School Choice and Its Long-Term Impact on Social Mobility in Sweden
Anders Trumberg and Susanne Urban

ABSTRACT
Sweden possesses a highly deregulated school system in which students in the compulsory school system are free to choose almost any school they prefer. This study focuses on the long-term difference in educational level twelve years after finishing elementary school for students who made a school choice compared to those who did not. The study uses the Voronoi method of estimating school choice and is based on detailed register-based data for all students that finished elementary school in Sweden in the years 2000-2002. The results confirm previous findings that the most resourceful families more often make active choices. However, those who made an active school choice seem to have lower future educational achievement. The exception are those who have foreign-born parents, and those living in low-resource areas, who made an active school choice. They have a more positive educational achievement compared to those who stayed in the closest school.

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Introduction
Proponents of school-choice reforms argue that the opportunity to choose improves opportunities for social advancement and leads to decreasing ethnic and socioeconomic segregation in schools (Chubb & Moe, 1990; Hoxby, 1998, 2003a; Schneider et al., 2000). However, a concern exists that the expansion of school choice will help students from more-advantaged family backgrounds leave schools with less-advantaged social compositions and with lower proportions of natives, thereby reinforcing socioeconomic and ethnic school segregation (Shavit & Blossfeld, 1993), which will facilitate socioeconomic segregation (Holmlund, 2016; Söderström & Uusitalo, 2010; Stubbs & Strathdee, 2012).

Sweden represents a case with an almost total turnaround from school assignment based on attendance areas to a so-called free school choice. The effects of this system have previously been studied in terms of school segregation and long-term effects for students. One of the challenges is to distinguish students that make an “active” school choice from those that go to the same school that they would have attended if school assignment was based on attendance areas.

This study uses data from three cohorts of students that finished elementary school in 2000–2002 and follows them in 12 years. First, we present the Voronoi method for measuring school-choice behavior in the Swedish context. Second, we describe the distinguishing factors of those who actively engage in school choice (i.e., do not choose the closest school) and how the school they choose differs from the school from which they opted out. Third, the study explores whether an active school choice...
choice is associated with higher educational achievements for students in the long run. Is it possible to counteract intergenerational social predispositions through the active choice of an elementary school?

**Background**

As in many countries, the Swedish school system has undergone major changes. One such change, which also paved the way for the forthcoming school choice reform, occurred when the responsibility for compulsory school shifted from the government to the municipalities in the late 1980s. The restructuring continued in 1992, when the government introduced the school-choice opportunity and subsequently eased regulations regarding independent schools (schools owned by companies or foundations but financed by the government through a voucher system).

This policy represented a break from previous school reforms; the government allowed the municipalities to take over and was no longer the guardian of equality and equivalence (Lidström & Hudson, 1995; Sundberg, 2005; Wahlström, 2002). Sweden currently has very few regulations concerning choice; the system is managed at the municipality level (290 municipalities), and generally, those who do not make a choice are automatically enrolled in a school closest to their homes. Today, the school-choice system in Sweden is considered one of the most decentralized globally (OECD, 2012; Trumberg, 2019).

**Theory and Previous Research**

**School Choice and the Effect on School Segregation**

Proponents of school-choice reforms argue that school choice will improve opportunities for social advancement among people who live in school attendance areas with low social resources, that the increased competition would lead to better quality in schools (Hoxby, 2003b; Sandström & Bergström, 2005), and that the school-choice reforms would have a decreasing effect on ethnic and socioeconomic segregation (Chubb & Moe, 1990; Hoxby, 1998, 2003a; Schneider et al., 2000).

Conversely, other studies have shown that people with greater family resources more often engage in school choice (Alves et al., 2015; Bagley et al., 2001; Dustmann, 2004; Ladd, 2003) and that the socioeconomic and ethnic compositions of schools are important drivers of school choice (Alegre & Ferrer, 2010; Billingham & Hunt, 2016; Holmlund, 2016). Therefore, a concern exists that the expansion of school choice will instead reinforce socioeconomic and ethnic school segregation (Shavit & Blossfeld, 1993).

Research on family preferences when selecting schools shows a heterogenic pattern. Parents do not always prioritize school effectiveness; other aspects are considered more important, such as proximity. Access to information is also of importance (Burgess et al., 2014; Thelin, 2019).

Effects of school choice, in terms of increased ethnic and socioeconomic segregation between schools, are relatively well described in studies using data from several countries (Bellei & Vanni, 2015; Bifulco & Ladd, 2007; Bunar, 2010; Holmlund, 2016; Karsten, 2011; Ladd et al., 2010; Mizala & Torche, 2012; OECD, 2012; Rowe & Windle, 2012; Savage et al., 2013; Stubbs & Strathdee, 2012; Veerman et al., 2013). Several studies have also identified interschool segregation in terms of achievement and grades tends to increase (Hansen & Gustafsson, 2016; Hsieh & Urquiola, 2006; Östh et al., 2013; Söderström & Uusitalo, 2010).

Lindbom (2010) concluded that “it cannot be ruled out that school choice has added somewhat to the (more significant) effect of residential segregation” (p. 628). Recent studies on Swedish data have confirmed, on the one hand, that segregation between schools has increased more than segregation between neighborhoods and that school choice has an impact on school segregation (Andersson et al., 2012; Böhlmark et al., 2015; Holmlund, 2016). On the other hand, Holmlund (2016) showed that there was no general reduction in student grades (used as a proxy for future labor outcomes) after the introduction of school choice.
School Choice and Social Mobility

School choice is expected to improve students’ social capital and learning outcomes as well as students’ future socioeconomic trajectories. The expectation that school choice could be an individual opportunity to level the playing field rests on the assumption that individuals are affected by the schools they attend (Chubb & Moe, 1990; Coleman, 1992).

This expectation could be motivated by varying quality of schools (for example pedagogical quality) or by the social composition and social capital among students and parents. Socialization processes between students are expected to affect their attitudes and ambitions as well as social and cultural capital (Bourdieu, 1986; Coleman, 1988, 1990).

A number of studies have shown that the school context is related to educational achievements (Johnson, 2012; Konstantopoulos & Borman, 2011; Lee, 2000; Raudenbush & Willms, 1995). Most of these studies focus on academic achievement as measured by various tests (Hanushek et al., 2009; Rumberger & Palardy, 2005). Some studies have also found that school-context factors influence educational attainment and school non-completion (McDermott et al., 2019; Rumberger & Lim, 2008). Studies examining school effects over a longer time-perspective are rather limited. Chetty et al. (2011) studied the effect on students of the STAR Project in Tennessee. Between 1985 and 1986, 6,232 kindergarten children were randomly assigned to schools with better-quality classrooms (better teachers and peers and smaller class sizes), where they remained until third grade. This study found that these individuals earned more and were more likely to attend college and to live in better neighborhoods at age 27 than those who did not change kindergarten.

Wondratschek et al. (2013), using registry-based data from Sweden, explored the long-term effects of parents’ decisions to make active school choices and found very small but positive effects on grades at the end of compulsory schooling but virtually no effects on longer-term outcomes, such as university education. When Edmark et al. (2014) attempted to measure the effects of school-choice opportunities on different subgroups using the same method used by Wondratschek et al. (2013), they found small effects suggesting that the students who benefit most from school choice are those from disadvantaged groups, such as students from low-income families. The results indicate that students from socioeconomically disadvantaged or immigrant backgrounds are not negatively affected by school choice (Edmark et al., 2014). The neighborhood’s socioeconomic status is also seen as an important factor in predicting educational success. However, this perspective does not guarantee educational success for students from less resourceful neighborhoods who attend schools with students from more resourceful neighborhoods (Owens, 2010).

Educational Achievement for the Foreign-Born

Jonsson and Rudolphi (2011) conclude that children of immigrant origins perform worse and enroll less often in upper secondary school than other students in Sweden, but that, after controlling for family background, almost all minority ethnic groups have been found to have higher transition rates (Jackson et al., 2012; see also Urban, 2012). Those enrolling in upper secondary school also have a higher propensity to choose academic studies and can take advantage of a choice-driven educational system (Jackson et al., 2012). Jackson et al. (2012) conclude that performance effects reduce the educational achievement of most ethnic minorities but that choice effects increase the transition rates of students.

Data and Method

Our study is based on registry data representing the entire population of Sweden compiled in the database Geosweden. We selected all individuals in Sweden who finished ninth grade in 2000, 2001 and 2002, and these students were followed for 12 years until 2012, 2013 and 2014, when most of them were 27 years of age, to observe their educational achievements in the long term. We also used data regarding their parents. Data on the schools were aggregated with individual data on the students and their parents. Data for all three cohorts were pooled into one dataset.
The original data file including all individuals who completed ninth grade in 2000, 2001 or 2002 included 283,237 individuals. After omitting those who did not remain in the database after 12 years and those who had missing information on one or several variables, 265,385 students were included in the dataset.

The analysis is made in four steps. First, we develop a method to estimate the school attendance area to measure school choice. Second, we compare those who made a school choice with those who did not. Third, we construct a logistic regression to explore how individual, family and residential area characteristics are related to school choice. Fourth, we make ordered logistic regressions including interaction effects with an indicator for “made a choice” (hereafter called Voter) to explore the long-term differences in educational achievement from school choice after controlling for individual, family and residential area-based characteristics.

**Dependent Variable**
The dependent variable measures the highest registered educational level 12 years after finishing ninth grade. The educational level is measured in seven levels (see Table 2). Data are from the educational register. The quality of the register is fairly good with regard to educational achievements in Sweden but can have missing information for educations obtained abroad.

**Measuring School Choice**
The most important independent variable is the indicator for having made a school choice or not (“Voter” or “Stayer”). We also treat this as a dependent variable in the third step of the analysis.

Because neither the real attendance area for all schools in the years 2001–2003 nor centralized data on choices made at the compulsory level are accessible, we apply the Voronoi method to approximate the attendance area of each school. This method considers that schools in Sweden use proximity to assign students to their home schools. This process means that students who do not make a school choice automatically are assigned to the schools nearest their homes. This method therefore allowed us to compare students who made a school choice and those who did not.

We used school coordinates to create polygonal areas (Voronoi) around the schools using a GIS program (MapInfo). Figure 1 shows the method (in this case, we show an area of central Sweden). First, we mapped the schools. The schools are the black squares in the first picture. Then, we created Voronoi polygons around each school, which were treated as the schools’ attendance areas. The Voronoi polygons were developed to delineate the nearest surrounding, nonoverlapping area around each school. These Voronoi polygons were used as an estimate of the schools’ attendance areas and described the closest school to a student’s home. In the last step, we used coordinates of the students’ home addresses to locate the attendance areas in which the students lived (the gray dots in the last picture). If the student was registered at the nearest school and lived in the corresponding attendance area, we assumed that no school choice had been made. If the student lived in one Voronoi area but was registered in a different school attendance area, we assumed that a school choice had been made.

The results should be interpreted with some caution: the Voronoi method can be used only to estimate potential school choices because the method uses only proximity to a school as a parameter for school choice and does not consider the true administrative borders of a neighborhood. Alternative methods could have been used, such as that of Wondratschek et al. (2013) and Edmark et al. (2014), who compared cohorts who had completed obligatory school before the school-choice reform of 1992 against cohorts who had completed obligatory school afterward. They used the difference between the number of schools within commuting distance (in relation to the median in the municipality, an average of 5 km) before and after the reform as a measure of students’ choice opportunities: whether the supply of schools within commuting distance had increased or decreased. They then controlled for a number of factors, such as the number of available schools in the area, regional- and individual-level covariates, the municipality and cohort fixed effects.

The most obvious advantage of our method compared with the method used by Wondratschek et al. (2013) and Edmark et al. (2014) is that dependent and independent variables are measured in
the same years for individuals who make a school choice and those who do not. We can therefore rule out time-period bias. We also know which schools the students were attending and can estimate the attendance areas around every school; therefore, we had a more certain way of measuring the level of school choice. Another method used by Östh et al. (2013) is to draw concentric curves at 50-m intervals around a school and assign students living within each 50-m interval to the school, thus, filling the school to its capacity. This method creates attendance areas of size and shape similar to those formed using the Voronoi method. A similar method is used by Allen (2007), who used zipcodes instead of concentric curves.

We compared the Voronoi method against other methods of estimating attendance areas. The tests were performed using data from the municipality of Örebro, for which we had access to the true attendance areas for seventh through ninth graders in 11 schools in 2015 (1,448 students). We did not have access to real data for students who made a school choice in the municipality, only the real attendance areas. We calculated the proportion of students who went to schools in the real attendance areas; if the students did not live in the same attendance areas as where they went to school, we categorized them as having engaged in school choice. This proportion was compared with those who made a school choice when the attendance area was estimated using the following approaches: (i) the Voronoi method; (ii) the 50-m-interval method of Östh et al. (2013); (iii) an alternative method of concentric curves at 10-m intervals and actual attendance at schools, which was designed to simulate attendance areas of various sizes for each school; (iv) a method using so-called small areas of market statistics (SAMS)\(^1\); and, finally, (v) a method based on students’ mean distances to schools.\(^2\) The proportions of students who were regarded as having made a school choice using the true attendance areas and using the other methods are compared in Table 1.

The Voronoi method we used yielded the closest approximation to the true proportion of school choice. We therefore regard the method as one of the most accurate methods. The estimate is, however, greater than the true value; therefore, it can be expected to slightly overestimate school choice when applied to Sweden as a whole.

The sizes of the estimated attendance areas using the Voronoi method also depend on how closely adjacent schools are located to one another. Consequently, the estimated attendance areas in urban

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\(^{1}\)SAMS’ areas divide Sweden into approximately 9200 areas, and the boundaries often coincide with neighborhood boundaries.

\(^{2}\)The method based on students’ mean distance (v) created attendance areas that were too large and overlapping; thus, they could not be used properly in this test.
areas are smaller than those in rural areas. This might have an impact on the result, in particular effects from the metropolitan areas. The shapes of the attendance areas and how they affect the results are also mentioned by Allen (2007), who concluded that the fact that so many students in her study did not attend the school nearest to their home could probably be attributed to the shape of the estimated attendance areas.

Control Variables
Other independent variables included in the analysis are gender (female or male), migration background (born in Sweden with two foreign-born parents or foreign-born), parents’ income and educational levels, metropolitan area, and characteristics of the residential area.

Fathers’ disposable incomes are divided into three groups: those with approximately 25% lowest and highest incomes are classified as low and high incomes; those in between are average incomes. Residential areas are described by aggregated characteristics of students and their parents in the same attendance area in which they live. Areas were categorized as low-resource areas according to the following criteria: 20% of students with the lowest attendance area average for fathers’ incomes, 20% with the lowest average for fathers’ educational levels, and 20% with the lowest proportion of those born in Sweden. Areas categorized as low-resource Sweden fulfill the same criteria for fathers’ incomes and fathers’ educational levels but include 80% of the higher proportion born in Sweden in the attendance area. High-resource areas include those among the 20% with the highest attendance area average of fathers’ incomes and the 20% with the highest average fathers’ educational levels. Average areas include the rest of the students.

Descriptive Statistics on the Population and Differences Between Stayers and Voters
According to the Voronoi method, we characterize 33.6% of the sample as having made a school choice (32.2%, 33.7%, and 34.7% for the 2000, 2001, and 2002 cohorts, respectively). Table 2 shows the distribution of the different characteristics on individual and family level and type of residential area by voter and stayer. Voters are more often female, more often have immigrant backgrounds, mothers with higher levels of education, and parents with higher income compared to stayers. The differences are small but most often statistically significant (except for the two categories of mother’s education: missing information, and secondary education more than 2 years but a maximum of 3 years, and cohort 2001) and are significant on at least the 95% level.

Table 3 shows logistic regressions for the odds to be a voter, separately by migrant background. Females are more likely to make a school choice compared to males, which is significant for the total sample and for those born in Sweden with at least one parent born in Sweden, but not significant for the two migrant background groups. Having a mother with a higher level of education is generally associated with higher odds of being a voter. For instance, students with a mother with postsecondary education 3 years or longer are 1.13 times more likely to be a voter compared to those with a mother with missing information on education. The odds ratio for the mother’s level of education for students born in Sweden with at least one parent born in Sweden was not significant after

| Method | School choice (%) | Percent "correct" |
|--------|-------------------|-------------------|
| True attendance areas | 42.3 | 100.00 |
| (i) Voronoi | 47.8 | 90.33 |
| (ii) Concentric zones at 50-m intervals, with the school filled to capacity (see Östh et al., 2013) | 48.9 | 89.47 |
| (iii) Buffer weighted by 1 student = 10 m | 68.8 | 67.70 |
| (iv) SAMS | 74.5 | 64.70 |

Proportions of individuals were defined as Voters and Stayers in the same manner as by True attendance areas. All methods are significantly different from the True attendance areas (CHI2 test). The differences between (i) and (ii) are also significant.
controlling for the father’s income. Having a father with a high income was slightly negative for the odds to be a voter for those born in Sweden with at least one parent born in Sweden, but positive for those with a migrant background. Foreign-born students with fathers in the highest income category are 1.25 times more likely to be a voter compared to those with fathers in the lowest income category.3

It is more common to be a voter in all three of the largest metropolitan regions compared to other parts of the country. This is significant for all migrant backgrounds.

The types of residence areas are clearly associated with voting behavior, but they differ due to migrant background. All backgrounds have higher odds to be a voter if they live in a high-resource area. Students that are born in Sweden with at least one parent born in Sweden and live in a low-resource area are more than 1.5 times more likely to be a voter compared to those that live in average areas, but those with a migrant background have lower odds to be a voter if they live in these areas compared to other areas. Those living in a low-resource area with a high proportion of native-born individuals are less likely to be voters for those born in Sweden with at least one parent born in Sweden, and foreign-born, but the results were not significant for those born in Sweden with foreign-born parents.

The comparison between the backgrounds of those who made a choice and those who did not confirm previous studies that concluded that individuals with more-advantaged backgrounds are more likely to make a choice. Students with migrant backgrounds are overrepresented among those who made a choice.4

3The regressions are also run with nontransformed earnings and include those with zero earnings. The conclusions are the same, but these models have somewhat poorer fit.
Those who arrived after the first year in school will have different conditions for school choice. They may have less access to information and be less interested in changing their environment (almost half of the foreign-born students arrived in Sweden after 1991, 1992, and 1993 (i.e., after school started)). However, the proportion of school choice did not differ between newly arrived students and those who arrived before school started.

In Table 4, we compare the school characteristics in the schools the students attended with the characteristics for the school in the attachment area where they live (only for voters; stayers have no difference). We conclude that voters on average chose to attend a school with a higher median for fathers’ incomes and a higher level for fathers’ educational levels. The differences in the means of fathers’ incomes are highest among those with foreign-born parents and were similar for non-migrant-origin and foreign-born students. On average, the foreign-born voters had a smaller proportion of students born in Sweden in their schools compared to the closest school, whereas second-generation students and those born in Sweden slightly increased the proportion born in Sweden by their school choice. Here are some examples to get an impression of the sizes of these differences: Voters born in Sweden with native-born parents, on average, go to schools where the father’s average income from work is 23,300 SEK/year higher, which is approximately one-tenth

| Table 3. Logistic regression for Voters by gender, level of education of mother, residential region and type of neighborhood for all and separately by migrant background. |
|----------------------------------|----------------------------------|----------------------------------|
|                                    | All                              | Born in Sweden with at least one parent born in Sweden | Sec gen, born in Sweden with both parents born abroad |
|                                    | OR SE                            | OR SE                                | OR SE                                      |
| Female                             | 1.09*** 0.01                     | 1.11*** 0.01                         | 1.05 0.04                                 |
| Mother’s education, missing = ref  | 0.91 0.06                         | 0.98 0.22                            | 1.21 0.26                                 |
| Compulsory education, less than 9 years |                                 |                                     |                                           |
| Compulsory education, 9 (10) years (equivalent) | 1.02 0.06                         | 1.05 0.24                            | 1.25 0.27                                 |
| Secondary education, maximum of 2 years | 1.01 0.06                         | 1.01 0.23                            | 1.47 0.31                                 |
| Secondary education, more than 2 years but no more than 3 years | 1.07 0.06                         | 1.07 0.24                            | 1.87 0.40                                 |
| Postsecondary education, less than 3 years | 1.13* 0.07                        | 1.13 0.26                            | 1.93** 0.42                                |
| Postsecondary education, 3 years or longer | 1.25*** 0.07                      | 1.26 0.28                            | 1.95** 0.42                                |
| Postgraduate (PhD) education       | 1.51*** 0.13                     | 1.42 0.33                            | 3.41** 1.27                                |
| FatherIncGr3                        |                                  |                                     |                                           |
| Father med inc                      | 0.86*** 0.01                     | 0.85*** 0.01                         | 0.94 0.04                                 |
| Father high inc                     | 0.96** 0.01                      | 0.94* 0.01                           | 1.12* 0.05                                |
| Stockholm                           | 1.96*** 0.02                     | 2.01*** 0.02                         | 1.88*** 0.08                              |
| Göteborg                            | 1.63*** 0.02                     | 1.55 0.03                            | 1.25*** 0.16                              |
| Malmö                               | 1.18*** 0.02                     | 1.04*** 0.02                         | 1.76*** 0.12                              |
| HighResource                        | 1.17*** 0.02                     | 1.18*** 0.02                         | 1.17*** 0.07                              |
| LowResource                         | 1.23*** 0.03                     | 1.68*** 0.05                         | 0.88* 0.04                                |
| LowResourceSWE                      | 0.66*** 0.01                     | 0.66*** 0.01                         | 0.99 0.12                                 |
| _cons                              | 0.38*** 0.02                     | 0.38*** 0.09                         | 0.26*** 0.06                              |
| PseudoR2                            | 0.0235 0.0264                    | 0.0269 0.0269                        | 0.0269 0.0269                            |

| Table 4. Difference between school characteristics for the actual school and the expected school; standard error in parenthesis. |
|----------------------------------|----------------------------------|----------------------------------|
|                                    | Difference in median father’s earnings | Difference in mean father’s level of education | Difference in mean proportion born in Sweden |
| All, n = 89,100                   | 142.78 (2.40)                     | 0.117 (0.0002)                    | 0.022 (0.000)                              |
| Born in Sweden and at least one parent born in Sweden, n = 76,143 | 139.00 (2.42)                     | 0.097 (.0021)                     | 0.024 (.0000)                              |
| Born in Sweden and both parents foreign-born, n = 5537  | 233.07 (13.43)                    | 0.206 (0.009)                     | 0.038 (0.003)                              |
| Foreign-born, n = 7420            | 112.45 (10.51)                    | 0.124 (0.008)                     | −0.011 (0.002)                             |

Note: Only for voters. All areas different from 0 at a 95% confidence level.
of the average annual income from fathers in the sample. The same voters go to a school where fathers have 0.2 steps higher levels of education. A voter born in Sweden with native-born parents increases the proportion born in Sweden in the school by 2 percentage points, and a foreign-born voter decreases the proportion by 1 percentage point.

Given these differences between students who make a school choice and those who do not, the expected transmission of social status between parents and their children, and the differences between the chosen school and the unselected school, we expected that students who made a choice would succeed better in the school system and achieve higher educational levels. However, Figure 2 shows that the difference between those who made a choice and those who did not is negligible, even without controlling for family and individual characteristics.

Educational Achievement 12 Years After Ninth Grade

We now turn to ordered logistic regressions to explore whether the differences are larger in educational achievement between students who make a school choice and those who do not when considering parental and individual characteristics and characteristics of the area of residence. The results are shown in odds ratios, which are to be interpreted as the proportional odds for students in a lower educational level to have a higher level of education for each one-unit change in the predictor variable. For instance, females have almost twice the odds to have higher education compared to males. A person that is characterized as a voter has relative odds that are less than one to have a higher level of education compared to stayers.

We used stepwise inclusion of the independent variables voter (the indicator for having made an active school choice), individual and parents’ characteristics (migration background, gender, mothers’ educational levels), metropolitan area, and type of residential area for our whole sample. We also added interaction effects with voter for all of the independent variables. The results are

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4 In a model with the same variables as in Table 3, but with inclusion of the immigrant categories, we found that the odds to be a voter were significantly higher for foreign-born students and for those with parents born in Sweden with foreign-born parents (results available on request).
The models are significant according to the chi-square test but have low explained variance ($R^2$). This result means that the results are useful only for predictions or inferences on the higher level but not on the individual-student level.

The first model, which includes our main variable of interest, voter, and control variables on family and individual level, shows that voters have significantly lower education after controlling for gender, migrant background, parents’ educational levels and incomes. Being female, having foreign-born parents, and having a mother with a high educational level is positively associated with level of education, and being foreign-born is negatively associated with the same. This finding is in accordance with previous research.

The second model includes variables for metropolitan areas and type of neighborhood. Those that live in a high-resource area have a higher educational level 12 years after finishing the ninth grade, presented in Table 5.

Table 5. Ordered logistic regression on level of education.

| Model 1 Family and individual characteristics | Model 2 Residential area | Model 3 Interaction effects |
|-----------------------------------------------|--------------------------|-----------------------------|
| Made a school choice (Voter) | 0.90*** 0.01 | 0.90*** 0.01 | 0.93 0.11 |
| Female | 1.97*** 0.01 | 1.97*** 0.01 | 1.99*** 0.02 |
| Voter#Female | 1.10*** 0.02 | 1.17*** 0.02 | 1.14*** 0.03 |
| SecGen | 6.11*** 0.35 | 5.88*** 0.33 | 5.85*** 0.41 |
| Voter#SecGen | 9.66*** 0.55 | 9.16*** 0.52 | 8.98*** 0.63 |
| ForeignB | 0.93*** 0.01 | 0.97* 0.01 | 0.98 0.02 |
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| Female | 1.97*** 0.01 | 1.97*** 0.01 | 1.99*** 0.02 |
| Voter#Female | 1.10*** 0.02 | 1.17*** 0.02 | 1.14*** 0.03 |
| SecGen | 6.11*** 0.35 | 5.88*** 0.33 | 5.85*** 0.41 |
| Voter#SecGen | 9.66*** 0.55 | 9.16*** 0.52 | 8.98*** 0.63 |
| ForeignB | 0.93*** 0.01 | 0.97* 0.01 | 0.98 0.02 |
| Voter#ForeignB | 1.45*** 0.08 | 1.45*** 0.08 | 1.49*** 0.11 |

| Model 1 Family and individual characteristics | Model 2 Residential area | Model 3 Interaction effects |
|-----------------------------------------------|--------------------------|-----------------------------|
| Made a school choice (Voter) | 0.90*** 0.01 | 0.90*** 0.01 | 0.93 0.11 |
| Female | 1.97*** 0.01 | 1.97*** 0.01 | 1.99*** 0.02 |
| Voter#Female | 1.10*** 0.02 | 1.17*** 0.02 | 1.14*** 0.03 |
| SecGen | 6.11*** 0.35 | 5.88*** 0.33 | 5.85*** 0.41 |
| Voter#SecGen | 9.66*** 0.55 | 9.16*** 0.52 | 8.98*** 0.63 |
| ForeignB | 0.93*** 0.01 | 0.97* 0.01 | 0.98 0.02 |
| Voter#ForeignB | 1.45*** 0.08 | 1.45*** 0.08 | 1.49*** 0.11 |

Table 5. Ordered logistic regression on level of education.

| Model 1 Family and individual characteristics | Model 2 Residential area | Model 3 Interaction effects |
|-----------------------------------------------|--------------------------|-----------------------------|
| Made a school choice (Voter) | 0.90*** 0.01 | 0.90*** 0.01 | 0.93 0.11 |
| Female | 1.97*** 0.01 | 1.97*** 0.01 | 1.99*** 0.02 |
| Voter#Female | 1.10*** 0.02 | 1.17*** 0.02 | 1.14*** 0.03 |
| SecGen | 6.11*** 0.35 | 5.88*** 0.33 | 5.85*** 0.41 |
| Voter#SecGen | 9.66*** 0.55 | 9.16*** 0.52 | 8.98*** 0.63 |
| ForeignB | 0.93*** 0.01 | 0.97* 0.01 | 0.98 0.02 |
| Voter#ForeignB | 1.45*** 0.08 | 1.45*** 0.08 | 1.49*** 0.11 |

Table 5. Ordered logistic regression on level of education.
and those living in a low-resource area have a lower educational level. The educational level was lower for those living in one of the three metropolitan areas compared to other areas after controlling for neighborhood type. Voters have still a significantly lower level of education after these controls.

In the third model, we included interaction effects with Voter and all variables included in the second model. The main effect from voter was not significant in this model. The results were insignificant when interacting voter with the variables female, mothers’ educational levels, and fathers’ incomes. The only positive interaction effects were with having two foreign-born parents, living in a low-resource area, and living in Stockholm. Living in a high-resource area and choosing another school were negative. Those that live in a low-resource area had 1.12 times higher odds to have a higher education level compared to those that live in an average area.

We have shown that students who choose to exercise choice are different from students who do not, based on the dimensions we can observe. It is important to mention that students in these two categories might also differ on a number of other aspects, which we cannot observe and control for here. If these unobserved aspects are correlated with educational attainment, then the “voter” coefficient suffers from “omitted variables bias”. For example, if voters who live in very difficult neighborhoods also have low-quality schools, then we do not know if lower educational achievement is caused by voting behavior or the social environment in the neighborhood.

To test if there are omitted factors that are location-specific, we also ran the same models in a linear regression with the educational variable recoded into years and fixed effects for cohort and residential Voronoi.\(^5\) This assessment resulted in some small changes in \(p\) values compared to the ones obtained from the ordered logit model, but the main conclusions did not change. The explained variances from cohort and residential Voronoi were small (ICC=0.000 and 0.014, respectively).\(^6\) There might also still be a number of unmeasured and unobservable factors from residential areas that are correlated to school choice behavior, even if we found no substantial effects from the residential area when they were added as fixed effects to our models.

Finally, we also added a variable for distance to the closest school (as “the crow flies”) to Tables 3 and 5. Voters have, on average, a 595-meter longer distance to travel to school compared to stayers. The effects from the other variables did not change when this variable was included in the models. These tables are available from the authors upon request.

Discussion and Summary

First, we conclude that the Voronoi method is a functional way to estimate school choice behavior, at least in the Swedish context. As described, the method does not yield a perfect result but one sufficiently close to reality that, without real figures, is the best of those methods with which we compare it. We conclude that the combination of register-based statistics and GIS analysis is a good tool and a way forward for future research.

The analyses show that a large proportion of students who finished elementary education at the beginning of 2000 transitioned into schools with higher parental incomes and higher parents’ educational levels compared to the situation that would have occurred had they remained at their closest schools. However, since the majority did not make an active school choice, more students went to schools with lower socioeconomic statuses than they would have if no school choice had been

\(^5\)To do this, we needed to recode educational levels into years and run a linear regression with random intercepts on two levels: cohort and residence Voronoi. This is not completely accurate since the levels of education are not defined by years: less than 9 years was coded into 8 years, and the others were coded as the maximum number of years, with the PhD level coded as 20 years. However, it provides an estimate of the sizes of the effects: for instance, voters in low-resource areas have 0.13 more years of education compared to stayers in the same areas.

\(^6\)The only difference was that the coefficient for foreign-born was significant (still negative; the \(p\) value was reduced from 0.337 to 0.002); for Malmö, it was not significant in model 2 (still negative, but the \(p\) value increased from 0.038 to 0.142), the interaction effect for voter#Göteborg was positively significant (the \(p\) value decreased from 0.058 to 0.008), and voter#high-resource area was not significant (still negative, but the \(p\) value increased from 0.044 to 0.087).
made. As expected, students whose parents had higher educational levels and higher incomes more often made an active choice.

We also observed that individuals with migrant backgrounds more often made a school choice. One explanation for this difference could have been the strong connection between migrant backgrounds and socioeconomic residential segregation in Sweden, in which individuals with migrant backgrounds more frequently have neighbors who have a low connection to the labor market, a low education, and social problems (Aldén et al., 2015; Gustafsson et al., 2016), which might also imply that they are more likely to live close to a school with low performance, and therefore be more inclined to make an active school choice. However, we also found that natives more frequently attended a school farther from home if they lived in a low-resource area, but that those with migrant backgrounds more often stayed in the closest school if they lived in a low-resource area. Therefore, we also argue that the overrepresentation among those with migrant backgrounds to be a voter is more likely to be explained by other factors related to their migrant backgrounds, such as compensation strategies involving high ambitions for children’s education to overcome expected discrimination in the labor market (Urban, 2012) or “immigrant optimism” and a drive for success in the destination country (Fernández-Reino, 2016). Newly arrived families, whose children are foreign-born, might have access to less information on the school systems to make the most advantageous choice or value proximity more.

The findings confirm that the Swedish school system has made it possible for resourceful parents in disadvantaged neighborhoods to choose to send their children to a school that the parents perceive to be better (Nieuwenhuis et al., 2016). At the same time, the exodus of students from more resourceful families left the remaining students in schools with lower-educated and lower-paid parents compared with the reverse situation, wherein all students would have stayed at the closest school.

We conclude that the first consequence of choice behavior is an increase in differences between schools. Fewer people had an improved social context, but more people had a less resourceful social context. Given the theories on cultural and social capital, we expected that choice would generate a positive effect on social mobility for those who made an active choice.

With regard to the long-term effects, we observe that those that realized their opportunity to make a school choice have, in general, a slightly lower educational achievement, even after controlling for gender, parents’ educational levels and incomes. The exceptions were those with two foreign-born parents and those living in low-resource areas; in those groups, those who made a choice had a better educational achievement compared to those with the same characteristics who stayed in the closest school.

The negative outcome could be explained by the fact that choosing to go to a school farther from home also involves changing the social environment, spending time and energy on commuting, and possibly losing access to part of the local social network, i.e., “disruption effects” (Chetty et al., 2016).

These findings support the idea that individuals with foreign-born parents living in poor residential areas might fare better in Sweden with the help of the choice opportunity. The school-choice option seems to provide opportunities for social mobility for those in problematic social contexts. However, since most students stay in the closest schools, those who live near schools with higher outward mobility and those who attend the closest school are exposed to fewer resourceful social contexts because of other students’ choices to change schools.

We therefore conclude that for some individuals, active school choice may resolve the problem of unequal quality of schools caused by segregation, as choices are used to gain access to schools with higher socioeconomic status. At the same time, school-choice behavior reinforces school segregation on a general level. School choice itself does not seem to have a large impact on individual future educational achievements, but it risks increasing the social distance between groups with different backgrounds, with different kinds of social tensions as plausible outcomes. This assessment is particularly true for areas with large proportions of foreign-borns, which also had large proportions of students who make a school choice outside the area, leaving students in underprivileged schools in even more disadvantaged positions.
Because differences across schools have increased more since our population finished their elementary education, the importance of the school attended and of school choice have likely become larger for later cohorts than was estimated for the cohorts followed in our study. We also know that residential segregation and income inequality in the population are growing and that these factors are intertwined with school segregation, inducement for active school choice, and school-level effects. However, we are not convinced that the possible positive effects favoring individuals through a system of choice have so far been able to balance the negative effects such a system has for others.

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