Immigrant Classmates and Their Long-Run Impact on Educational Outcomes of Students in Norwegian Comprehensive Schools

Abstract

In Western Europe and North America, the consequences of ethnic segregation for children's educational opportunities are of growing public concern. This study addresses the relationship between immigrant peer concentration in schools and the long-run educational outcomes of students. We study six entire student cohorts in the final grade of the Norwegian comprehensive school with longitudinal follow-up into young adulthood (310,742 students, 751 schools). Empirical analyses show negative correlations between immigrant peer concentration and educational outcomes, except for academic track enrollment in upper secondary schools. Controlling for school fixed effects and characteristics of students and peers, we find that students in cohorts with more immigrant peers within the same school have slightly higher educational achievement, academic track enrollment, and likelihood of completing upper secondary education. These effects indicate that the overall negative relationship does not reflect a direct negative influence of immigrant classmates, but rather student sorting and stable school quality.

Key words: peer effects, immigration, ethnic minorities, school segregation, causal inference

Word count: 9,300

Introduction

The long-run consequences of post-war immigration are of growing public interest in Western Europe and North America (Alba and Nee 2003; Castles and Miller 2009; Parsons and Smeeding 2006). In the coming years, successful integration of children from immigrant families as productive citizens and full-fledged members in society is of critical importance, and their performance within the educational system is central in meeting this challenge (Alba, Sloan, and Sperling 2011).

Schools are key institutions in promoting intergenerational social mobility and fostering human capital development. However, immigrants and their families tend to settle in metropolitan areas, where they often cluster in residential areas marked by relative social deprivation and spatial ethnic segregation (Fong and Shibuya 2005; Musterd 2005). Thus, policy makers, school administrators, and parents alike, worry that high concentrations of low-skilled immigrant students with language problems in segregated schools may harm educational opportunities of children attending these. Alternatively, children from immigrant families with strong motivation for school work and high educational ambitions might have a positive influence on the learning climate of fellow students. Moreover, variation in the immigrant student composition could affect allocation of resources and teacher recruitment between schools. Understanding whether—and how— ethnic segregation in schools affect student outcomes is important in order to alleviate educational disparities and implement social policy.

In this study, we address the relationship between immigrant concentration in school and the educational outcomes of native and immigrant students using administrative panel data from Norway. The growing empirical literature on the impact of immigrant peers in school on student outcomes is still inconclusive. Some studies find limited evidence of immigrant peer effects (e.g. Cebolla-Boado 2007; Cortes 2006; Fekjær and Birkelund 2007;

Jensen and Rasmussen 2011), while others conclude that a presence of immigrant students depress the academic performance of fellow student (e.g. Gould, Lavy, and Paserman 2009; Hardoy and Schøne 2013; Schwartz and Stiefel 2011; Szulkin and Jonsson 2007). Moreover, our knowledge about whether immigrant peer concentration has a long-lasting impact on educational outcomes is still much wanting.

Our study makes several contributions to the existing literature. First, we investigate the long-term impact of immigrant classmates by following six entire cohorts of students in their final grade of the Norwegian comprehensive school into young adulthood to examine whether they complete upper secondary education (310,742 students, 751 schools). Few studies look at student outcomes this long after exposure to immigrant classmates in order to evaluate the peer effects wears off over time (e.g. Gould, Lavy, and Paserman 2009). In addition, we also examine effects on students' educational achievement and academic track enrollment in upper-secondary schools.

Second, to estimate the causal effect of immigrant classmates on educational outcomes we exploit within-school variation in peer composition across adjacent cohorts. This strategy addresses concern for nonrandom student sorting by identifying the effect of peers under the key assumption that students and their parents sort into schools according to the average school characteristics, but not particularities of the student's cohort (cf. Hoxby 2000). So far, only a few of studies have used similar designs to study the impact of immigrant peers in school (e.g. Gould, Lavy, and Paserman 2009; Hardoy and Schøne 2013; Schwartz and Stiefel 2011; Szulkin and Jonsson 2007).

Third, studying immigrant classmate effects in the Norwegian setting is particularly interesting. While Norway has strong welfare state with universal social policies and a low degree of economic inequality (e.g. Esping-Andersen 1999; OECD 2008), high rates of immigration over the past decades has introduced a new dimension of ethnic stratification

into society (Brochmann and Kjeldstadli 2008). In the case of ethnic school segregation, universalistic welfare state institutions and characteristics of the publicly financed comprehensive school system in Norway, such as compensatory resource transfers to schools serving many immigrants and the lack of formal ability tracking, might offset the potentially adverse effects of high immigrant peer concentration in school on children's educational opportunities.

Background

Theoretical Considerations

In this section, we present different theoretical arguments linking immigrant peer composition in school to the academic success of students. We discuss alternative causal and non-causal explanations through which a systematic relationship might arise.

Immigrant minority students might affect their fellow classmates through direct peer interactions in school as well as other more indirect pathways. Although the Coleman et al. (1966) report convinced many that school-based influences are relatively small, recent studies show that peer characteristics—such as academic performance, socioeconomic position, gender, and minority status—may affect the school performance of students (e.g. Bifulco, Fletcher, and Ross 2011; Black, Devereux, and Salvanes 2013; Crosnoe 2009; Hanushek, Kain, Markman, and Rivkin 2003; Hanushek, Kain, and Rivkin 2009; Hoxby 2000). Students' educational behavior may be directly shaped by the behavior their peers, such as how much time and effort they spend on school work, how exited they are about learning, and what educational aspirations they have. Moreover, classmate effects may operate more indirectly by causing changes in teacher behavior. A presence of low-achieving and disruptive students with special needs, such as language difficulties or emotional problems, will demand extra attention from teachers, and may lower the quality of

their classroom instruction (e.g. Fletcher 2010; Lazear 2001). In schools with many disadvantaged students, teachers may lower their expectations about the academic potential of the whole student body (e.g. Rosenthal and Jacobson 1968). Higher-achieving peers might, alternatively, improve the learning climate in classrooms and schools by demanding better instruction and asking more advanced questions to teachers. However, having high-achieving peers might also further disadvantage low-performing students, if they face fiercer competition for good grades, higher risks for stigmatization, and lowered self-esteem (e.g. Crosnoe 2009).

The direction of any immigrant peer effect will, therefore, likely depend on both the behavior and achievement of the immigrant students in school. If immigrant students have poor academic skills and limited proficiency in the host-country language, they might exhibit a negative influence on the academic outcomes of their classmates. Past research shows that children in immigrant families often face educational disadvantages although much of this is accounted for by parental characteristics such as education and socioeconomic position (see reviews by Heath, Rothon, and Kilpi 2008; Kao and Thompson 2003).[1] However, studies also show that children in some immigrant minorities are more motivates for school work, have higher educational ambitions, and make more ambitious educational choices relative to native peers of similar social origins (e.g. Goyette and Xie 1999; Jackson, Jonsson, and Rudolphi 2012; Kao and Tienda 1995; 1998; Lauglo 1999) . Alternatively, thus, immigrant students with a firm belief in schooling as the main avenue for social mobility may have a positive influence on the achievement of their fellow peers. Moreover, different mechanisms could be at play simultaneously, nulling each other out. For example, positive effects of hard working and highly ambitious immigrant peers might be counteracted by their poor academic achievement due to limited language fluency and disadvantaged family situation.

Variation in immigrant student composition may also affect allocation of resources and teacher recruitment between schools. Teachers have a direct, significant impact on the academic performance of students in their classrooms (for a review, see Hanushek and Rivkin 2006). In a segregated setting, however, the possibility exists that schools serving low-status and immigrant minority student populations will experience difficulties in recruiting and retaining skilled teachers (Clotfelter, Ladd, and Vigdor 2005; Hanushek, Kain, and Rivkin 2004). Within schools, tendencies towards assigning less experienced teachers to classes with many disadvantaged minority students and more difficult working conditions might also operate (Kalogrides, Loeb, and Béteille 2013). Moreover, schools in residential areas dominated by immigrants may also be disadvantaged with respect to other school inputs, such as financial resources and class sizes (e.g. Ellen, O'Regan, Schwartz, and Stiefel 2002). Alternatively, policy makers and school administrators may attempt to counteract negative trends by allocating extra resources to schools with many immigrant students. Moreover, within-school distribution of resources might, for example, be targeted to special language classes and acculturation programs serving immigrant students.

In segregated schools, there may also be less interaction across groups of students according to nativity and propensities towards ethnic closure in interpersonal networks may become more pronounced (e.g. Moody 2001; Sanders 2002). The role of access to informal friendship networks may have larger consequences for immigrants, because absent contact with native peers might have negative effects on their language acquisition, acculturation of social norms and behavior, and, ultimately, school performance. If immigrant students evaluate their future opportunities based on what they observe in the wider residential context of their schools, they might also underestimate the value of formal credentials and school effort if they observe many adult immigrants unable to transfer their educational merits into adequate employment (Zhou 1997). Immigrant communities are, however,

heterogeneous and many are not characterized by poverty and social marginalization. The influence of an ethnic environment is likely to depend on the overall level of human capital and other resources within the community (cf. Borjas 1995), which is indicated by recent studies (e.g. Åslund, Edin, Fredriksson, and Grönqvist 2011; Bygren and Szulkin 2010).

It is, however, also possible that the existence of an association between immigrant peer concentration and educational outcomes could be noncausal, reflecting sorting of students and their families across schools (e.g. Duncan, Magnuson, and Ludwig 2004; Hauser 1970). Allocation of children to different schools is largely governed by decisions made by each student's own family, given their economic constraints, which implies that the characteristics of the chosen option will likely also correlate with the characteristics of the family itself. In a setting where school attendance is based on residential location, selection of students to different schools is likely to reflect the desirability of different residential areas. If school catchment areas populated by many immigrant families have low desirability, this may give rise to stratification by family income across schools, even in a situation where all families put equal value on school quality. However, families may, also value the importance of children's education and school quality differently, in which case schools with high immigrant densities may serve families with a combination of disadvantaged socioeconomic position, low educational ambitions for their children, and other unobserved family characteristics. If this is the case, unmeasured characteristics of students and their families influence both school choices and educational outcomes, biasing the estimated effects of immigrant peers. To handle concern for student sorting between schools, within-school variation in student composition across cohorts has recently been introduced as a strategy to estimate the causal effect of peers on student outcomes (cf. Hoxby 2000).

To summarize, immigrant peer concentration may have a direct negative impact on educational outcomes if poorly performing immigrant student disrupt the classroom learning

environment. Alternatively, immigrant students with high educational aspirations and a strong work ethic could have a positive influence on their fellow classmates. Moreover, allocation of resources between schools, as well as recruitment of skilled teachers could vary systematically with immigrant student composition. However, measuring the effect of immigrant peers is difficult because both school choice and inequality in educational success could be the result of student selection. To tease apart these alternative hypotheses, we compare changes over time in student outcomes across cohorts within the same school to differences across schools with varying immigrant concentration. If the estimates represent the direct effect of immigrant classmates, one would expect the effects to persist when comparing across adjacent cohorts within schools.

Previous Research

Previous research often document negative relationships between immigrant student composition in schools and educational outcomes. However, most studies fail to handle problems related to nonrandom student sorting across schools, and are, thus, unable to evaluate the causal nature of these relationships.

The findings of studies that try to handle student sorting are, however, mixed. Cebolla-Boado (2007) found that, after taking selection into account, the concentration of immigrants in Spanish schools did not have a statistically significant impact on grade retention and track selection in upper secondary. Similarly, Cortes (2006) found no effect of attending immigrant enclave schools on reading and math test performance of immigrant students after controlling for nonrandom sorting. Moreover, Jensen and Rasmussen (2011) conclude that a higher concentration of immigrants in Danish schools has a negative impact on the reading scores of immigrant and native students, although controlling for sorting yields a more modest effect on native Danes and no effect on immigrants. A few studies

relying on within-school peer variation, all find persisting negative effects of immigrant peers. Szulkin and Jonsson (2007) find that immigrant and native students in cohorts exposed to higher shares of immigrant peers have lower average grade achievement at the end of Swedish comprehensive education. Schwartz and Stiefel (2011) find higher achievement on math and reading tests among students in New York City schools with higher densities of foreign-born students, however, they find a negative effect of attending cohorts with more immigrant peers within the same school. Using data from Israel, Gould, Lavy, and Paserman (2009) find negative effects of high immigrant concentrations in elementary schools on the native students' probability of passing their high school matriculation exams, but the impact on fellow immigrants is less clear.

In Norway, recent studies have investigated the influence of immigrant student composition in upper secondary schools on educational outcomes, but reached contradictory conclusions. Without taking unobserved student sorting into account, Fekjær and Birkelund (2007) found a weak positive relationship between attending schools with many immigrant minority students and educational achievement. In contrast, Hardoy and Schøne (2013), using a within-school strategy, show negative effects of immigrant peer on completion of upper secondary education.[2] However, the current study examines the long-term impact on educational outcomes from immigrant peers in the final grade of Norwegian comprehensive lower secondary education, a schooling environment without ability tracking, where school attendance is based on residential location and not student choice, and before early school leaving can occur. In this respect, it is interesting to that a recent comparative study found evidence suggesting that the effects of immigrant peers on student outcomes are stronger in ability-differencing school systems than in comprehensive school systems (Entorf and Lauk 2008).

The Norwegian Setting

Norway is characterized by a strong welfare state offering universal social policies and basic services to its citizens (e.g. Esping-Andersen 1999). In comparative perspective, Norwegian society has modest levels of economic inequality, low prevalence of child poverty, and high levels of intergenerational social mobility (OECD 2008; UNICEF 2007). Recent waves of immigration have, however, introduced a new dimension of ethnic stratification. Adult immigrants from less developed countries experience persistent penalties in earnings and employment compared to natives, and elevated risks of poverty and social welfare dependency (e.g. Birkelund and Mastekaasa 2009; Bratsberg, Raaum, and Røed 2010).

Over the past decades, Norway has become increasingly multiethnic and diverse society. In 2013, immigrants and their native-born children constituted approximately 14.1 percent of the population in Norway—approximately 710,000 individuals—as opposed to 1.5 percent in 1970 (Statistics Norway 2013). The relative size of the Norwegian immigrant population is comparable to countries such as the Netherlands, Germany, France, United Kingdom, and the United States (OECD 2013). The new era of immigration in Norway started with the inflow of labor migrants from Pakistan, Turkey, India and Morocco in the early 1970s. After 1975, however, a moratorium on unskilled labor migration outside of the Nordic region was introduced, but allowed for family reunification for individuals already in Norway. Since the late 1970s, however, the number of refugees and asylum seekers from countries such as Vietnam, Chile, Iran, Iraq, Somalia and Former Yugoslavia grew (Brochmann and Kjeldstadli 2008). The share of immigrant background children is steadily rising within school-age cohorts, and children of immigrants born in Norway is estimated to constitute approximately ten percent of these cohorts by 2025 (Bratsberg, Raaum, and Røed 2011).

The Norwegian comprehensive school system is mandatory and publicly funded. Since 1997, Norwegian comprehensive education has consisted of ten years of schooling from age six. However, for the cohorts we consider, students started at age seven and comprehensive education was split into primary schools (grades 1—6) and lower secondary schools (grades 7—9). Comprehensive schools are run by local municipalities and there is no formal tracking by ability during these years. School attendance is based on place of residence and the rules specifying that students attend the school in their local catchment area are strictly enforced. After completing comprehensive schooling (usually at age 16), the majority of students continue into upper secondary education. Norwegian comprehensive schools are also characterized by low socioeconomic stratification and modest variation in test scores between schools (OECD 2006). Moreover, schools with high shares of immigrants and disadvantaged students also have higher teacher-student ratios and receive compensatory resources for students with special needs (Hægeland, Kirkebøen, and Raaum 2009; Hægeland, Raaum, and Salvanes 2005). However, previous research also indicate that qualified teachers tend to navigate away from jobs in schools serving many immigrant students (Bonesrønning, Falch, and Strøm 2005).

Data and Methods

Sample

We use matched panel data on students and schools from high-quality Norwegian administrative registers. A system of personal identifiers enables linkage between various administrative registers, as well as matching children to their parents and students to their schools. The dataset include information six entire student cohorts (about 345,000 individuals) in the final grade of the Norwegian comprehensive school system. The cohorts we study graduated between 2001 and 2006.

We exclude students graduating from private schools and small schools. We define small schools are defined as schools where less than 120 students graduate from the school summing over all six cohorts or cohorts with less than 20 graduating students. Private and small schools are likely to be of a special kind or serve students with special needs (such as children with mental or physical disabilities). We also restrict our sample to students who graduate from lower secondary schools within one year before or after the norm of graduating at age 16. With these restrictions, our final sample consists of 310,742 students graduating from 751 lower secondary schools. The students are different across cohorts, but the schools are the same.

The geographical origins of the immigrant students ($n = 19,912$) in our final sample (see Appendix Table A1) merits some discussion. Pakistan is the largest country of origin and make up 14.5 percent of all immigrant students in our sample. Vietnam (7.5 percent), Iraq (6.8 percent), Bosnia-Herzegovina (6.5 percent), Kosovo (5.6 percent), Iran (5.6 percent), Turkey (5.4 percent), and Somalia (5.0 percent) constitute the other major countries of origin among the immigrant students. While there is much heterogeneity with respect to geographical origin within the immigrant sample, the majority of immigrant students originate from developing countries and recent conflict areas.

Variables

The dependent variables in our analysis are different measures of educational outcomes. The primary focus is on educational attainment in young adulthood, measured as completion of upper secondary education. We also consider academic track enrollment in upper secondary and educational achievement. Our key predictor of educational outcomes is the proportion of immigrant students within each student's graduating cohort at the end of lower secondary education. To avoid attributing to immigrant peer effects what should be attributed to

correlated determinants of the school attended and the educational outcomes of interest, we include a number of control variables. Table 1 lists the variables used in the analyses.

[Table 1 here]

We measure educational attainment in young adulthood as whether the students had graduated from upper secondary education at age 21. The statutory duration of upper secondary education in Norway is three or four years, depending on academic or vocational track, and students usually graduate from upper secondary at ages 19 or 20 years. Upper secondary education is a prerequisite for continuation into postsecondary education, and the upper secondary diploma has been documented to have high labor market returns for both natives and children of immigrants (e.g. Hermansen 2013).

We also consider additional educational outcomes. We measure students' enrollment in an academic upper secondary track (relative to a vocational track and non-enrollment) in the year succeeding completion of lower secondary education. To measure educational achievement, we include students' grades from standardized exams in two core subjects, mathematics and English, and their grade point average at the end of lower secondary education. For each subject, a random set of students are selected for these exams, which are graded anonymously by teachers from a different school than the one the students attend.[3] Exams are graded on a scale between one (lowest) and six (highest), where two is the first pass grade. Grade point average (GPA) is available from the final grade of lower secondary education. GPA measures the sum of the weighted sum of the student's teacher-assigned grades in eleven subjects and selected exam grades, and varies between 11 and 66.[4] GPA is the main admission criteria to upper secondary schools and is, thus, consequential for

students' later educational opportunities. All educational achievement outcomes are used in z-standardized form (mean = 0, std. dev. = 1) in the analyses.

We measure the proportion of immigrant minority students within each school cohort at the end of the final grade of comprehensive lower secondary education. Our measure of the proportion of immigrant minority students includes both native-born and foreign-born children of immigrant background. The advantage of such a simple measure of school segregation is that it is both easy to compute and understand, while also informative for social policy (Reardon and Firebaugh 2002). Figure 1 shows that the highest proportion of immigrant students within a school is 86 percent. In 67 of the schools in our sample, no immigrant students are present in any graduating cohort. Index of Dissimilarity estimates (not shown) indicate that 43 percent of the immigrant students would have to move in order to balance the distribution of students across schools. In addition, we also measure the average socioeconomic peer composition within cohorts (e.g. the mean of parental income and the proportion parents with postsecondary education) and the number of students within each cohort.

The dataset also contain information on a number of relevant demographic characteristics of student and their families. Immigrant background students refer to children with two foreign-born parents, and we distinguish between immigrant students born in Norway and abroad. Parental education is measured using information on the parent with the highest educational qualification. We distinguish between five levels of educational qualifications. We also include a separate category for children with no registered information on parental education, since immigrant students are overrepresented within this category. Parental income is measured by taking the annual earnings of each parent averaged over the years the child was aged eleven to fifteen years and then compute a measure of parental income as the average earnings of the mother and the father.[5] We then calculate the

student's relative position within the distribution of parental incomes within each separate birth cohort, which is entered as a set of dummies for each decile in the distribution. To measure parental experience of unemployment benefits and social welfare assistance, we rely on the basic amount threshold of the Norwegian Social Insurance Scheme (used to define labor market status, determining eligibility for unemployment benefits as well as disability and old age pensions). Parental social welfare indicates whether the parents in sum received means-tested social welfare transfers above the monthly basic amount rate, which was about 820 USD in 2006. Parental unemployment indicates whether at least one parent received unemployment benefits above the same threshold. For both measures, we use information from the student's final year of lower secondary education. Family structure is measured by an indicator of whether the student lived in an intact or reconstituted family (i.e. lived in a household with two adults that are either married or have common children) in the final year of lower secondary education. Using information on residential neighborhood location, we include an indicator of whether the child has experienced residential moves during the years of comprehensive school enrollment (i.e. whether the child experienced a residential relocation between neighborhoods once or more). We also measure student gender, whether the student is the first born child of his or her mother, and the students' number of siblings.

Empirical Strategy

The aim of our analyses is to identify the causal effect of immigrant peers in schools on educational outcomes of students. The problem of endogenous school choice and nonrandom student sorting, implying that unobserved student and family background characteristics (such as the aspirations and academic orientation of parents) both determine which schools students attend also influence their educational outcomes, is the main

difficulty in estimating peer effects. Furthermore, student and peer achievement are simultaneously determined. Since the average educational outcomes in a school is just an aggregation of individual student outcomes, individual student outcomes will, on average, by necessity be higher in a year when the school average is higher (cf. Manski's 1993 "reflection problem"). Studies that regress student outcomes on a set of peer characteristics without addressing the endogenous nature of school choice and the simultaneity of peer interactions may therefore overestimate the impact of peers. Moreover, schools with many immigrant students may also be different on unobserved characteristics, such as student counseling and teacher quality, which may affect student outcomes. While our data permit us to control for a wide range of theoretically relevant and well-measured variables, their primary strength is the panel structure which identify multiple student cohorts within the same schools. This enables us to reduce bias from unobserved variables at the level of both students and schools.

We aim to break any remaining correlation between immigrant peer concentration and unobserved characteristics of students and their schools by analyzing the effects of variation in student composition across adjacent cohorts within the same school. This strategy identifies the effects of peers under the assumption that students and their families do not select which schools to attend based on peculiarities of their child's cohort, but rather the average student composition of the school (cf. Hoxby 2000). To ensure that the estimation of the immigrant peer effect is based on comparisons across cohorts within schools, we estimate the educational outcomes of individual students as the linear function of the individual's own observable characteristics, the immigrant student composition and additional peer characteristics of the individual's school cohort, a cohort fixed effect, and a school fixed effect. The equation below describes these OLS regression models:

$$Y_{ist} = \alpha PropImmPeer_{st} + \beta Z_{st} + \gamma X_i + \delta_s + \theta_t + \varepsilon_{ist} \tag{1}$$

where i, s, and t are indices for students, schools, and cohorts, respectively. Y_{ist} is the relevant educational outcome; $PropImmPeer_{st}$ measures the proportion of immigrant minority students within each school cohort; Z_{st} include variables measuring the number of students within each school cohort and socioeconomic peer characteristics; X_i is the set of control variables for student and family background characteristics; δ_s the school fixed effects and θ_t indicate the cohort fixed effects; and ε_{ist} is an error term with usual properties.[1] The school fixed effects capture all time-invariant observed and unobserved differences between schools and the cohort fixed effects capture any trends over time across graduating cohorts. Thus, the effect of immigrant classmates is obtained solely by relying on variation in immigrant student proportions across graduating cohorts within the same schools.

It should, however, be noted that some of the mechanisms through which immigrant peer composition might influence student outcomes are constant across cohorts. For example, if the immigrant density within a school is related to the school's ability to attract resources and skilled teachers, this is most likely influenced by the school's overall student composition and not the peculiarities of single cohorts. Furthermore, teacher's motivation and evaluation of students might also be influenced not only by the student composition of the current cohort but also by characteristics of preceding cohorts. By relying on within-school variation in cohort composition, our estimates will miss any effects of immigrant student composition of the school as a whole on student outcomes. However, by comparing estimates from OLS regressions with and without school fixed effects we gain some leverage to disentangle between-school variation in student sorting and stable characteristics of schools from dynamic effects of immigrant classmates within schools.

Results

Variation in Immigrant Peer Composition across Schools and Student Characteristics

Table 1 provides summary statistics on the educational outcomes and family background characteristics of students, as well as the peer characteristics of their school cohorts, by immigrant background. We see that immigrant students, those born abroad more so than the native born, lag substantially behind native students in educational achievement and completion of upper secondary education. However, immigrant students have a higher enrollment rate in academic tracks in upper secondary schools relative to natives. Higher continuation rates into academic tracks relative to natives, in spite of low school performance, could be interpreted as a sign of high educational aspirations among the immigrant students. The table also clearly shows how immigrant students grow up in families marked by more economic disadvantage and less parental human capital than natives. Table 1 also displays how peer characteristics of the schools attended differ between native and immigrant background students. Immigrant students attend schools with higher proportions of immigrant peers relative to native students, as well as schools with slightly larger student bodies and where the students' parents have somewhat lower socioeconomic statuses.

[Figure 1 here]

Figure 1 plots the relationship between the proportions of immigrant students at the yearly school level against the average completion of upper secondary education among the students within the same cohorts. Each observation in the scatter plot represents a single graduating school cohort. The pattern in the figure indicates that schools with higher

18

proportions of immigrant students have fewer students that complete upper secondary education (Pearson's r = -0.198, $p < 0.001$). Table 2 displays the correlation between educational outcomes of individual students and the immigrant student proportion of their school cohorts. There is a modest negative relationship between higher immigrant student proportions in school and educational outcomes of students, except for academic track choice in upper secondary education. Overall, these results clearly document that students in schools with higher immigrant peer concentrations have lower school performance relative to students in schools with lower immigrant densities. The question which remains, however, is whether this pattern reflects a causal effect of immigrant classmates on the educational outcomes of their fellow students.

[Table 2 here]

Validity of Model Assumptions: Within-School Variation and Balancing Tests

Two main assumptions must be met for our within-school identification strategy to be a valid test of causal immigrant peer effects. The first is that there must be sufficient within-school variation in immigrant peer shares over time. The second is that the characteristics of students and their families are essentially uncorrelated with deviations in immigrant peer shares across cohorts over time.

In Table 3, Panel A presents overall (between- and within-school) variation in immigrant peer shares. Panel B presents within-school variation. The distribution shown in Panel B is calculated from the residuals of regressions of the proportion of immigrant minority students while controlling for school and cohort fixed effects. In the full sample, the variation in immigrant student proportion average at 5.9 percent, with a standard deviation at about 10 percentage points. Among native students, the mean is 4.9 percent with

19

a standard deviation of about 7 percentage points. For native-born and foreign-born immigrant students, the corresponding averages are 26.2 percent and 16.3 percent, with standard deviations in the magnitude of 20 percentage points. Within-school immigrant peer variation among all students shrinks to a standard deviation of 2.5 percentage points. The corresponding figure is 2.3 percentage points among native students. Among immigrant minority students, within-school peer variation is reduced to between 4.6 and 3.8 percentage points among the native-born and foreign-born students, respectively. These deviations in within-school peer composition are the basis of our within-school identification of immigrant peers effects. They may seem small, yet, as shown in the analyses, there is sufficient precision left to determine statistical significance at conventional levels.

[Table 3 here]

The second assumption posits that within-school peer variation across cohorts is a result of random fluctuation and not systematic selection of students. We conduct a set of informal balancing tests of this assumption (e.g. Gould, Lavy, and Paserman 2009), by estimating separate regressions of observable student characteristics as a function of the proportion of immigrant minority students, in addition to school fixed effects, cohorts fixed effects and whether the student is a native-born or foreign-born immigrant student. Table 4 presents estimated coefficients, standard errors, and conventional significance levels for the yearly immigrant student proportion in schools from each of these balancing tests. Estimates from OLS regressions without school fixed effects are also reported as a benchmark for comparison. Lack of statistically significant estimates suggests that the observable student characteristics are not systematically correlated with deviations in immigrant peer composition across cohorts within schools. Table 4 provides evidence that our within-school

strategy removes most of the systematic correlation. There is, however, correlation in some student attributes after control for school fixed effects. In particular, the remaining association with parents' education and income indicate that the within-school peer estimates may still be biased due to remaining sorting across cohorts with different immigrant student compositions. However, Table 4 provides overall support to the internal validity of the identification strategy since most of the systematic correlation in observed student variables is captured by controlling for school fixed effects.

[Table 4 here]

Estimated Effect of Immigrant Peers on Completion of Upper Secondary Education

Table 5 presents results from the regressions of upper secondary completion, our main dependent variable, on the proportion of immigrant students. The table shows linear probability coefficients estimated using OLS regression.[6] Column 1 shows the effect of immigrant student composition without any additional controls beyond students' immigrant background. The coefficient for proportion immigrant students indicates that a one percentage-point increase in immigrant peers is associated with a statistically significant 0.0012 percentage-point ($p < 0.001$) reduction in the likelihood of completing upper secondary education. Columns 2-4 show how these estimates change when adding controls. Columns 2 and 3, adds control for student characteristics and peer characteristics, respectively. Column 4 adds cohort fixed effects. The negative graduation gaps between native and immigrant students are eliminated once we control for student and peer characteristics. Moreover, we see that the effect of immigrant peers is barely significant and reduced to about three-quarters of the original estimate. A one percentage-point increase is associated with a 0.0003 percentage-point reduction in the probability of completing upper

secondary education ($p < 0.10$). This relationship is, however, identified by variation in immigrant minority peer composition both between and within schools. As argued above, the estimated effect of immigrant peers could, however, be biased due to unobserved student sorting or stable unobserved characteristics of schools with varying proportions of immigrant students.

In Column 5 of Table 5, we introduce school fixed effects to address these problems. Column 5 shows the within-school relationship between changes in the immigrant student composition across cohorts and likelihood of upper secondary completion. We see that the introduction of school fixed effects eliminates the negative effects of immigrant peers completely. In fact, the sign of the coefficient flips to a significant and positive effect of immigrant peer variation across cohorts within the same school. This positive effect is, however, rather, modest. A one-percentage increase in the share of immigrant peers within schools is associated with a 0.0011 percentage higher probability of completing upper secondary education ($p < 0.01$). The effects of student immigrant background are similar to what we found in the model without school fixed effects. These results indicate that students in cohorts with more immigrant peers have a slightly higher probability of completing upper secondary education. Thus, the negative relationship between immigrant student composition and upper secondary completion does not seem to reflect a dynamic, direct negative influence of immigrant classmates.

[Table 5 here]

So far, we have assumed that the effect of immigrant peers is linear. However, it could be that the effect of immigrant peers is nonlinear, where negative effects emerge only in schools with particularly high concentrations of immigrant students. In Table 6, we

present results where the effect of immigrant peers is allowed to vary across schools with varying densities of immigrant student proportions. Here we estimate the effect of immigrant peer concentration using linear splines in full OLS models with school fixed effects. The effect is allowed to vary across knots at 10 percent intervals up to a concentration of more than 50 percent immigrant students within the school. The estimates from the spline model specification do, however, not indicate that the effect of immigrant peers is increasingly more negative in schools with higher immigrant student proportions. The estimated effects of immigrant peers are positive at all levels, except in schools with immigrant student shares between 40 and 50 percent, however, this negative estimate is not statistically significant (-0.097, $p > 0.10$). Overall, the results from Table 6 does not indicate that the effect of immigrant peers is nonlinear with negative peer effects emerging in particularly segregated schools with very high immigrant densities.

[Table 6 here]

Estimated Effect of Immigrant Peers on Achievement Outcomes and Academic Track Choice
Table 7 provides results for our four additional educational outcomes. It should be noted that the scale of the different outcomes differ, and, hence, also the interpretation of the effect size of the estimated coefficients. The estimate for the immigrant peer effect on academic track enrollment is a linear probability coefficient estimated using OLS regression.[7] The estimates for the remaining three educational outcomes are unstandardized coefficients from OLS regression, where the grade achievement measures are z-standardized.

In Table 7, our primary focus is on the estimates from models with school fixed effects, but for comparison we also show estimates from specifications without school fixed effects. Looking at the models without school fixed effects first, we see that the estimates

for immigrant student proportion are positive for all outcomes, except for exam grades in mathematics (-0.267, $p < 0.001$). Turning to the within-school estimates, we see find a statistically significant positive effect of immigrant peers on academic track choice (0.091, $p < 0.05$) and exam grades in English (0.345, $p < 0.10$). The estimated effects for grade point average and exam grades in mathematics are virtually zero and marginally positive, respectively. Both are, however, not statistically significant at conventional levels. Table 7 also shows that for all educational outcomes, native-born immigrant students outperform native students after adjusting for parental socioeconomic status and student characteristics, except for exam grades in mathematics. Foreign-born immigrant students also have higher propensities to complete upper secondary education and enroll in academic tracks in upper secondary relative to native students after the adjustments for the same background characteristics. This is broadly consistent with studies documenting that children in immigrant families often have higher educational motivation and better school performance when compared to native children with similar social origins. Taken together, Table 7 indicates that students who are enrolled in cohorts with more immigrant classmates perform slightly better than students enrolled in cohorts with fewer immigrant classmates within the same schools. Moreover, even if we compare across schools with different immigrant student concentrations, there is little evidence of lower school performance among students in schools with many immigrant peers after adjusting for family background and socioeconomic characteristics of peers.

[Table 7 here]

Effect Heterogeneity by Immigrant Background, Parental Education, and Gender

It is essential to investigate whether the effect of immigrant peers on educational outcomes differs across between students of native and immigrant background, and a comparison according to parental education and gender is also warranted. Within schools, peer relations and friendship dynamics, as well as teacher behavior and allocation of resources, could vary systematically between students according to observable background characteristics.

Table 8 provides estimates of the effect of immigrant classmates on all educational outcomes separately for these subgroups of students. For comparison, Column 1 shows the main effects estimates from the full sample. Columns 2-4 present estimates on the effect of immigrant peers separately by immigrant background. Overall, these results do not reveal a clear pattern of negative effects across students with different immigrant backgrounds. In fact, effect of immigrant peers on completion of upper secondary education is positive and statistically significant for foreign-born immigrant students and native students. While some of the effect estimates have a negative sign, none of these estimates reach statistical significance at conventional levels. Table 8 also shows that there is some variation in the effect of immigrant peers according to parental education (columns 5-6) and gender (columns 7-8). However, this effect heterogeneity varies across the different educational outcomes, without revealing any clear patterns. Overall, these estimates offer little evidence of negative immigrant peer effects that are specific to the gender of the students or their parents' educational attainment. Taken together, the results in Table 8 do not indicate that there is any systematic heterogeneity in the effect of immigrant peers on educational outcomes.

[Table 8 here]

25

To summarize, to the extent that the estimates we have reported can be interpreted as the causal effect of immigrant classmates on educational outcomes of fellow students, our empirical analyses indicate that students attending cohorts with more immigrant peers have slightly better educational outcomes than students in cohorts with fewer immigrant peers within the same school. Our results, thus, suggests that the overall negative correlation found between immigrant student proportion and students' educational outcomes reflect student sorting and, to a lesser degree, stable characteristics of the schools.

Discussion and Conclusion

This study asks whether immigrant peers in school matter for the long-run educational outcomes of their fellow students. To address this question this we use rich administrative panel data on six entire cohorts of students in their final grade of the Norwegian comprehensive school system. The panel structure of the data, where we observe multiple student cohorts within the same schools, enables us to identify the effect of immigrant classmates on students' educational outcomes using within-school variation in peer composition across adjacent cohorts. The key identifying assumption of this approach is that students and their families decide which school to attend based on average characteristics of the school, and not the specific peer compositions of the student's cohort.

Our findings show that students in cohort with more immigrant peers have a slightly higher likelihood of completing upper secondary education in young adulthood. Estimates from the school fixed effects models find positive effects of immigrant classmates on students' academic track enrollment in upper secondary schools and, to a lesser degree, educational achievement. In interpreting the result from our school fixed effects models, it must be noted that the effect sizes are rather modest. Moreover, the effect of immigrant peers seems relatively stable across schools with different densities of immigrant students.

Subsample analyses of effect heterogeneity do not reveal systematic differential effects of immigrant peers on student outcomes according to their immigrant background, parental education, and gender. Taken together, our analyses indicate that the overall negative relationship between immigrant peer composition and the educational achievement and attainment of students does not reflect a direct negative influence of immigrant classmates, but rather arise from the student sorting across schools with varying immigrant densities and, to a lesser degree, the stable quality of these schools.

A caveat related to the interpretation of our results is worth noting. The identifying assumption in our within-school framework is that students and their families select schools based on average school characteristics and not particularities of each cohort. This implies that our within-school estimates only capture effects of immigrant classmates that operate through mechanisms that vary between cohorts within schools. If a school's overall immigrant concentration affects the ability to attract and retain skilled teachers over time, these effects are missed. Moreover, we are not able to rule out effects of immigrant peers that operate on a school-wide level, such as the long-term effects on learning climate or lowered teacher expectations among the remaining staff. Our within-school results therefore only provide an answer to the counterfactual question related to the impact of relatively modest changes in the immigrant peer composition on educational outcomes. Our analyses are not informative the consequences of moving students between schools at the far ends of the distribution of immigrant peer composition across schools.

Nonetheless, there are important lessons to be drawn from our study. First, we find that family background plays a decisive role in the explaining variation in the school success among students in schools with varying immigrant peer density. Furthermore, low socioeconomic family background is the main reason for explaining educational disadvantage among children of immigrants. To raise overall school success and close gaps

27

between native and immigrant students, policies that provide support to children with disadvantaged backgrounds and especially increase immigrant parents' human capital and labor market situation may have more potential than policies narrowly aimed at reducing school segregation.

Second, the effect of immigrant classmates on student outcomes is modest. This finding largely holds also in models without school fixed effects, which allow for the presence of school-wide peer effects and assume no student sorting on unobserved background characteristics. Previous research indicates stronger effects of immigrant peers in educational systems with ability tracking and more selective admission criteria (cf. Entorf and Lauk 2008, see also Hardoy and Schøne 2013). Future research on the effects of immigrant concentration in schools on educational outcomes might benefit from more specifically addressing the role of ability sorting across schools in choice-dependent school systems.

To what degree are our results relevant for other countries experiencing large-scale immigration? The underlying processes assumed to be related to immigrant school segregation—such as peer externalities due to immigrant language problems and poor school performance, but also high educational ambitions—suggests that our results could be exported to other immigrant-receiving settings. The rapid growth of the Norwegian immigrant population, as well as growing school and residential segregation among immigrant minorities, is also comparable to the experience in other North American and Western European countries. However, as indicated by this study, institutional characteristics of the Norwegian comprehensive schools and universal welfare state policies may limit the magnitude of adverse effects of immigrant school segregation. In this regard, one can speculate that the Norwegian evidence represent a lower bound on the effect of immigrant concentration in schools on children's educational opportunities.

Notes

[1] In Norway, recent studies document that children from immigrant families, in particular foreign-born children arriving after school-staring age, lag behind children of natives within the educational system (e.g. Birkelund and Mastekaasa 2009; Bratsberg, Raaum, and Røed 2011; Støren and Helland 2010). There has, however, been a clear catching-up trend towards lower gaps in completion of upper secondary education between native-born immigrant students and native students in recent years (Bratsberg, Raaum, and Røed 2011).

[2] Differences in results can, however, be reconciled because Hardoy and Schøne (2013) do not find negative effects in analyses of average grade achievement when the sample is constrained to students who finish upper secondary, which is the same restriction used by Fekjær and Birkelund (2007).

[3] Exam grades are only available for a subsample of the students in five of our graduating cohorts. These are the cohorts graduating between 2002 and 2006.

[4] Furthermore, students who did not pass in a minimum of eight subjects are included, with a GPA score of zero. However, these students only comprise 0.8 percent of our sample.

[5] For immigrant parents, we followed the same procedure with the exception of children arriving after age eleven, where we only average over the years the child is present in Norway.

⁶ We have estimated the average marginal effects from logit regressions. The estimated average marginal effects are very similar to the linear probability coefficients from the OLS regressions. Results can be obtained from the authors.

⁷ For academic track enrollment, we have also estimated the average marginal effects from logit regressios, and the estimated coefficients are very similar to the linear probability coefficients from the OLS regressions. Results can be obtained from the authors.

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Tables and Figures
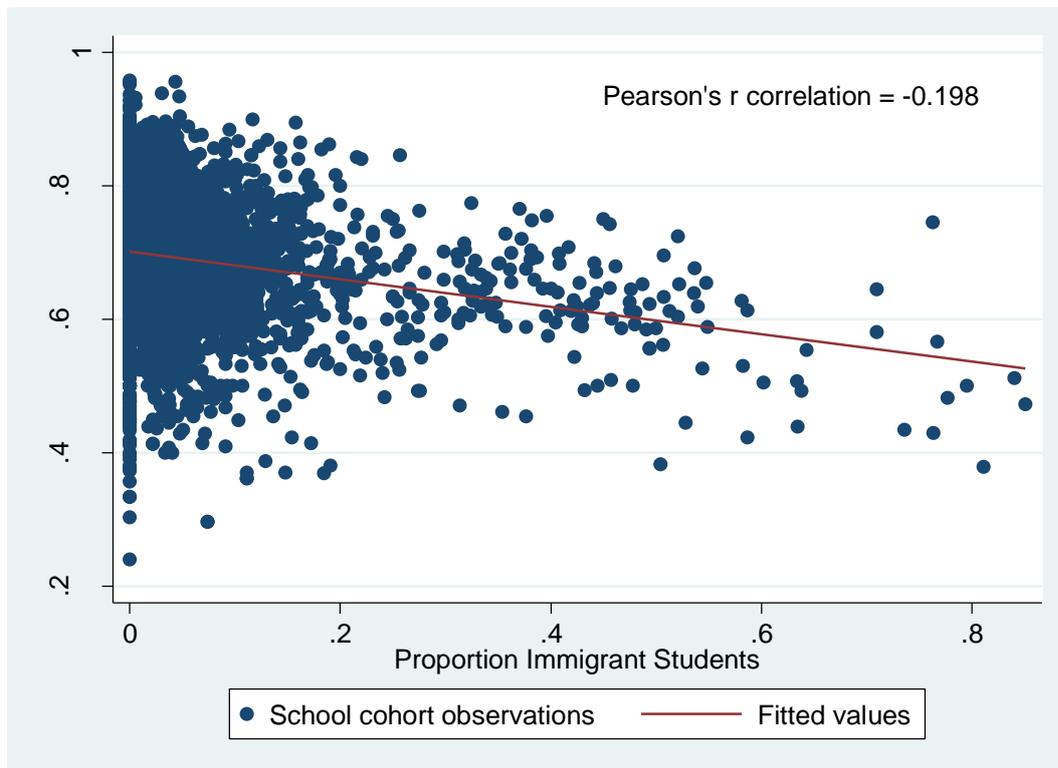

Figure 1. Average Completion of Upper Secondary Education and Immigrant Student Proportion across Schools.

Note: Dots represent graduating cohorts within schools (*N* = 4,245). Linear fit based on estimates from OLS regression.

Table 1. Descriptive Statistics By Immigrant Background.

	All		Natives		Native-born immgirants		Foreign-born immigrants	
	Mean (1)	SD (2)	Mean (3)	SD (4)	Mean (5)	SD (6)	Mean (7)	SD (8)
Educational Outcomes								
Upper secondary completion	0.70		0.71		0.65		0.52	
Academic track enrollment[a]	0.48		0.48		0.60		0.52	
Grade point average	0.00	(1.00)	0.03	(0.98)	-0.17	(1.01)	-0.58	(1.20)
Math exam grade[b]	0.00	(1.00)	0.03	(0.99)	-0.31	(0.99)	-0.50	(1.00)
English exam grade[c]	0.00	(1.00)	0.02	(0.99)	-0.20	(0.99)	-0.44	(1.11)
Peer Characteristics								
Average cohort characteristics								
Students with immigrant background	0.07	(0.10)	0.06	(0.08)	0.27	(0.22)	0.17	(0.18)
Parental income percentile	0.50	(0.10)	0.50	(0.10)	0.46	(0.13)	0.47	(0.11)
Parental postsecondary education	0.40	(0.14)	0.40	(0.14)	0.38	(0.14)	0.38	(0.14)
Number of students in cohort	93.1	(40.9)	92.7	(41.1)	101.9	(35.4)	97.95	(38.3)
Student Background								
Native-born immigrant	0.024		0.00		1.00		0.00	
Foreign-born immigrant	0.040		0.00		0.00		1.00	
Parents' education								
Basic education	0.12		0.10		0.37		0.33	
Some upper secondary	0.12		0.12		0.08		0.04	
Full upper secondary	0.35		0.36		0.22		0.19	
Some postsecondary	0.29		0.30		0.21		0.15	
University degree	0.11		0.11		0.08		0.06	
No education registered	0.01		0.00		0.04		0.23	
Parental income, percentile	0.50	(0.29)	0.52	(0.28)	0.27	(0.26)	0.17	(0.22)
Parental unemployment	0.08		0.08		0.11		0.16	
Parental social welfare	0.06		0.05		0.11		0.32	
Female	0.49		0.49		0.49		0.49	
First born child of mother	0.44		0.44		0.33		0.42	
Sibship size	1.88	(1.20)	1.83	(1.14)	2.65	(1.60)	2.47	(1.89)
Intact or reconstituted family	0.74		0.74		0.81		0.72	
Residential mover	0.38		0.36		0.59		0.70	
Number of schools (max)	751		751		496		703	
Number of students (max)	310,742		290,830		7,328		12,584	

Note: Standard deviations are not shown for discrete variables, as the full distribution of responses is shown. Sample includes all students graduating from Norwegian lower secondary schools in the ages of 15-17 in the years 2001-2006. Students from private schools and small schools are excluded.

[a] *N* = 307,745.

[b] *N* = 98,604.

[c] *N* = 97,674.

Table 2. Correlation Matrix Between Immigrant Peers and Educational Outcomes of Students.

	1	2	3	4	5	*N*
Proportion immigrant students	1					310,742
Upper secondary completion	-0.045 ***	1				310,742
Academic track enrollment	0.035 ***	0.283 ***	1			307,745
Grade point average	-0.049 ***	0.552 ***	0.490 ***	1		310,742
Math exam grade	-0.066 ***	0.450 ***	0.447 ***	0.763 ***	1	98,604
English exam grade	-0.040 ***	0.348 ***	0.421 ***	0.686 ***	0.484 ***	97,674

Note: Pairwise Pearson's r correlation coefficients.

† $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed tests).

Table 3. Overall and Within-School Variation in Immigrant Peers.

	Proportion immigrant students			
	Mean	SD	Min	Max
Panel A: Total variation				
All	0.059	0.095	0.000	0.856
Natives	0.049	0.073	0.000	0.856
Native-born immigrant	0.262	0.215	0.000	0.856
Foreign-born immigrant	0.163	0.184	0.000	0.856
	Mean	SD	Min	Max
Panel B: Within-school variation				
All	0.000	0.025	-0.236	0.223
Natives	0.000	0.023	-0.202	0.310
Native-born immigrant	0.000	0.046	-0.319	0.199
Foreign-born immigrant	0.000	0.038	-0.264	0.183

Note: Panel A provides the overall distribution of immigrant student proportion in our sample Panel B provides the distribution in residuals from regressions of immigrant student proportion on 751 school fixed effects and 6 cohort fixed effects. *N* = 310,742.

Table 4. Balancing Tests for Immigrant Peers.

	Proportion immigrant students	
	OLS	School FE
Dependent variable	(1)	(2)
Parents' education		
Compulsory	0.129***	0.066**
	(0.007)	(0.023)
Full upper secondary	-0.136***	-0.022
	(0.010)	(0.034)
Postsecondary	0.011	-0.083*
	(0.010)	(0.034)
Parents' income, percentile	0.040***	-0.074***
	(0.006)	(0.019)
Parents' unemployment	-0.031***	0.029
	(0.006)	(0.019)
Parents' social welfare	0.083***	0.024
	(0.005)	(0.017)
Female	0.018†	0.009
	(0.010)	(0.036)
First born	0.128***	-0.002
	(0.010)	(0.035)
Sibship size	-0.360***	0.227**
	(0.025)	(0.084)
Intact or reconstituted family	-0.358***	-0.016
	(0.009)	(0.031)
Residential mover	0.326***	-0.044
	(0.010)	(0.033)

Note: The figures in each row present the coefficients from OLS regression models with and without school fixed effects. All models control for cohort fixed effects and immigrant background. N = 310,742.

  † $p<0.10$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$ (two-tailed tests).

Table 5. Estimated Effects of Immigrant Peers on Completion of Upper Secondary Education.

	(1)	(2)	(3)	(4)	(5)
Proportion immigrant students	-0.122***	-0.043**	-0.032†	-0.031†	0.108**
	(0.024)	(0.015)	(0.016)	(0.016)	(0.035)
Student immigrant background					
Native-born immigrant student	-0.030***	0.092***	0.091***	0.091***	0.090***
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Foreign-born immigrant student	-0.174***	0.049***	0.048***	0.048***	0.048***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Student characteristics	No	Yes	Yes	Yes	Yes
Peer characteristics	No	No	Yes	Yes	Yes
Cohort fixed effects	No	No	No	Yes	Yes
School fixed effects	No	No	No	No	Yes
Number of students	310,742	310,742	310,742	310,742	310,742
Adjusted R^2	0.007	0.130	0.130	0.131	0.138

Note: Linear probability coefficients from OLS regressions. Student characteristics include controls for child gender, whether the student was the first born child of his or her mother, sibship size, whether the student lived in an intact or reconstituted family, residential movement, parental education, parental income, parental receipt of unemployment benefits, and parental receipt of social welfate assistance. Peer characteristics include controls for the mean parental income percentile, the proportion of parents with postsecondary education, and the number of students in the cohort. Huber-White standard errors in parentheses are robust to within school clustering and heteroskedasticity.

† $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed tests).

Table 6. Estimated Non-Linear Effects of Immigrant Peers on Completion of Upper Secondary Education.

	(1)
Proportion immigrant students	
Student proportion spline, .00 – .10	0.034
	(0.051)
Student proportion spline, .10 – .20	0.090
	(0.094)
Student proportion spline, .20 – .30	0.299†
	(0.153)
Student proportion spline, .30 – .40	0.234
	(0.201)
Student proportion spline, .40 – .50	-0.097
	(0.142)
Student proportion spline, .50 <	0.186
	(0.136)
Number of students	310,742

Note: Linear probability coefficients from OLS regression with spline terms. All model specifications include controls for all student characteristics, peer characteristics, cohort fixed effects, and school fixed effects. Huber-White standard errors in parentheses are robust to within school clustering and heteroskedasticity.

† $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed tests).

Table 7. Estimated Effects of Immigrant Peers on Additional Educational Outcomes.

	Academic track enrollment		Grade point average		Math exam grade		English exam grade	
	OLS	School FE	OLS	School FE	OLS	School FE	OLS	School FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Proportion immigrant students	0.172***	0.091*	0.038	-0.004	-0.267***	0.089	0.031	0.345†
	(0.019)	(0.045)	(0.047)	(0.090)	(0.077)	(0.183)	(0.065)	(0.203)
Student immigrant background								
Native-born immigrant	0.211***	0.212***	0.153***	0.147***	0.013	0.015	0.078**	0.086**
	(0.010)	(0.010)	(0.018)	(0.018)	(0.026)	(0.026)	(0.027)	(0.028)
Foreign-born immigrant	0.186***	0.185***	0.005	0.007	-0.063**	-0.066**	-0.050*	-0.052*
	(0.006)	(0.006)	(0.015)	(0.014)	(0.021)	(0.021)	(0.025)	(0.025)
School fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Number of students	307,745	307,745	310,742	310,742	98,604	98,604	97,674	97,674
Adjusted R^2	0.161	0.171	0.258	0.270	0.202	0.225	0.169	0.184

Note : Linear probability coefficients from OLS regressions in columns 1-2. Unstandardized coefficients from OLS regressions in columns 3-8. Model specifications with and without school fixed effects. All models include controls for all student characteristics, peer characteristics, and cohort fixed effects. Huber-White standard errors in parentheses are robust to within school clustering and heteroskedasticity.

† $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed tests).

Table 8. Effect Heterogeneity of Immigrant Peers on Educational Outcomes By Immigrant Background, Parental Education, and Gender.

	All	By immigrant background			By parental education		By gender	
		Natives	Native-born immigrant	Foreign-born immigrants	Academic families	Nonacademic families	Boys	Girls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Upper secondary graduation								
Proportion immigrant students	0.108**	0.079*	-0.144	0.402**	0.103**	0.102	0.096*	0.121**
	(0.035)	(0.039)	(0.155)	(0.137)	(0.039)	(0.065)	(0.047)	(0.047)
Number of students	310,742	290,830	7,328	12,584	233,130	77,612	159,292	151,450
Panel B: Academic track choice								
Proportion immigrant students	0.091*	0.068	0.181	0.093	0.032	0.205**	0.129*	0.054
	(0.045)	(0.051)	(0.158)	(0.125)	(0.052)	(0.064)	(0.056)	(0.066)
Number of students	307,745	288,349	7,222	12,174	231,480	76,265	157,593	150,152
Panel C: Grade point average								
Proportion immigrant students	-0.004	0.071	-0.182	-0.204	-0.001	0.001	0.006	-0.022
	(0.090)	(0.095)	(0.312)	(0.370)	(0.097)	(0.155)	(0.118)	(0.121)
Number of students	310,742	290,830	7,328	12,584	233,130	77,612	159,292	151,450
Panel D: Math exam grade								
Proportion immigrant students	0.089	0.132	1.115	-0.289	0.037	0.231	0.301	-0.161
	(0.183)	(0.203)	(0.941)	(0.663)	(0.195)	(0.316)	(0.262)	(0.248)
Number of students	98,604	92,448	2,337	3,819	75,259	23,345	50,581	48,023
Panel E: English exam grade								
Proportion immigrant students	0.345†	0.466*	0.126	-0.136	0.321	0.331	0.476†	0.227
	(0.203)	(0.226)	(0.620)	(0.778)	(0.234)	(0.331)	(0.282)	(0.248)
Number of students	97,674	91,621	2,365	3,688	74,764	22,910	49,520	48,154

Note: Linear probability coefficients from OLS regressions in panels A and B. Unstandardized coefficients from OLS regressions in panels C, D, and E. All model specifications include controls for relevant student characteristics, peer characteristics, cohort fixed effects, and school fixed effects. Huber-White standard errors in parentheses are robust to within school clustering and heteroskedasticity.

† $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (two-tailed tests).

Appendix Table A1. Geographical Origin of Immigrant Background

Regions of Origin	%	Countries of Origin (15 Largest)	%
Asia & Oceania	34.4	Pakistan	14.5
		Vietnam	7.5
		Sri Lanka	3.1
		India	2.3
		Afghanistan	1.7
Middle East	19.4	Iraq	6.8
		Iran	5.6
		Turkey	5.4
Africa	12.0	Somalia	5.0
		Morocco	2.3
Latin America	4.3	Chile	3.2
Europe, North America	29.9	Bosnia-Hercegovina	6.5
and other Western		Kosovo	5.6
		Russia	2.4
		Poland	1.9
		Other countries	26.2
Total	100.0	Total	100.0
Number of students	19,912	Number of students	19,912

Note: Sample includes all students graduating from Norwegian lower secondary schools in the ages of 15-17 in the years 2001-2006. Students from private schools and small schools are excluded.