	**None**
Contemporaneous	0.032	-0.051**	0.023	0.028	-0.004
	(0.024)	(0.024)	(0.015)	(0.018)	(0.006)
Cumulative	0.038	-0.068	0.049	0.052	-0.019
	(0.043)	(0.044)	(0.030)	(0.033)	(0.011)
School x Year FE	X	X	X	X	X
Cohort x Year FE	X	X	X	X	X
Individual Controls	X	X	X	X	X
Family Controls	X	X	X	X	X
Family FE	X	X	X	X	X
Observations	373,686	373,686	373,686	373,686	373,686
R-squared	0.68	0.63	0.61	0.62	0.52

Notes: The dependent variable is a dummy variable for whether a student chooses an academic, a vocational, or an introductory (general) track in high school. Each variable is coded as 1 if the given type of program is chosen, and 0 otherwise. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Incumbent students are defined as students born in Sweden. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A16: Effect of exposure to recent migrants on test scores for different groups of students, instrumenting exposure with older sibling's school's exposure

	Standardized scores					
Exposure:	Native	Immigrant background	Low PS	High PS	Female	Male
Contemporary predicted	0.072***	0.101*	0.082***	0.037	0.102***	0.063***
	(0.022)	(0.055)	(0.027)	(0.031)	(0.023)	(0.023)
Cumulative predicted	0.209***	0.087	0.158***	0.150***	0.174***	0.228***
	(0.038)	(0.096)	(0.048)	(0.055)	(0.039)	(0.039)
Grade x Year FE	X	X	X	X	X	X
School x Year FE	X	X	X	X	X	X
Individual controls	X	X	X	X	X	X
Family FE	X	X	X	X	X	X
Mean LHS	0.117	-0.170	-0.259	0.444	0.204	-0.016
SD LHS	0.941	1.013	0.966	0.802	0.920	0.969
Observations	1,546,564	142,106	803,714	799,486	1,702,186	1,702,186
R-squared	0.672	0.723	0.671	0.669	0.672	0.672

Notes: The tables shows the results with the exposure to recent migrants that the student would have had in the school of their older sibling. The regressions are run separately for contemporary and cumulative exposure and using split samples for columns 1-4, but with an interaction for gender in columns 5-6. Note that Mean and SD of LHS and Obs in columns 5-6 refer to male and female students. Observations are student-by-year. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A17: Effects of contemporaneous recent migrant exposure by municipality type

	Test Scores			**Class Size**			**Home Language**		
	All	Native	Foreign	All	Native	Foreign	All	Native	Foreign
Large City	-0.102*	-0.121**	-0.092	-0.074	-0.614	0.989	0.117***	0.245***	-0.026
	(0.054)	(0.062)	(0.091)	(0.572)	(0.680)	(0.807)	(0.041)	(0.049)	(0.056)
Small City	0.102**	0.098**	0.136	-0.213	-0.336	0.158	0.083**	0.130***	0.157**
	(0.046)	(0.049)	(0.106)	(0.519)	(0.555)	(0.936)	(0.040)	(0.044)	(0.080)
Rural	0.191***	0.194***	0.058	-0.347	-0.054	-3.616***	0.066	0.067	0.088
	(0.049)	(0.050)	(0.190)	(0.495)	(0.503)	(1.247)	(0.047)	(0.049)	(0.144)
Year FE	X	X	X	X	X	X	X	X	X
School FE	X	X	X	X	X	X	X	X	X
Individual controls	X	X	X	X	X	X	X	X	X
Family FE	X	X	X	X	X	X	X	X	X
Mean LHS	0.014	0.049	-0.253	22.640	22.611	22.970	0.091	0.050	0.426
SD LHS	0.984	0.971	1.039	5.839	5.860	5.576	0.288	0.218	0.494
Observations	2,747,060	2,434,990	300,654	2,459,042	2,176,049	272,313	1,791,009	1,589,862	190,463
R-squared	0.624	0.627	0.643	0.811	0.818	0.780	0.769	0.776	0.722

Notes: The table shows the effect of contemporaneous recent migrant exposure on test scores, class sizes, and home language participation by municipality type and the student's migration background. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A18: Effects of cumulative recent migrant exposure by municipality type

	Test Scores			**Class Size**			**Home Language**		
	All	Native	Foreign	All	Native	Foreign	All	Native	Foreign
Large City	-0.280***	-0.373***	-0.264**	-0.841*	-1.671***	0.256	0.058*	0.081**	0.012
	(0.062)	(0.078)	(0.103)	(0.477)	(0.623)	(0.668)	(0.035)	(0.038)	(0.057)
Small City	0.137***	0.110*	0.080	-2.071***	-2.479***	-0.903	0.045*	0.100***	0.089
	(0.051)	(0.059)	(0.110)	(0.383)	(0.443)	(0.659)	(0.024)	(0.022)	(0.063)
Rural	0.383***	0.404***	0.129	-2.916***	-2.780***	-3.917***	0.086***	0.079***	0.164
	(0.059)	(0.062)	(0.200)	(0.439)	(0.463)	(1.086)	(0.030)	(0.030)	(0.123)
Year FE	X	X	X	X	X	X	X	X	X
School FE	X	X	X	X	X	X	X	X	X
Individual controls	X	X	X	X	X	X	X	X	X
Family FE	X	X	X	X	X	X	X	X	X
Mean LHS	0.014	0.049	-0.253	22.640	22.611	22.970	0.091	0.050	0.426
SD LHS	0.984	0.971	1.039	5.839	5.860	5.576	0.288	0.218	0.494
Observations	2,747,060	2,434,990	300,654	2,459,042	2,176,049	272,313	1,791,009	1,589,862	190,463
R-squared	0.624	0.627	0.643	0.811	0.818	0.780	0.769	0.776	0.722

Notes: The table shows the effect of cumulative recent migrant exposure on test scores, class sizes, and home language participation by municipality type and the student's migration background. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A19: Effect of contemporaneous and cumulative recent migrant exposure on test scores, controlling for class size

	Test Scores		
	All	Native	Foreign
Contemporaneous	0.081***	0.090***	0.037
	(0.031)	(0.033)	(0.070)
Cumulative	0.107***	0.144***	-0.110
	(0.036)	(0.041)	(0.076)
Year FE	X	X	X
School FE	X	X	X
Individual controls	X	X	X
Family FE	X	X	X
Mean LHS	0.009	0.044	-0.256
SD LHS	0.984	0.972	1.037
Observations	2,459,042	2,176,049	272,313
R-squared	0.635	0.638	0.653

Notes: The regressions are run separately for contemporaneous and cumulative exposure. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A20: Effect of contemporaneous and cumulative recent migrant exposure on test scores, controlling for class size: by Municipality Type

	Test Scores		
	All	Native	Foreign
	Panel A: Contemporaneous		
Large City	-0.051	-0.078	-0.021
	(0.056)	(0.064)	(0.095)
Small City	0.101**	0.099*	0.131
	(0.048)	(0.051)	(0.111)
Rural	0.185***	0.186***	0.043
	(0.051)	(0.052)	(0.193)
	Panel B: Cumulative		
Large City	-0.245***	-0.304***	-0.264**
	(0.065)	(0.082)	(0.107)
Small City	0.123**	0.103*	0.020
	(0.054)	(0.062)	(0.116)
Rural	0.410***	0.432***	0.168
	(0.061)	(0.064)	(0.207)
Year FE	X	X	X
School FE	X	X	X
Individual controls	X	X	X
Family FE	X	X	X
Mean LHS	0.009	0.044	-0.256
SD LHS	0.984	0.972	1.037
Observations	2,459,042	2,176,049	272,313
R-squared	0.635	0.638	0.653

Notes: The regressions are run separately for contemporaneous and cumulative exposure. Observations are student-by-year and include incumbent students with at least one sibling that we can observe in the school registers. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

Table A21: Effects of high exposure to migration crisis: Differences-in-Differences estimates

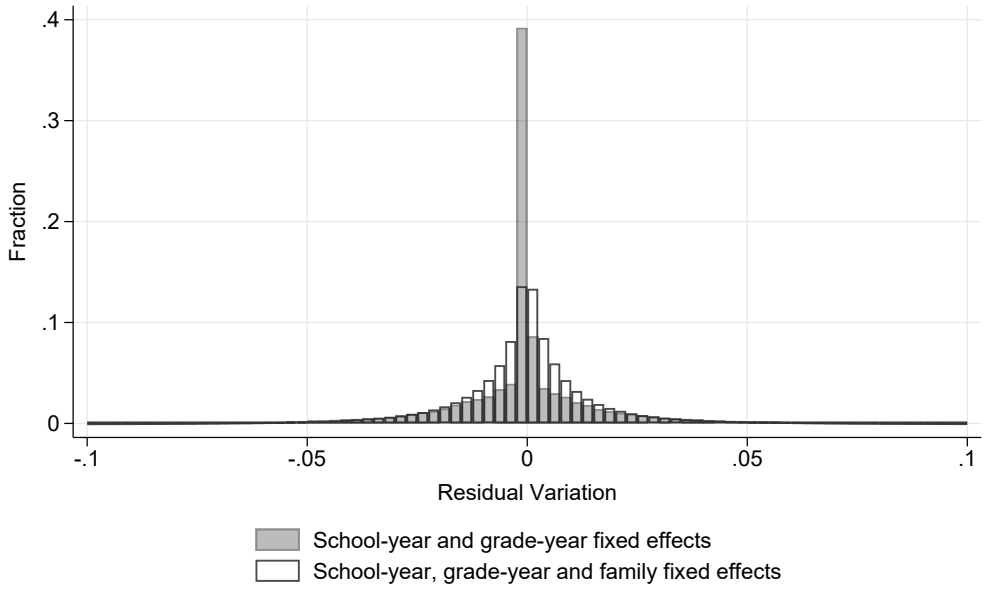
	Standardized scores	
Exposure:	2008–2018	2008–2021
Contemporaneous × post	0.183**	0.178**
	(0.087)	(0.084)
Year FE	X	X
Grade FE	X	X
School FE	X	X
Individual controls	X	X
Family FE	X	X
Mean LHS	0.019	0.017
SD LHS	0.998	0.996
Observations	634,443	896,151
R-squared	0.744	0.736

Notes: Post is a dummy variable equal to one if year $\geq$ 2015. The first column has a post period up until 2018 and the second column up to 2021. Standard errors in parenthesis, *p<0.1, **p<0.05,***p<0.001, are clustered at the school-by-cohort and family level.

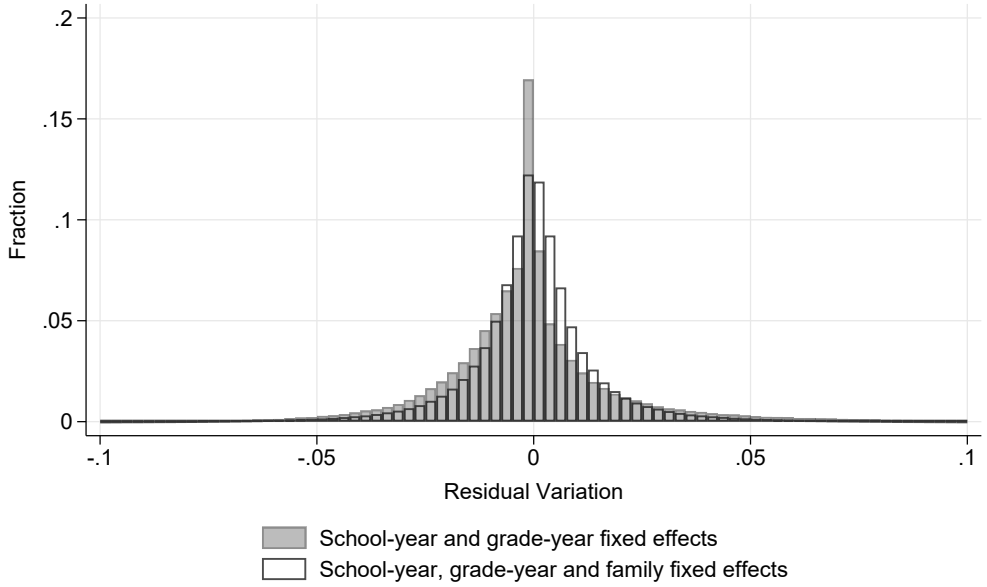
Appendix B: Additional figures

Figure B1: Distribution of residuals

(a) Contemporary exposure



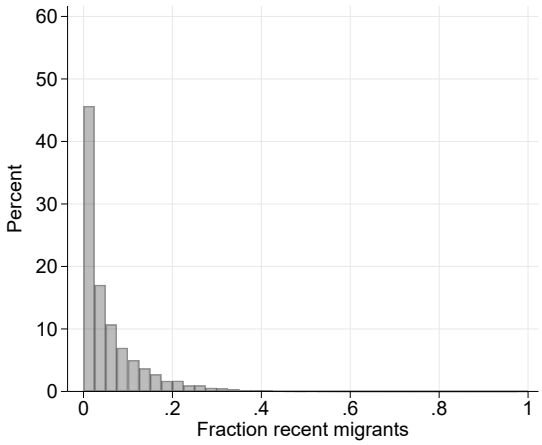
(b) Cumulative exposure



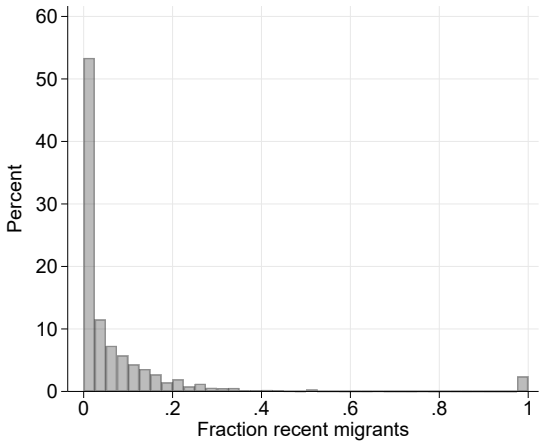
Note: The figures shows the distribution of residuals for our main model when excluding and including family fixed effects.

Figure B2: Distribution of recent migrants across classrooms.

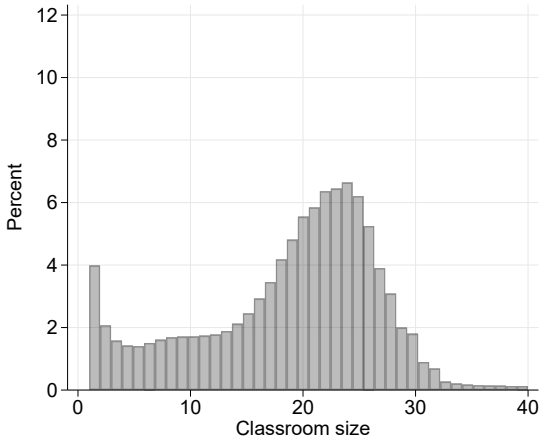
(a) Fraction recent migrants



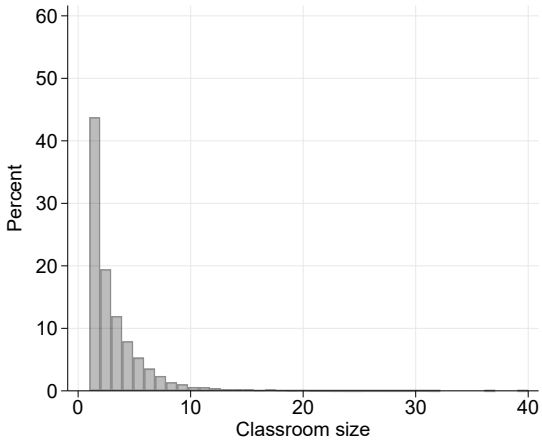
(b) Fraction recent migrants per classroom



(c) Distribution of classroom size

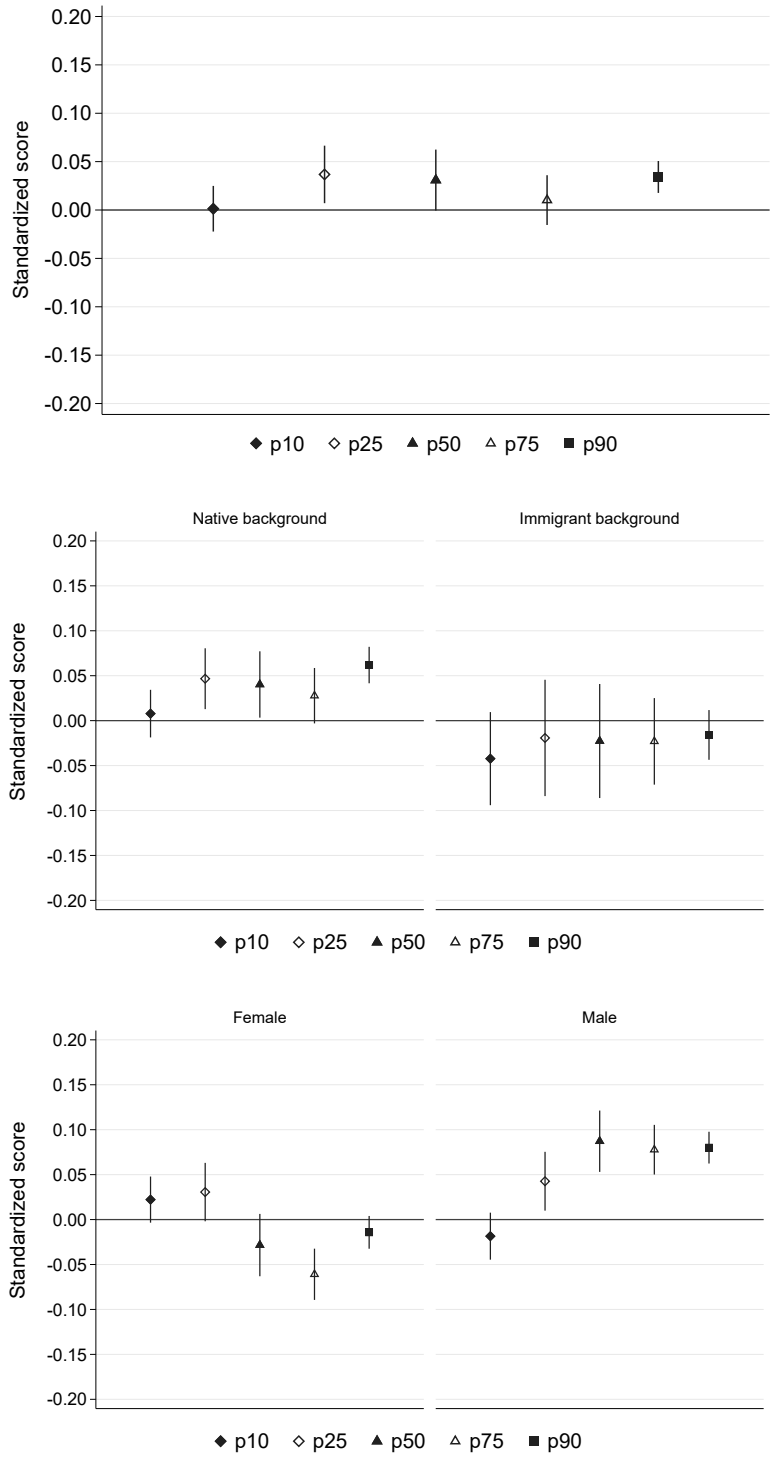


(d) Distribution of classroom size if fraction of recent migrants > 0.9



Note: Distribution of recent migrants across classrooms. The upper panel shows the fraction of recent migrants per student (a) and per classroom (b) during our main study period (2008–2022). The lower panel shows the distribution of students per classroom (c) and the distribution of students per classroom in classes where at least 90 percent are recent migrants (d).

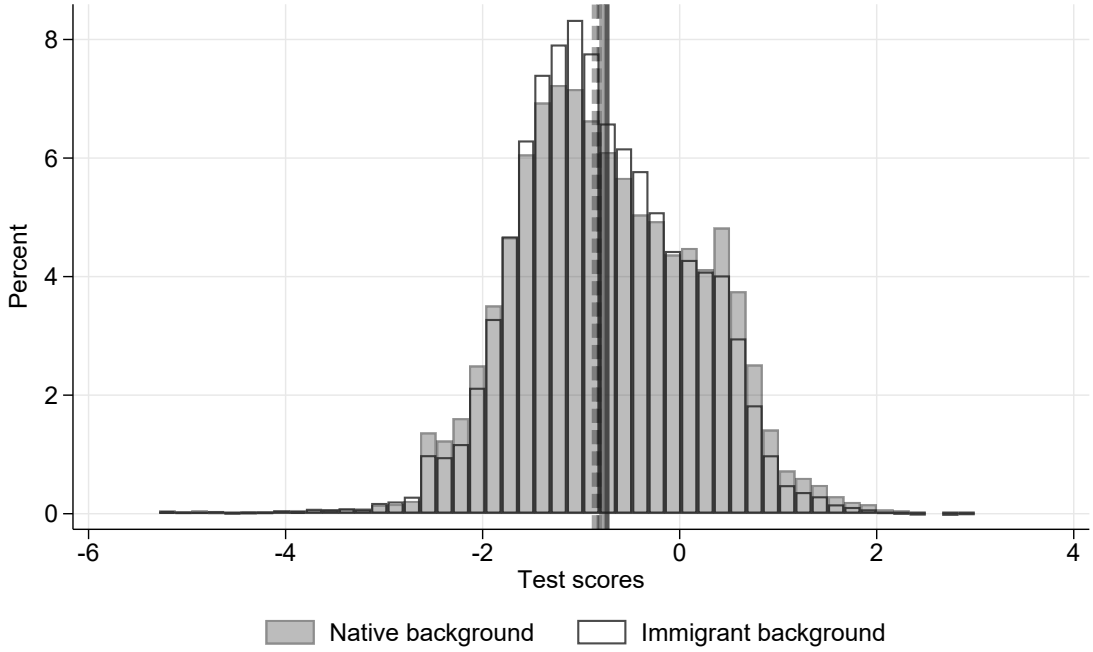
Figure B3: Heterogeneity of the effect across the test score distribution



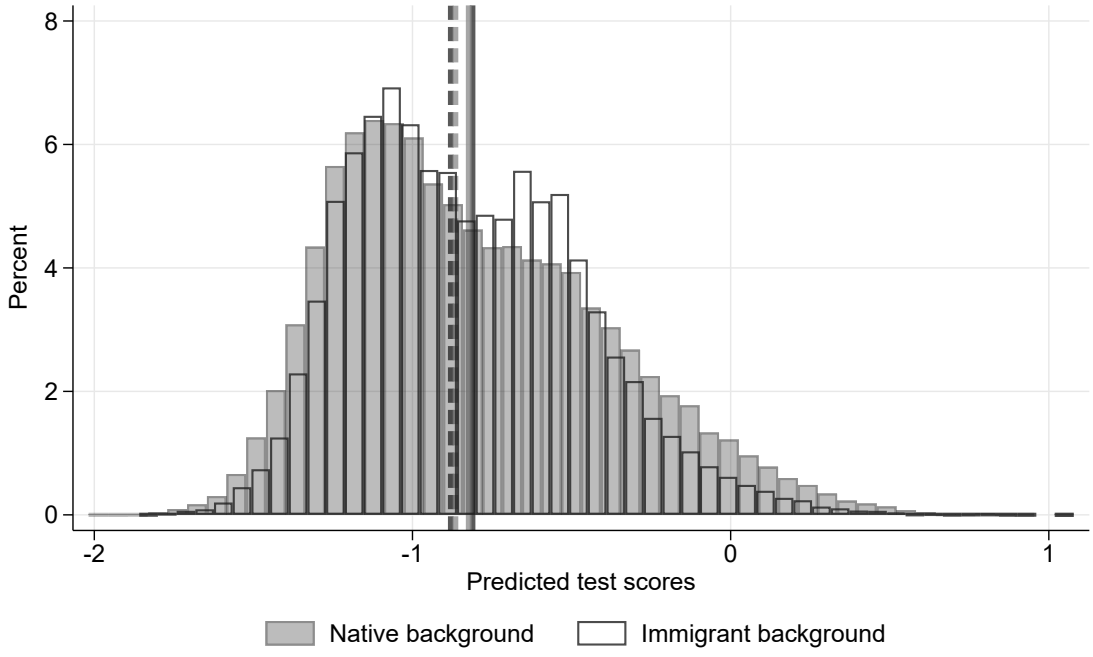
Note: Heterogeneity of effects by position in the distribution of standardized scores. Each point in the graph represents the point estimate of effect of cumulative exposure to recent arrivals on the probability of having standardized scores above the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentile, respectively. The first graphs shows the results for the main analysis sample.

Figure B4: Distribution of actual and predicted test scores of recent migrant students.

(a) Actual test scores



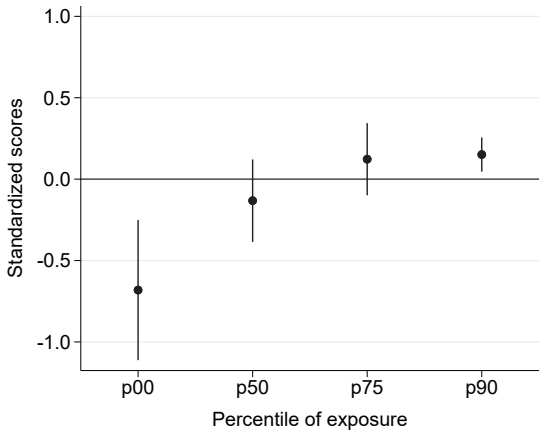
(b) Predicted test scores



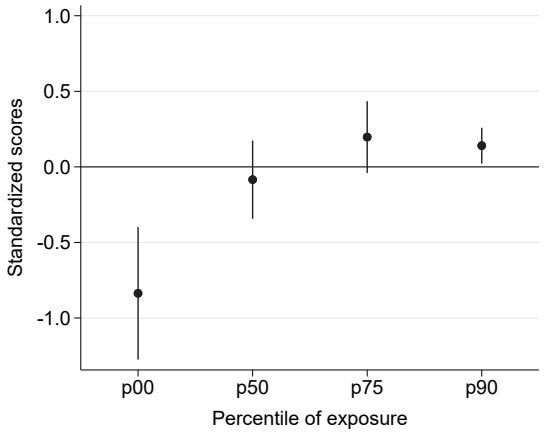
Note: The figures show the distribution of actual (upper) and predicted (lower) test scores among the recent immigrants that students with native and immigrant background are exposed to, respectively. The solid dark (light) gray line shows the mean test score of recent immigrants that native (immigrant background) students are exposed to. The dashed dark (light) gray line shows the median test score of recent immigrants that native (immigrant background) students are exposed to.

Figure B5: Effects of contemporaneous exposure at different levels of exposure.

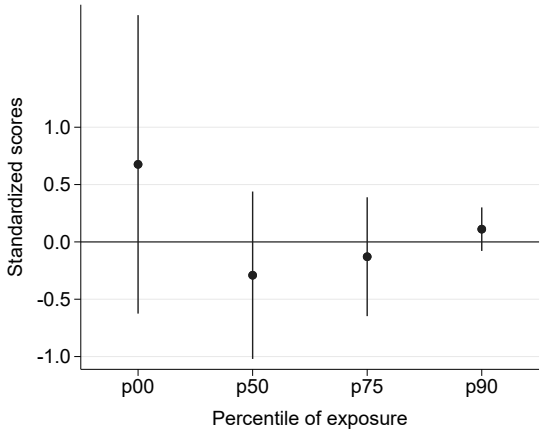
(a) Contemporaneous exposure



(b) Contemporaneous exposure—Native background



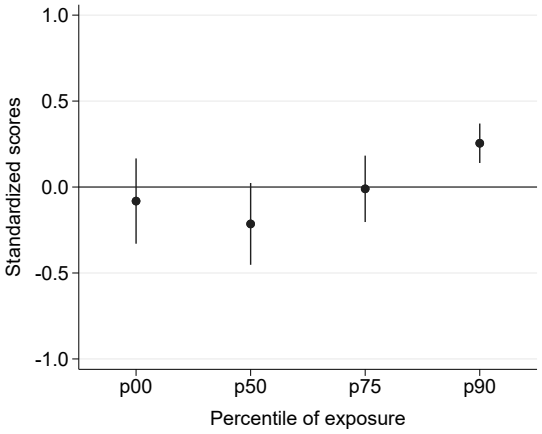
(c) Contemporaneous exposure—Immigrant background



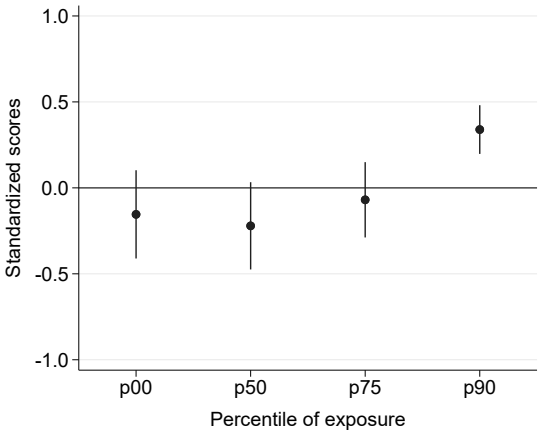
Note: The figure shows point estimates and confidence intervals from a piece-wise linear regression.

Figure B6: Effects of cumulative exposure at different levels of exposure.

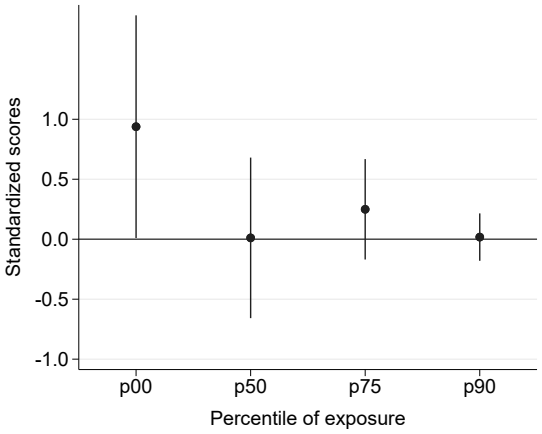
(a) Cumulative exposure



(b) Cumulative exposure—Native background

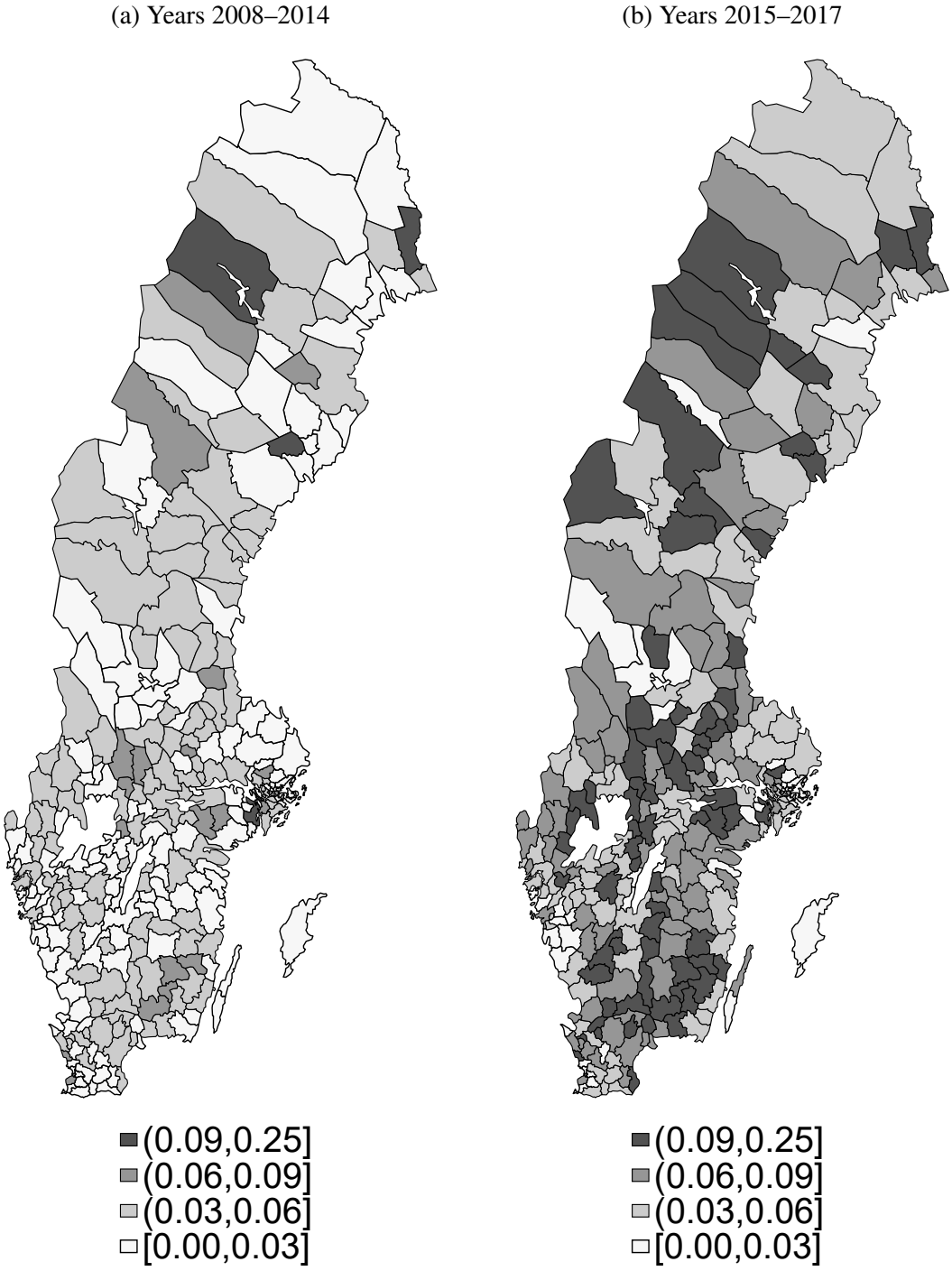


(c) Cumulative exposure—Immigrant background



Note: The figure shows point estimates and confidence intervals from a piece-wise linear regression.

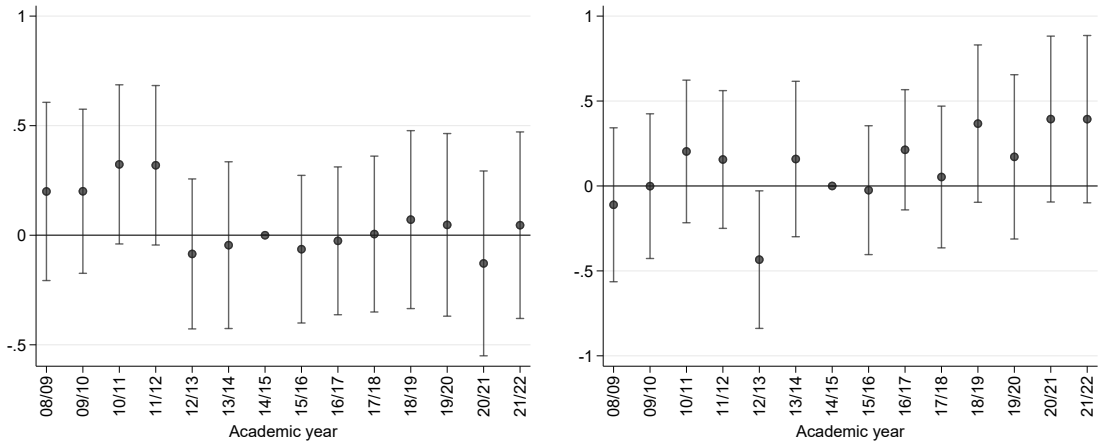
Figure B7: Share of recent migrants in schools in grade 9 by municipality.



Note: Darker regions have a higher share of recent migrants.

Figure B8: Effects of exposure to the refugee crisis: Incumbent students with immigrant background.

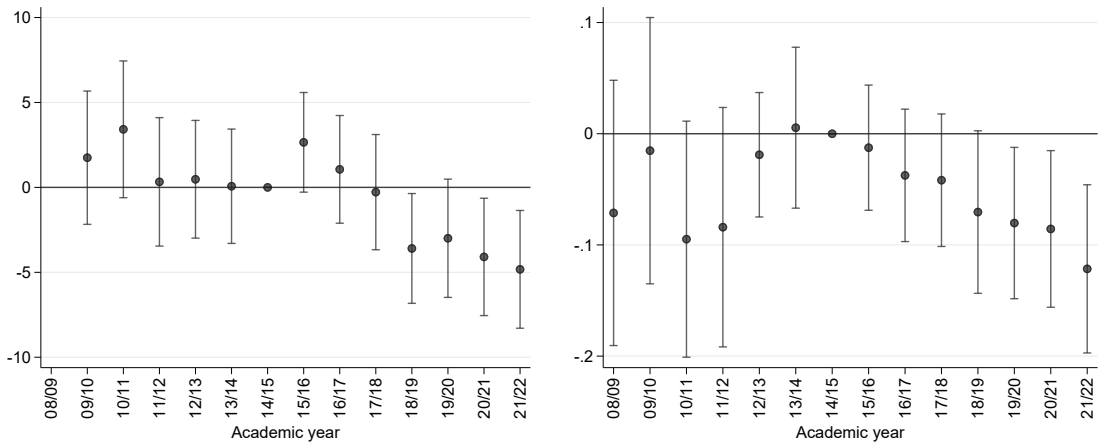
(a) Standardized scores—Without Family FE (b) Standardized scores—With Family FE



Note: The figure shows the estimated coefficients of crisis exposure on student outcomes for students with immigrant background. Incumbent students are defined as students born in Sweden and immigrant background as a native student with two foreign-born parents. The dependent variable is our main measure of academic performance. See Section 5 for a description of the identification.

Figure B9: School responses to crisis exposure. The figure shows the estimated coefficient of crisis exposure on classroom size and probability for students to participate in home language classes. See Section 5 for a description of the identification.

(a) Classroom size—With Family FE (b) Home language classes—With Family FE



Note: The figure shows the estimated coefficient of crisis exposure on classroom size and probability for students to participate in home language classes. See Section 5 for a description of the identification.