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Peers, neighborhoods and immigrant student achievement - evidence from a placement policy

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Non-Technical Abstract

Immigrants typically perform worse than other students in the OECD countries. We examine to what extent this is due to the population characteristics of the neighborhoods that immigrants grow up in. We address this issue using a governmental refugee placement policy which provides exogenous variation in the initial place of residence in Sweden. The main result is that, for a given share of immigrants in a neighborhood, immigrant school performance is increasing in the number of highly educated adults sharing the subject's ethnicity. A standard deviation increase in the fraction of highly educated adults in the assigned neighborhood increases compulsory school GPA by 0.9 percentile ranks. This magnitude corresponds to a tenth of the gap in student performance between refugee immigrant and native-born children. We also provide tentative evidence that the overall share of immigrants in the neighborhood has a negative effect on GPA.

Keywords: Peer effects; Ethnic enclaves; Immigration; School performance

JEL Classification: J15; I20; Z13.

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by

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October 29, 2009

Abstract

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1 Introduction

Immigrant students typically perform substantially worse than native students in the OECD countries. According to PISA, the performance gap between first generation immigrants and natives amounts to around half a standard deviation in math, reading, and science (OECD 2006). In this paper we examine to what extent this is due to the characteristics of the neighborhoods in which the immigrants grow up. Since recently arrived immigrants tend to settle in close proximity to people sharing their ethnic background (Stark 1991), we pay particular attention to the characteristics of the ethnic community.

There is a large literature on the impact of residential and school segregation on the outcomes of disadvantaged groups in general. But there is not so much dealing with immigrant children in particular. This is perhaps surprising given that the characteristics of the neighborhood community can exert particularly strong influences on young migrants striving to find their place in the new country. Moreover, the work by Heckman and coauthors (e.g., Cunha and Heckman 2007) suggests that the impact of the environment is more pronounced in disadvantaged families.

The question we examine also sheds light on the rationale for policies designed to shift the location of immigrants. These policies may come in the form of incentive programs, such as Moving to Opportunity (see Kling et al. 2007), or deliberate attempts by the governments to restrict the location choices of new immigrants; the latter kind of policies are (or have been) practiced by many European countries (see Edin et al. 2004).

It is an open question whether the characteristics of the ethnic community has a causal effect on immigrant student achievement. Ethnic concentration per se may be beneficial if the enclave provides useful information on, e.g., the workings of the education system, but detrimental if residential concentration hampers proficiency in the host country's language. But the characteristics of the contacts are arguably at least as important. Well-established and educated peers may act as role models, but living among people with poor socioeconomic status and performance may have a negative influence on youth (cf. Cutler and Glaeser 1997).

Our paper is related to several branches of literature. First, there is a large literature on the impact of residential segregation on adult minorities (including immigrants) in general.[1] The evidence is somewhat mixed. Segregation per se may hurt individuals (e.g. Cutler and Glaeser

[1] See, e.g., Åslund and Fredriksson (2008), Bertrand et al. (2000), Cutler and Glaeser (1997), Edin et al. (2003), and Goel and Lang (2009) for recent contributions.

1997) but the literature also points to the importance of the quality of neighborhood contacts (Bertrand et al. 2000; Åslund and Fredriksson 2008).

Second, there is a growing body of (largely U.S.) research studying the effects of racial composition within schools or neighborhoods on student performance.[2] In general, these studies suggest that the performance of black students is reduced by attending schools with a large fraction of black students.

Third, there is a small literature examining whether ethnic concentration affects the school performance of immigrants. Cortes (2006) studied the effect of age at arrival and attending an enclave school on the test scores of a sample of first and second generation immigrants residing in the cities of Miami and San Diego in the U.S. She found that attending an enclave school (defined as one where above 25 percent are foreign-born) has no effect on students' test scores. [3]

Fourth, there are some studies which examine whether immigrants' labor market success is related to the characteristics of the childhood neighborhood.[4] For instance, Borjas (1995) found that (second generation) immigrants who grew up in ethnic communities with an abundance of human capital did better on the labor market.

The studies by Cortes (2006) and Borjas (1995) are directly relevant to our paper. However, as for many other studies of contextual effects, one could worry that selection problems bias the estimates in these two studies. This is mainly because a student's neighborhood or school is a family choice variable. If residential choice is based on unobserved characteristics which also affect learning outcomes, the estimates will be biased and cannot be interpreted causally.

We rely on a governmental placement policy to generate exogenous variation in the initial residential distribution. Between 1987–1991 Swedish authorities assigned refugees to their initial location. Since individuals were not free to choose, we argue that the initial location was independent of (unobserved) individual characteristics, an issue we will obviously return to below.[5]

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[2] See e.g., Angrist and Lang (2004), Boozer et al. (1992), Card and Rothstein (2007), Grogger (1996), Guryan (2004), Hanushek et al. (2002), Hoxby (2000), and Rivkin (2000).

[3] See Bygren and Szulkin (2007) for a related study using Swedish data. Jensen and Rasmussen (2008) have examined whether student outcomes are related to immigrant concentration using Danish data. Their estimates suggest a negative impact of immigrant concentration on student performance. Neither of these studies in practice handles the problems caused by residential self-selection.

[4] The paper by Grönqvist (2006) belongs to this category.

[5] We have previously used this approach to study economic outcomes among adult migrants; see Edin et al. (2003) Åslund and Fredriksson (2008) Åslund et al. (2006) and Åslund and Rooth (2007). Gould et al. (2004) use a similar placement policy where Ethiopian refugees were distributed across Israeli municipalities to identify the causal effect of school quality on students' high school grades. There are also papers exploiting similar policies in Denmark; see e.g. Damm (2009a, 2009b).

Our strategy is demanding on data availability. We have access to administrative records containing detailed information on all students graduating from Swedish compulsory schools during 1988–2003. The data also contain rich individual information on the population age 16–65 from 1985 and onwards, and provide the opportunity to link children to their parents. This means that we can identify when the individual arrived, where he or she initially resided, the characteristics of his or her parents, and the properties of the neighborhood peers at different points in time.

The results suggest that a standard deviation increase in the fraction of highly educated peers in the assigned neighborhood raises compulsory school GPA by 0.9 percentile ranks; a corresponding increase in the size of the ethnic community in the assigned neighborhood has about the same effect, but the effect is less precisely estimated. The effects of the characteristics of the ethnic community are larger among those who arrived before age seven than for those who arrive at an older age.

Had we not accounted for residential self-selection using the placement policy, our conclusions regarding the impact of ethnic concentration would have been very different. Auxiliary regressions suggest that disadvantaged children (in the unobserved sense) are sorted into neighborhoods with a high share of members from their own ethnic group. The sorting bias is so severe that the size of the ethnic community at the time of graduation is negatively related to student outcomes. Sorting bias does not plague the estimate on the educational composition of the ethnic group, however.

The analysis also shows that the effects of the educational composition of peers do not vary by gender or parental education. However, the size of the ethnic community is more important for boys and for children whose parents are less-educated, two groups that have the poorest school outcomes. These results shed light on the sorting bias alluded to above. Having a less-educated family background, for example, is arguably negatively correlated with the unobserved determinants of school outcomes. The results on heterogeneous effects thus suggest that it is rational for students from weak backgrounds to sort themselves into ethnic communities, which, again, is the sorting pattern we observe in our data.

The above results are obtained using neighborhood fixed effects, and thereby implicitly holding the overall population of immigrants constant. In auxiliary regressions, imposing more restrictive assumptions, we also report evidence on how school performance is affected by the size of the total immigrant community. These tentative results suggest that immigrant concentration is detrimental for school performance, but that the positive effects of ethnic concentration prevail.

The remainder of this paper is organized as follows. The next section provides background information on the educational system, how immigrant students perform in Swedish schools, and the placement policy which we base our analysis on. In Section 3, we present the data. Section 4 outlines the empirical strategy in more detail and contains the empirical results. Section 5 concludes.

2 Background

2.1 Immigration and residential concentration in Sweden

Sweden has a large immigrant population: 12 percent (out of a population of 9 million) are foreign-born. Even though Sweden has received net migration since the 1930s, the larger inflows began in the 1950s and 1960s as workers were recruited primarily from Finland, but also from Central and Southern Europe and Turkey. Starting in the 1970s, labor migrants were gradually replaced by refugees and family reunification migrants, a development which accelerated in the 1980s and 1990s. The large refugee inflows have changed the source country composition of the immigrant population dramatically. Parallel to the demographic changes there has been a decline in the economic performance of migrants. Today, Sweden stands out as one of the countries with the largest immigrant-native differentials in the labor market (OECD 2007).

As in other Western countries, the immigrant population is concentrated to certain regions and neighborhoods. Greater Stockholm, Göteborg and Malmö host about one third of the overall population but as much as half of the foreign-born. Within larger regions, immigrants tend to be concentrated to particular areas, usually situated in the suburbs (Åslund et al. 2006). The residential concentration is also reflected in the immigrant share of the neighborhoods populated by the foreign-born.[6] The typical immigrant lives in an area where a quarter of the working-age population is foreign-born, which can be compared to the national average of 12 percent.

Previous studies show that the typical immigrant-dense neighborhood contains a mix of ethnic groups. Such areas are primary united by a shortage of natives (Andersson 2000). Still, different groups are relatively concentrated in different areas; e.g. Iranians constitute a substantially larger share of the foreign-born in Göteborg than in Sweden's other major cities. Also at the finest geographic level this segregation is evident; people have substantially more country-of-origin peers living in their neighborhood than what can be explained by regional

[6] As described in the data section we use SAMS (Small Area Market Statistics) areas to define neighborhoods.

sorting or by a division of immigrants and natives in general. We will return to this issue in the description of our sample of child migrants.

2.2 Immigrants in Swedish compulsory education

Compulsory education is 9 years in Sweden and starts at age 7; the typical age at graduation is thus 16.[7] There is a national curriculum that all compulsory schools follow. After compulsory school a vast majority go on to upper-secondary education where admission is based on compulsory school grades.

We study cohorts graduating the nine-year compulsory school between 1988 and 2003. Within this time-frame, the grading system was reformed. Up until 1998, grades given at graduation were on a scale from 1 to 5 and relative in the sense that the national average for each graduating cohort was to be 3.0. We use the GPA (i.e. the mean of the individual's grades), rounded to one decimal. Given that there are no observations with GPA below 1, there are 40 steps in the GPA for these years. From 1998, grades are on an "absolute" scale, which is to be based on performance only and not related to the achievement of others. Each subject gives one of the following points: 0 (fail), 10 (pass), 15 (pass with distinction), or 20 (pass with special distinction), and the GPA is defined as the sum of the best 16 grades. The maximum score is thus 320, the minimum is 0, and the distribution contains 80 observed steps. Given the differences in the grading system over time, and the fact that there is evidence of grade inflation in the new system (e.g., Cliffordson, 2004), we use the by-cohort percentile ranking of the individual grade and include cohort dummies in all estimations.

Of special interest for our study are the rules for allocating students to schools. Up until 1991, the Swedish compulsory school system assigned students to the school situated nearest to their residential area. This residence principle is still the leading rule on how to allocate students to schools. However, in 1992, the central government introduced a school choice reform, where parents in principle are free to choose their children's school within the municipality. It is important to note, however, that parental preferences are severely constrained by space limitations, and priority is always given to kids residing close to the school. Thus, the assignment of refugee children to neighborhoods to a very large degree determined which schools they attended. Also, since there are far more neighborhoods than schools, controlling for area of residence effectively also means controlling for schools.

[7] See Björklund et al. (2005) for further details on the Swedish education system.

There is ample evidence that immigrant children perform poorly in the Swedish school system.[8] According to PISA 2003, the gap between the Swedish-born and the foreign-born at age 15 amounts 0.7–0.8 standard deviations of the PISA score distribution in math, reading and science (OECD 2006). The gap between the native-born and immigrants is about twice as large as the gender difference in reading. Within the immigrant group, there are big differences depending on time spent in Sweden: those who arrive after age 7 perform substantially worse than those who migrate before age 7 (Böhlmark 2008).

2.3 The refugee placement policy[9]

In 1985, the Swedish Immigration Board was given the task of assigning newly arrived refugee immigrants to an initial municipality of residence. The policy was introduced in response to complaints from cities that had experienced a rise in immigration and perceived this as a burden on local public budgets. By placing asylum seekers in municipalities that had suitable characteristics for reception the government hoped to speed up the integration process.

Because of the large inflow of asylum seekers in the late 1980s, the number of receiving municipalities was increased from 60 to include 277 of Sweden's 284 municipalities in 1989. Available public housing essentially determined the placement. The policy was formally running 1985–1994, but the implementation was strictest between 1987 and 1991. During this period, the placement rate was around 90 percent, and the individuals involved were given very little room to choose the initial municipality of residence. Therefore, we focus our analysis on the 1987–91 period.

Asylum seekers were placed in refugee centers pending a decision from the immigration authorities. The centers were located all over Sweden, and center assignment was independent of port of entry to Sweden. The mean duration between entry into Sweden and the receipt of a permit varied between three and twelve months during 1987–1991. After receiving the permit, municipal placement occurred within a much shorter period of time, partly because there were explicit goals for reducing the time span between receipt of the residence permit and placement. Refugee preferences were considered in the municipal assignment, but individuals applied for residence in the largest cities where there were few vacancies because of the economic boom. Assigning a refugee to a municipality was conditional on having found a vacant apartment within that particular municipality. (Since individuals were assigned to an

[8] See Lundh et al. (2002) and Björklund et al. (2005), for instance.
[9] Edin et al. (2003) contains a more detailed description of the placement policy. As is common in the European context, we do not distinguish refugees from asylees.

apartment, they were in practice assigned to a neighborhood.) After having been assigned to an apartment, refugees were basically free to move. The only "cost" of moving, apart from direct moving costs, was delayed enrolment in language courses.

2.3.1 Placement as a policy experiment

The *a priori* arguments for considering placement as exogenous with respect to the unobserved characteristics of the individual are the following: (i) the individual could not choose his or her first place of residence due the institutional setup, the practical limitations imposed by scarce housing, and the short time frame between the receipt of residence permit and placement; (ii) there was no direct interaction between local placement officers and individual refugees, meaning that any selection must have been on observed characteristics.

With respect to the first point, note that the timing of the receipt of the residence permit must coincide with the arrival of a housing vacancy in the preferred location, if the refugee was to realize his or her most preferred option. The joint probability of these two events happening at the same time must be considered extremely low.[10]

Previous work substantiates the argument that the placement policy did create a geographic distribution which was independent of unobserved individual characteristics. Edin et al. (2003) showed that the overall geographic distribution of those subjected to the placement policy differed from the location choices made by migrants arriving from the same regions shortly before the reform. Åslund et al. (2006) showed that the initial characteristics of the assigned locations differed pre and post reform; but after 9–10 years in Sweden the sorting pattern of those who arrived under the placement policy came to resemble that of other migrants. We take this as evidence that people were not able to realize their preferred option.

A strict test of our assumption that placement is exogenous conditional on the observables is hard to come by since it requires a characteristic which was not exploited by placement officers but correlated with the unobserved ability of the individual. Nevertheless, we have examined whether the share of highly educated in the ethnic community ("ethnic human capital") in the assigned location is correlated with month of birth, which in turn is related to various outcomes (Bound et al. 2000). Figure 1 presents the regression coefficients on dummies for month of birth, along with a 95-percent confidence interval, holding constant the other individual characteristics which potentially influenced placement. There is no systematic relationship between ethnic human capital and month of birth. One of the individual coefficients is close to being significant. But this is not surprising: even if ethnic

[10] Oreopoulos (2003) uses a similar argument to motivate why assignment to a public housing project can be considered exogenous for new recipients of welfare payments in Toronto.

human capital and birth month are randomly associated we would expect 1 of the 11 coefficients to be significant at the 9 percent level.

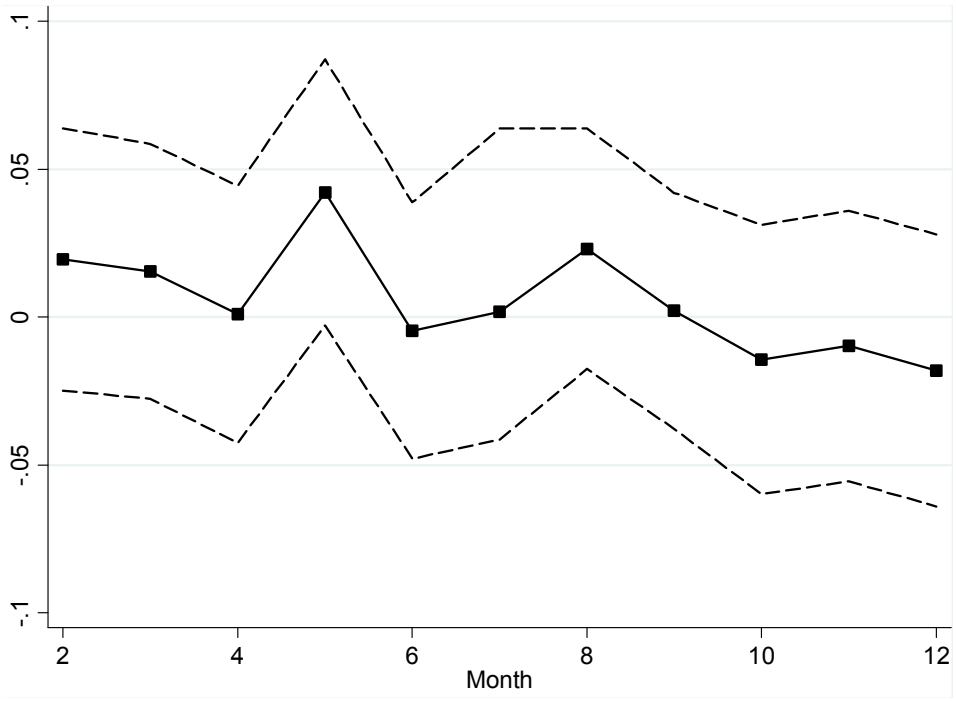

Figure 1 Ethnic human capital in assigned location by month of birth

Notes: The figure shows estimates (solid line, 95 percent confidence interval given by dashed lines) from a linear regression of the share of highly educated in the ethnic community in the assigned location on a set of dummies for month of birth. The model also controls for gender, age at immigration, age of the mother, the educational attainment of the mother as well as the father, family size, country of birth fixed effects, neighborhood fixed effects, immigration year fixed effects, and graduation year fixed effects.

Given the institutional setting, and the information documented here, we think it is valid to assume that the assignment location is exogenous to the child, conditional on his or her observed characteristics. Note that this assumption is less strict than in, e.g., Edin et al. (2003), since child and parental characteristics are not perfectly correlated.[11]

3 Data

We use administrative data covering the entire Swedish population aged 16–65 for each year during 1985–2004. The data originate from administrative registers maintained by Statistics Sweden and contain information on, e.g., labor market status, educational attainment, income,

[11] Estimates of the intergenerational earnings correlation are typically much lower in Sweden than in the U.S. Corak (2006) reports "preferred" estimates for different countries: the estimate for Sweden is 0.27 compared to 0.47 for the U.S.

taxes, and various demographic variables.[12] An important feature of the data is that we can link students to their parents and we are thereby able to include information on several parental characteristics. We define parental characteristics separately for each parent.

Our main sample consists of the children of refugees whose parents obtained their residence permit between the years 1987 to 1991. These children may have graduated from compulsory school between 1988 and 2003. From 1988 and onwards there is information on all final grades for students graduating from Swedish compulsory school. The individuals were between 0 and 16 years of age at migration. We identify refugee immigrants by region of origin and exclude children who did not arrive together with the parent who first came to Sweden. The motivation for excluding these individuals is that they are likely to have immigrated because of family reunification reasons, and these immigrants were exempted from the placement policy.

In this paper we use SAMS (Small Area Market Statistics) areas to capture neighborhoods. SAMS areas are defined as homogenous areas in certain respects; it may be a homogenous area with certain types of buildings—high-rise buildings, owner-occupied housing, or business complexes, for instance. The SAMS are the smallest geographic unit available in Swedish data. Sweden has about 9,000 SAMS areas, which gives an average of 1,000 residents (of which about 600 are of working age). However, the average individual lives in an area with 1,849 inhabitants aged 16–65. Since the foreign-born are concentrated to urban areas it is not surprising to find that the average immigrant lives in a somewhat more populated area; the average immigrant lived in a SAMS area with 2,498 inhabitants aged 16–65.

Since individuals do not enter the data before age 16, we use the assignment location of the parent(s) who arrived together with the child to get information on the first SAMS area. We also measure the characteristics of the location observed in the individual's year of graduation. A potential problem is that we only observe the region of residence at the end of the year. If the observed initial location differs from the actual initial placement due to internal migration, this creates a measurement error in initial placement. This issue has been thoroughly investigated in Edin et al. (2003) where a weighting scheme based on aggregate data on municipal refugee reception from the Immigration Board was used. The estimates

[12] The key registers are the income tax registers (*Inkomst- och taxeringsstatistiken*), population registers (*Registret för totalbefolkningen*), the register on educational attainment (*Utbildningsregistret*), the grade-9 register (*Årskurs-9 registret*), and the multi-generational register (*Flergenerationsregistret*).

from the weighted regressions were very similar to the non-weighted ones, suggesting that this measurement error is not a big concern.

Notice that, by and large, schools aggregate neighborhoods. There are close to 2,000 schools and 9,000 SAMS areas. In principle, it would be interesting to examine whether it is the characteristics of the neighborhood or the school which matter for student achievement. But in practice it will be very hard to disentangle the two. Since the characteristics of the neighborhood will capture the neighborhood as well as the schools, we choose to measure the characteristics at the neighborhood level.[13]

The outcome studied in this paper is the percentile rank (by graduation year) of the compulsory school GPA. Although not perfect, the GPA is the best widely available summary measure of compulsory school performance in Sweden. Furthermore, it is the basis for admission and selection to upper secondary school.

3.1 A description of the sample

Table A1 and Table A2 provide some general descriptive statistics of the estimation sample, containing a total of 20,039 individuals. Not unexpectedly, outcomes are quite poor; the average percentile rank of the GPA is 40. The typical child migrant in the sample was 8 years of age when he/she arrived in Sweden. There are slightly more boys in the sample (53–47) and mean sibship size is close to 3, which is relatively high by Swedish standards.

A fair share (16.5 percent) of the fathers is not present in the data. Among those observed, educational information is unavailable for about 11 (7.6) percent of the fathers (mothers). The observed distribution of education shows that about half the parents have only compulsory education. Thirty percent have some short or long high school, and approximately 20 percent have obtained education at the university level.

It is also clear that there is variation in region of origin. Iranians are the largest group, making up about a quarter of the sample. 17.8 percent originate in Northern Africa, 13.3 percent in Chile. About 20 percent of the individuals have arrived from different parts of Eastern Europe and the former USSR.

The descriptive statistics also show residential concentration among the studied refugees. There is substantial variation in the size of the SAMS population in the sample, but the average is higher than what is observed in the overall population, which is consistent with concentration to larger cities with higher population density. The immigrant share in the

[13] There is some scope for trying to disentangle the effects of school and neighborhood characteristics. Children in some neighborhoods go to different schools, and there is time variation in school catchment areas. But given that there are substantial difficulties in identifying catchment areas, we leave this endeavor for future research.

neighborhood (at the time of graduation) is as high as 31 percent, which is much higher than in the overall population (12 percent). Concentration in the "ethnic" dimension is even stronger: on (a weighted) average, the groups studied constitute 0.6 percent of the working-age population, yet the average "ethnic" share in the neighborhood is 3.2 percent at the time of graduation.

4 How do neighborhood characteristics affect immigrant student achievement?

We begin this section by discussing specification issues and our empirical strategy. We pursue two different specifications. One is designed to estimate the impact of the size of the immigrant community, the other to estimate the impact of the characteristics of the ethnic community, holding immigrant concentration constant. The latter specification constitutes our main empirical approach. We then turn to presenting the results. Section 4.2 examines the impact of the size of the immigrant community in the assigned location. Section 4.3 presents the results pertaining to the characteristics of the ethnic community; the section contains the average effects as well as separate estimates by certain observed characteristics (gender, parental education, and age at arrival), and some robustness checks.

4.1 Empirical strategy and specification issues

To fix ideas, consider the following simple model (where we have suppressed arrival time fixed effects and graduation time fixed effects for convenience).

$$y_{ics} = \alpha x_i + \beta^e \ln X^e_{cs} + \beta^m \ln X^m_s + \beta^p \ln X^p_s + \lambda_s + \lambda_c + \varepsilon_{ics} \qquad (1)$$

where *i* indexes individuals, *c* countries of origin, and *s* neighborhoods (SAMS areas). *y* is the outcome of interest (the percentile ranked GPA), X^j, $j = e,m,p$, denotes the characteristics of the (*e*)thnic community, the (*m*)igrant community, and the (*p*)opulation in the neighborhood. x_i denotes a vector of individual characteristics (the subject's age at immigration, the mother's age, mother's and father's level of education, gender and family size).

Notice that the effects of X^e_{cs} are identified even if we treat λ_s as neighborhood fixed effects, since there is variation across ethnicities within a neighborhood. However, the effects of X^m_s and X^p_s are not, since there is no variation within a neighborhood. This obvious point

demonstrates a trade-off in the analysis: investigation of some issues comes at the price of stronger assumptions for identification.

Indeed, a lot of the (European) policy discussion focuses on the consequences of attending immigrant dense schools or growing up in immigrant dense neighborhoods. To tackle this wider policy question, we replace the neighborhood fixed effects with municipality fixed effects (there are 290 municipalities). The effects of X_s^m, say, are then identified using the variation across neighborhoods within a municipality. The estimates from this specification will not suffer from bias due to individual self-selection, given that the placement policy generates variation in neighborhood characteristics which are independent of unobserved individual characteristics. But there is a potential for bias due omitted variables at the neighborhood level, for instance, due to correlations between unobserved school quality and immigrant density.[14]

The neighborhood fixed effects model imposes a weaker set of assumptions. Therefore we focus on this model and thus elaborate mostly on the importance of the characteristics of the ethnic community.

4.2 The impact of size of the immigrant community

Table 1 reports the results of a barebones model, where we relate immigrant student achievement to the sizes of the ethnic and immigrant communities. In column (1) we present the results from the municipality fixed effects model, while column (2) contains the neighborhood fixed effects model. Throughout we enter the neighborhood characteristics in logs.[15]

[14] Notice, though, that the municipality fixed effects arguably absorb everything related to the labor market.

[15] The log specification is very convenient since it implies that the results are invariant to the precise segregation measure used; see Bertrand et al. (2000) on this point. Although convenient, the log specification comes with a small "price". We encounter some problems when there are no fellow countrymen in the community. We deal with this issue by assigning an arbitrary low value for the size of the ethnic community and then include a dummy variable that indicates no other fellow countrymen. Note that the inclusion of the dummy variable implies that the procedure of assigning arbitrary values to empty cells will not affect the estimate on the neighborhood characteristics. Further, the estimate on the size of the community gives the effect of increasing the size of the community conditional on there being at least one person from one's own ethnic group in the neighborhood.

Table 1 A barebones model

	Dependent variable: Percentile ranked GPA	
	(1)	(2)
Characteristics measured at year of arrival		
Size of ethnic community	.646**	.514*
	(.247)	(.290)
Size of immigrant community	–1.034**	
	(.524)	
Population size	.879	
	(.554)	
(Initial) SAMS FE:s	No	Yes
(Initial) Municipality FE:s	Yes	No
Ethnic group FE:s	Yes	Yes
Year of arrival FE:s	Yes	Yes
Year of graduation FE:s	Yes	Yes
Number of observations	20,039	20,039

Notes: Neighborhood characteristics are measured in logs. The sample consists of refugee immigrants whose parents arrived during the period 1987−1991 and who completed compulsory school not later than 2003. All regressions control linearly for the subject's and the mother's age, with dummies for each parent's educational attainment (five levels), family size, gender and missing values. Standard errors robust for clustering at the SAMS*ethnic group level (5947 cells) in parentheses. ** = significant at 5 % level; * = significant at 10 % level

The interpretation of the estimates in column (1) relies on the assumption that we have not omitted relevant neighborhood variables. The fact that the coefficient on the size of the ethnic community only changes marginally when we move from column (1) to column (2) suggests that omitted variables are not a big concern.

The estimates in column (1) suggest a positive impact of a larger ethnic community. By contrast, there is a negative effect of expanding the immigrant community. Notice that the estimate on the size of the ethnic community captures the effect of replacing an immigrant of another ethnicity with an immigrant of the subject's own ethnicity (since the overall size of the immigrant community is held constant). The estimate on the size of the immigrant community, on the other hand, should be interpreted as the effect of increasing the density of immigrants of another ethnicity (since the size of the ethnic community is held constant).

How should the magnitudes be interpreted? Since the neighborhood variables are entered in logs, a unit change corresponds to increasing the size of the community by around 170 percent.[16] Evaluated at this change, an increase in the size of the ethnic community in the assigned location has the effect of raising immigrant student achievement (at graduation) by 0.65 percentile ranks. An increase in the density of other immigrants would reduce immigrant performance by roughly a percentile rank. On the basis of the estimates, we can also examine what happens to student performance when the size of the ethnic group changes, taking into account that this will also change overall immigrant density. The effect of increasing the size

[16] This is just to say that (exp(1)–exp(0)) ≈ 1.7. Notice that the standard deviation of the log of the size of the ethnic group is 1.3, i.e., it exceeds unity.

of the ethnic community, holding only neighborhood population constant, equals 0.56 which is significant at the 5-percent level (the standard error is 0.23).

4.3 The impact of the characteristics of the ethnic community

Now, let us turn to the impact of the characteristics of the ethnic community. To analyze this issue we focus on the specification including neighborhood fixed effects, a specification which is robust to omitted variables at the neighborhood level.

Column (2) of Table 1 reports the estimates of the "barebones" model, which only includes the size of the own community. As noted, the effect of increasing the size of the ethnic community in the assigned location is positive. But the result does not yield so much insight into why this is the case.

To make some headway into this question we postulate what we think of as a pure peer effects model. Our incarnation of this model is that the student outcomes of immigrant children are influenced by the educational background of the children with whom the potentially interacts, in school as well as in the neighbourhood. In practice we assume that X_{cs}^{e} = (the number of highly educated adults with kids under age 18 in the ethnic community).[17] It is straightforward to decompose this quantity into three components: (i) the number of adult countrymen (aged 25–65) living in the neighborhood (denoted by *N*); (ii) the fraction of these countrymen who are high-educated, i.e. have at least three years of upper-secondary education (which is denoted by *h*); and (iii) the fraction of the highly-educated countrymen in the neighborhood who have kids under age 18 (denoted by π). We thus have $X_{cs}^{e} = (N \times h \times \pi)_{cs}^{e}$. Introducing this expression into equation (1), and attaching a separate coefficient on the components, we get

$$y_{ics} = \alpha x_i + \beta_1^e \ln N_{cs}^e + \beta_2^e \ln h_{cs}^e + \beta_3^e \ln \pi_{cs}^e + \lambda_s + \lambda_c + \varepsilon_{ics} \qquad (2)$$

where we have suppressed X_s^m and X_s^p since they do not vary within neighborhood and are thus picked up by the fixed effects. We emphasize again that the neighborhood variables are measured at the time of immigration, since this is the only time when neigborhood characteristics are exogenous to the unobserved characteristics of the individual. Moreover, we exclude the parent(s) of the individual when calculating the neighborhood characteristics.

[17] We would have liked to have a closer matching between the age of the subject (the immigrant child) and the age range of his potential peers. Since the ethnic communities are so small this not feasible in practice.

The specification in (2) provides a convenient test of what characteristics of the ethnic community are important, and to some extent why. If $\beta_1^e = \beta_2^e = \beta_3^e$, the pure peer effects model applies and it is the number of highly educated parents that have an impact on student performance. The configuration $\beta_3^e = 0, \beta_1^e = \beta_2^e$ may suggest that the neighborhood is important because all adults act as role models. In this case, it is the number of highly educated in the entire ethnic community that matters; there is no additional effect coming from the human capital of the parents. In general, β_2^e measures the impact of increasing the human capital of the community while holding size constant, while β_1^e gives the effect of increasing the size of the community (contact availability) while holding the educational composition constant.

This specification can be seen as a way of estimating the impact of the assignment location invoking a minimum of assumptions. An alternative view is to interpret equation (2) as a reduced form of a structural model where school performance is affected by cumulated peer influences between the time of immigration and the time of graduation (see Åslund and Fredriksson 2008 for further discussion).[18]

4.3.1 Baseline results

Table 2 presents the baseline results relating compulsory school GPA to neighborhood characteristics. The table only reports the results of main interest; the estimates on the other included characteristics are presented in Table A3. These additional covariates exhibit the expected impact. Girls outperform boys by about 8 percentile ranks on average. Parental education has a substantial impact on outcomes: a university educated mother increases the percentile rank by over 11 points relative to a mother with compulsory education (the estimates on father's education have a similar flavor). There are substantial performance differences across birth regions and also patterns suggestive of worse outcomes in larger families, even though these patterns are weaker than what is sometimes found in descriptive studies (Åslund and Grönqvist 2009).

Let us now turn to the estimates of the upper panel of Table 2, where school performance is related to the characteristics of the assigned neighborhood. Both the size and the educational attainment of the ethnic community have a positive impact on performance. There is no additional effect coming from the human capital of the parents. The latter result may be

[18] We do not estimate the structural model since, to identify it, we would have to assume that (i) the entire history of peer characteristics (since immigration) is equally important and (ii) that the characteristics of the assigned location are excludable from the outcome equation. Neither of these two assumptions is particularly attractive.

somewhat surprising. One interpretation is that highly educated adults in the ethnic community act as role-models.

The magnitudes involved suggest that a given change in the educational attainment of the ethnic community is almost twice as important as the size of the community. However, if the estimates are evaluated at the typical variation in the data they are about as important: one standard deviation changes in quality (education) and quantity (size of community) improves student performance by 0.9 percentile ranks. The effect of quantity is less precisely estimated (it is significant at the 10-percent level).

Since the human capital of the parents has no additional effect on student performance, we move on to the more parsimonious specification in column (2). The size of the coefficients is reduced somewhat but the level of human capital in the ethnic community remains statistically significant at the 10-percent level.[19]

Table 2 The relationship between neighborhood characteristics and compulsory school grades

	Dependent variable: Percentile ranked GPA		
	(1)	(2)	(3)
Panel A. Year of arrival			
Size of ethnic community	.647*	.488	.409
	(.330)	(.310)	(.315)
Share with high education	1.141**	.987**	1.120**
	(.511)	(.498)	(.508)
Share of high-educated who are parents	–.209	--	--
	(.668)		
Interaction (size and share high-educated)	--	--	–.078
			(.059)
Panel B. Year of graduation			
Size of ethnic community	–.522**	–.532**	–.680**
	(.228)	(.196)	(.207)
Share with high education	1.256**	1.237**	1.386**
	(.566)	(.519)	(.530)
Share of high-educated who are parents	.295	--	--
	(.533)		
Interaction (size and share high-educated)	--	--	–.120*
			(.065)
(Initial) SAMS FE:s	Yes	Yes	Yes
Ethnic group FE:s	Yes	Yes	Yes
Year of arrival FE:s	Yes	Yes	Yes
Year of graduation FE:s	Yes	Yes	Yes
Number of observations	20,039	20,039	20,039

Notes: Neighborhood characteristics are measured in logs. The sample consists of refugee immigrants whose parents arrived during the period 1987−1991 and who completed compulsory school no later than 2003. Panel A displays estimates of neighborhood characteristics measured at the year of arrival. Panel B shows the corresponding estimates for the year of graduation. All regressions control linearly for the subject's and the mother's age, with dummies for each parent's educational attainment (five levels), family size, gender and missing values. Column (2) presents estimates where the coefficients are evaluated at the mean of the other variable. Standard errors robust for clustering at the SAMS*ethnic group level (5947 cells) in parentheses. ** = significant at 5 % level; * = significant at 10 % level

The interaction between quantity and quality may also matter, i.e., it may be more (or less) important to have high quality peers in a sizable community. Column (3) adds the interaction

[19] An alternative evaluation point is the standard deviation calculated within ethnic groups across neighborhoods (see Table A.1). This evaluation point produces somewhat smaller effects but does not change the relative importance of quantity and quality.

of the two variables to the specification. The point estimate on the interaction is insignificant, and therefore we drop this specification from here on.

The estimates in Panel A of Table 2 are not subject to bias due to residential sorting. To illustrate the importance of sorting bias, Panel B presents results from models where the characteristics of the ethnic community are measured at the time of graduation. The results show that sorting bias is a concern for the estimate on the size of the community: the estimate is statistically significant and has the opposite sign compared to the corresponding estimate in Panel A. Sorting bias does not appear to affect the estimate on the educational composition of the ethnic community.

We noted in the previous section that the studied refugees became more concentrated with time in Sweden. The size of the ethnic community in the neighborhood doubles between the time of arrival and the time of graduation. The results in Table 2 imply that it is primarily less-skilled families (in the unobserved sense) that relocate to neighborhoods where ethnic concentration is higher. This pattern is similar to the findings of Edin et al (2003), who also conclude that sorting inflicts a negative bias on the estimate on the number of peer contacts. Note that we arrive at this conclusion despite having very flexible controls for neighborhood and region of origin.

4.3.2 Analyses by subgroups

We have re-estimated the baseline model of column (2) in Table 2 for some demographic subgroups; the results are presented in Table 3. First we examine if the effects vary by gender. According to the estimates, boys (who perform poorly in school) are significantly influenced by the number of peers, whereas girls are not.

A similar pattern is available in columns (3) and (4), where the size of the community has a positive and significant for children from "non-academic" families (who perform less well in school). The effects of the human capital of the ethnic community do not vary by gender and educational background.

The differential effects of the size of the peer group are interesting and shed some light on the sorting pattern in our data. Boys and children with a less-educated family background perform worse than average in school. The observed determinants of school outcomes are, arguably, positively associated with the unobserved factors determining school performance. The results presented in columns (1) to (4) thus suggest that it may be beneficial for students from weak backgrounds to sort themselves into ethnic communities, which is also the sorting pattern implied by the results in Table 2.

In columns (5) and (6) the sample is split by age at migration. The assignment neighborhood characteristics are only important for children arriving before age seven. This could be interpreted in two ways. First, it could be that skills are shaped at low ages (cf. Cunha and Heckman, 2007). And, second, the estimates could reflect a cumulative effect of peer contacts. Arriving at a young age arguably means longer exposure to the environment captured by the included variable, and thereby a higher treatment dose.

Table 3 Differential effects with respect to background characteristics.

	By gender		By parental education		By age at immigration	
	Boy	Girl	Academic family	Non-Academic family	Up until age seven	After age seven
	(1)	(2)	(3)	(4)	(5)	(6)
Size of ethnic community	1.279**	–.441	–.121	.946**	1.284**	–.543
	(.396)	(.450)	(.473)	(.454)	(.449)	(.409)
Share high educated	1.358**	1.091	1.521*	1.169*	1.903**	–.514
	(.619)	(.697)	(.892)	(.690)	(.731)	(.644)
(Initial) SAMS FE:s	Yes	Yes	Yes	Yes	Yes	Yes
Ethnic group FE:s	Yes	Yes	Yes	Yes	Yes	Yes
Year of arrival FE:s	Yes	Yes	Yes	Yes	Yes	Yes
Year of graduation FE:s	Yes	Yes	Yes	Yes	Yes	Yes
Mean (sd) of the dependent variable	36.60 (26.86)	44.78 (28.54)	48.13 (28.52)	33.67 (25.63)	44.08 (28.27)	37.01 (27.22)
Number of observations	10,598	9,441	9,407	10,632	9,767	10,272

Notes: Neighborhood characteristics are measured in logs. The sample consists of refugee immigrants whose parents arrived during 1987−1991 and who completed compulsory school no later than 2003. Where appropriate, the regressions control linearly for the subject's and the mother's age, with dummies for each parent's educational attainment (five levels), family size, gender and missing values. Standard errors robust for clustering at the SAMS*ethnic group level (5,947 cells) in parentheses. "Academic family" is defined as having at least one parent who has completed at least university preparatory upper-secondary school. ** = significant at 5 % level; * = significant at 10 % level.

4.3.3 Robustness checks

We have performed a number of robustness checks to investigate whether our results are sensitive to changes in sample composition, specification or outcome measure. In this section we discuss the results from these exercises.

One concern is that neighborhood effects may be non-linear. For instance, the effect of living in an ethnic enclave might matter more for individuals residing in very highly segregated areas. To examine this we ran regressions including quadratic terms for our key variables of interest. It turns out that the estimates on the non-linear terms are not significantly different from zero.

Another concern is that small source countries have been aggregated for confidentiality reasons in our data. Treating such regions as a single "country" obviously introduces measurement error in our analysis. We therefore re-estimated our models for individuals for whom we can uniquely identify country of origin. It turns out that the coefficients are not statistically significantly different from our baseline estimates.

We also experimented with alternative outcome variables. One relevant question is whether segregation influences host country language skills. We have therefore run regressions where the outcome is grade in Swedish.[20] The results suggest that there is no impact of ethnic peers for Swedish grades: the estimate on the size of the community is –0.01 (with a standard error of 0.28) and the estimate on the share high educated is 0.52 (with a standard error of 0.45). The weaker effects for this particular outcome can be interpreted in several ways. If it is the human capital of the ethnic peers that matters, it is reasonable that we estimate smaller effects where adults have less to contribute; another contributing factor is that there may be weaker incentives to learn the host country language in ethnic neighborhoods.

Finally, we have investigated to what extent ethnic concentration affects the probability to finish school on schedule. In fact, 22 percent of our sample finish 9th grade later than "normal". It turns out that these estimates are very imprecise. There is no evidence that peer characteristics influence the probability to graduate in time.

5 Concluding remarks

This paper studies peer effects in compulsory school performance among immigrant children in Sweden. To handle sorting in the residential market, the analysis uses a governmental refugee placement policy in place in the late 1980s and early 1990s.

The results show that peers matter. The size of the local ethnic community is positively related to compulsory school grades. Separating this effect into its components, we find that a higher level of education among fellow countrymen in the assigned neighborhood has a positive effect: A standard deviation increase in the fraction of highly educated peers raises student performance by 0.9 percentile ranks. A standard deviation increase in the size of the ethnic community has about the same effect, but the effect is less precisely estimated.

Is this a small or large effect? At first glance, it may seem small relative to the importance of individual or family characteristics. For instance, it corresponds roughly to a tenth of the grade difference between refugee immigrants and the native-born in our data. But we think it would be a mistake to conclude that the characteristics of the neighborhood are largely irrelevant. Whether the magnitudes involved should be interpreted as small or large depends on the true structural model relating student performance to neighborhood or peer characte-

[20] These estimates should be interpreted cautiously since immigrant students are allowed to choose between two different tracks: a standard track and a special track for immigrants. This introduces a potential selection problem; however, we find no evidence suggesting that the ethnic network affects the choice of track.

ristics. Any human capital model would imply that the entire history of peer characteristics is relevant. In our setting, the majority of the families (some 75 percent) escaped "treatment" by moving out of the assigned neighborhoods. Under reasonable assumptions, this implies that our estimates on initial neighborhood characteristics are lower bounds on the true effects in the structural human capital model.

We have also presented some evidence on the importance of handling the problems associated with residential sorting in studies relating contextual variables to individual outcomes. Like some previous studies on adult migrants (Edin et al. 2003, Åslund and Fredriksson 2008), we find that one is likely to infer—erroneously—that the number of peer contacts has a negative effect on school performance if sorting bias is not addressed appropriately. In this respect, our analysis of heterogeneous effects reveals an interesting pattern. Disadvantaged students/families gain more by having many peers around than other students/families. And it is also these families that move to ethnically concentrated areas. The sorting pattern thus appears to be rational from the point of view of the disadvantaged groups.

Our baseline estimates answer questions concerning the impact of varying the size and characteristics of one's own ethnic group holding the other characteristics of the neighborhood constant. We also attempt to study the broader issue of immigrant segregation. Taken at face value, the results suggest that an immigrant-dense environment has a negative impact on student performance. While tentative, these results raise interesting questions. Establishing what lies behind these estimates is an important area for further study.

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Appendix

Table A1 Summary statistics

Variable	Mean	Standard deviation
Subject:		
GPA (percentile rank)	40.45	27.96
Age (in 2003)	21.95	3.84
Age at immigration	8.00	3.8
Female	.47	.50
Sibship size	2.99	1.56
***Mother*:**		
Age (in 2003)	47.38	6.39
Education: Compulsory school	.50	.50
Upper secondary school ≤ 2 years	.14	.34
Upper secondary school > 2 years	.17	.38
University ≤ 2 years	.11	.31
University > 2 years	.08	.28
***Father*:**		
Age (in 2003)	51.48	6.99
Education: Compulsory school	.42	.49
Upper secondary school ≤ 2 years	.14	.35
Upper secondary school > 2 years,	.17	.38
University ≤ 2 years	.12	.33
University > 2 years	.15	.35
Regional characteristics: Year of arrival		
Share high-educated in own group	34%	
Share high-educated in immigrant group	31%	
"Ethnic" concentration	1.6%	
Immigrant concentration	19%	
Population size	1528	
ln(share high-educated in own group)	–1.016	.758*
		[0.520]
ln(size of ethnic community)	2.372	1.445*
		[1.100]
ln(size of immigrant community)	4.830	1.217*
		[0.769]
Regional characteristics: Year of graduation		
Share high-educated in own group	39%	
Share high-educated in immigrant group	38%	
"Ethnic" concentration	3.2%	
Immigrant concentration	31%	
Population size	2012	

Notes: The regional characteristics are defined with respect to the adult population aged 25-65. Summary statistics for each parent's educational attainment is conditional on having found this information in the records. * The standard deviations are calculated excluding "empty cells", i.e., excluding the observations where there is no other immigrant from the same source country in the neighborhood. The standard deviations within square brackets correspond to the standard deviation within ethnic group across neighborhoods.

Table A2 Region of birth

Region of birth	Percent of sample
1. Former Yugoslavia	5.2
2. Poland	5.5
3. The Baltic states (Estonia, Latvia, Lithuania)	0.3
4. Eastern Europe 1 (Rumania, The former USSR, Bulgaria, Albania)	6.0
5. Eastern Europe 2 (Hungary, The former Czechoslovakia)	2.4
6. Mexico and Central America (El Salvador, Mexico Other countries)	1.6
7. Chile	13.3
8. Other South America (Peru, Brazil, Colombia, Argentina, Uruguay, Other countries)	2.0
9. African Horn (Ethiopia, Somalia, Sudan, Djibouti)	5.0
10. North Africa (Arabic countries) and Middle East (Lebanon, Syria, Morocco, Tunisia, Egypt, Algeria, Israel, Palestine, Jordan, Other countries)	17.8
11. Other Africa (Gambia, Uganda, Zaire Ghana, Other countries)	1.1
12. Iran	25.5
13. Iraq	4.8
14. Turkey	3.8
15. South East Asia (Vietnam, Thailand, the Philippines, Malaysia, Laos Other countries)	3.9
16. Other Asia (Sri Lanka, Bangladesh, India, Afghanistan, Pakistan)	1.7
Total	100

Table A3 Estimates on individual characteristics for specification in Table 2, column (2)

	Dependent variable: Percentile ranked GPA
Individual characteristics:	
Female	8.137**
	(.371)
Age at immigration	–4.694**
	(.429)
***Mother characteristics*:**	
Age	.124**
	(.040)
Education: Compulsory school	--
High school ≤ 2 years	4.716**
	(.800)
High school > 2 years	5.886**
	(.732)
University ≤ 2 years	11.339**
	(.897)
University > 2 years	13.561**
	(1.039)
Missing education	.729
	(.939)
***Father characteristics*:**	
Missing father	1.237
	(1.057)
Education: Compulsory school	--
High school ≤ 2 years	3.475**
	(.848)
High school > 2 years	3.443**
	(.792)
University ≤ 2 years	8.061**
	(.880)
University > 2 years	11.697**
	(.905)
Missing education	–1.865**
	(.932)
Family size FE:s	Yes
(Initial) Municipality FE:s	Yes
Ethnic group FE:s	Yes
Year of arrival FE:s	Yes
Year of graduation FE:s	Yes
Number of observations	20,039
R-squared	0.335

Notes: Estimates on individual characteristics for the specification in Table 1, column (1). The sample consists of refugee immigrants whose parents arrived during the period 1987−1991 and completed compulsory school not later than 2003. The regression also controls for the regional characteristics listed in Table 1, column (1) and indicator variables controlling for the SAMS*(ethnic group) "cell" having no observations. Standard errors are robust for clustering at the SAMS*ethnic group level (5947 cells) in parentheses. ** = significant at 5 % level; * = significant at 10 % level.