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A Study of Swedish School Leavers 1991–2012

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Abstract: Against the background of a liberalization of Swedish compulsory education, this paper analyses post-1991 shifts in the way compulsory education performance in Sweden has been shaped by parental background, residential context and school context. We can document increasing school and residential segregation of foreign background students and, after 2008, increasing segregation by income, employment status, and social allowance reception. Over time, educational performance has become increasingly linked to family, neighbourhood and school context. The greatest change has been for parental background, but the importance of school context and neighbourhood context has also increased. A noteworthy finding is that residential context consistently has a stronger effect on student performance than school context. Student grades were found to be most strongly influenced by the closest (12 or 25) residential peers of the school leavers as compared to larger peer groups. The increase in the influence of family, neighbourhood and residential context has been accompanied by a dramatic increase in the between-school variation (ICC) in student performance, but it was not until after 2005 that this increased variability became clearly linked to the social composition of the schools. This study's results suggest that the restructuring of Swedish compulsory education has had consequences for equality, possibly because disadvantaged social groups have not been as able as advantaged groups to navigate and benefit from the educational landscape created by the school reforms.

Keywords: Class inequality, Longitudinal studies of education, Neighborhood effects, Segregation, School effects

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Introduction

In the literature on educational inequality, Sweden has been singled out as an exception to a general pattern of persistent inequality (Gamoran, 2001) The reason for this is that Sweden during the 20th century managed to reduce the influence of socio-economic class on educational attainment. In a thorough study of this process Erikson and Jonsson (1996) have pointed out two main explanatory factors for this reduction in educational inequality. On the one hand, a general reduction in social inequality and, on the other hand, a quantitative expansion of the educational system that has made education less selective. The period analysed by Erikson and Jonsson corresponds well with what has been seen as the most successful part of the Swedish welfare state era, closely connected to the political program of the Social Democrats. Post-1990 trends, on the other hand, have been influenced by welfare state retrenchment and neo-liberal inspired reforms that in many ways have implied a reversal of earlier policies in Sweden (Lundahl, 2002).

The restructuring of the Swedish school system is a prominent feature of these post-1990 trends. The aim of these reforms, implemented after 1992, has been to provide more competition, as well as higher quality and a higher degree of market control (Broady and Gustafsson, 2000, Wiborg 2013). Moreover, the reforms have established what has been described as a 'quasi-market' (Alegre and Ferrer, 2010, Lundahl, 2002). School vouchers, school choice, and private stakeholders in independently run schools are important elements of the new policy (Bunar, 2010, Lindbom, 2010). In terms of possibilities for school choice, Sweden is not a unique case in the Nordic context. Denmark had school choice also before 1990, and in Finland possibilities for school choice have expanded in the 2000s, especially in the Helsinki metropolitan area (Bernelius and Vaattovaara, 2016; Kosunen, Bernelius, Seppänen, and Porkka, 2016; Lundahl, 2016; Rangvid, 2007). However, in Nordic research the Swedish school system has been seen as a benchmark in neo-liberalisation since Danish,

Norwegian and Finnish school systems are not as liberalised (Bernelius and Kauppinen, 2012; Brattbakk and Wessel, 2013; Fekjaer and Birkelund, 2007; Kauppinen, 2008; Wiborg, 2013)

In addition to liberal reforms, the post-1990 period has seen a transformation of the European as well as the Swedish population, with a large increase and a changing composition of the foreign-born population (Authors, 2018b) as well as an increase in income inequality (Hedman and Andersson, 2015).

Against this background, the overarching aim of this paper is to analyse if progress towards reductions in educational inequality that were reported for Sweden up to the 1990s has been endangered by increased opportunities for school choice, increased social inequality, and a changing population composition. Our study will build on the existing literature of inequality in educational opportunities by specifically analysing changes in the way parental background, residential context and school context influence educational performance in Sweden during the 1991-2012 period. We will focus on school grades given to students at the end of Sweden's nine-year long compulsory education (ages 15/16). This implies that we will focus not on how educational inequality is produced by differences in transition rates to higher level of education but rather on the extent to which differences in educational outcomes are shaped by inequalities in parental background, social and ethnic school segregation, and social and ethnic residential segregation. Furthermore, in the Swedish context, school grades play a central role in sorting students into different educational careers after compulsory education. Admittance to upper secondary school (school year 10 to 12) and the most attractive tracks is largely determined by one's grade in the ninth school year. Also, admittance to the university is determined by school grades (at the end of upper secondary school) with university courses leading to the highest paying jobs having the highest grade

requirements. Ensuring that their children earn high grades is, therefore, essential for parents that want to promote their children's entry into high-status, high income occupations.

Theoretical considerations

In the sociological literature there has, since Coleman (1966) been an ongoing discussion about factors that influence educational inequality (ethnicity, socioeconomic factors and school reforms) (Erikson and Rudolphi, 2009; Helgøy and Homme, 2016; Jackson, Jonsson, and Rudolphi, 2012, Hällsten and Pfeffer, 2017, Lareau, 2011). Also, much work on the effects of class and family background on educational achievements builds on the tradition of habitus and reproduction of class (Bourdieu, 2008) and other works of sociologists (Breen and Jonsson, 2005, Palme, 2008). Middle-class parents raise children to manoeuvre the educational system using inherited skills and these children are impregnated with ways of conduct and values for educational success (Barthon and Monfroy, 2010, Bourdieu, 2008, Forsberg, 2015, Reay and Ball, 1997). Apart from family life taken as an ensemble, parents' education is often found to be important for educational performance, for example parents with university qualifications usually have children who also go on to higher education.

While there is a general agreement that parental background is the most important factor, there is less agreement on the extent to which schools influence inequality (Downey and Condron, 2016), or on the role of neighbourhood context for shaping inequality (Brännström, 2008; Sykes and Musterd, 2011).

Theoretically, our analysis of how parental background, school context, and residential context shape educational outcomes, and how educational and societal changes since 1990 have strengthened or weakened the reproduction of educational inequality in Sweden, will build on ideas put forward in the *effectively maintained inequality* approach to educational inequality. Thus, as Lucas (2001: p. 1650) argues, once a 'level of schooling becomes nearly universal … the socioeconomically advantaged seek out whatever qualitative

differences there are *at that level* and use their advantages to secure quantitatively similar but qualitatively better education'. Lucas's main interest is, admittedly, in transitions to different curricula and this can be seen as limiting the applicability of the effectively maintained inequality framework to our study. However, since grades given in year nine serve as an instrument by which admittance into different upper secondary school programs is regulated, it can be argued that they not only reflect ability, but are also related to strategies used by parents to further the educational achievements of their children.

The need for such strategies has increased as a consequence of the transformed educational landscape that Swedish parents are facing. In the year 2000, only 3.2% of compulsory school graduates attended independent schools. In 2011/2012, the end of our period of study, the percentage of students leaving independent compulsory schooling was 14.6% (Skolverket, 2017). To attract students, most schools, both public and independent, advertise themselves as pedagogically specialized. The profiling includes focusing on specific school subjects (sports, language, media, etc.), using specific pedagogical methods, or being based on particular religious orientations. Independent schools are voucher financed per student from the municipality but have to obey the national regulations for education. To summarize the reform discussion in relation to concerns about segregated schools, the law requires equal education in every form of schooling and equality in access to education independent of geographical location and socio-economic status (Gorard and Smith, 2004, Regeringskansliet, 2010).

Effectively maintained inequality can also provide a tool for understanding parental support for school choice (Authors, 2014) since it provides a means by which qualitatively better educational alternatives can be accessed within a framework of universal education. More generally, not only school choice but also the selection of residential neighbourhoods (Holme, 2002, Poupeau *et al.*, 2007) could be considered as means by which

'socioeconomically advantaged actors secure for themselves and their children some degree of advantage wherever advantages are commonly possible' (Lucas, 2001: p. 1652).

Our study will add to the literature in two ways. First, we will add to the analysis of how school choice and other liberal educational reforms affects educational inequality (see e.g. Authors, 2013; Byun and Kim, 2010, Liu and Apple, 2016, Resh and Dar, 2012, Saporito and Sohoni, 2007, Van Zanten, 2005; Böhlmark, Holmlund, and Lindahl, 2016; Böhlmark and Lindahl, 2015; Forsberg, 2015; Lindbom, 2010) by providing a long-term perspective. A long-term perspective is an advantage because it takes time before reforms affect systems that include several reciprocal components that co-evolve: For example, school choice patterns will both be influenced by and influence the establishment of new schools; changing student compositions in schools can make them more or less attractive; and business models used by private entrepreneurs in the school sector can shift with increasing experience.

Second, differences in residential context is acknowledged as one of the drivers of educational inequality in the literature (Erikson and Jonsson, 1996; Gamoran, 2001). Having access to detailed geo-coded individual level register data for an entire national population makes it possible for us to measure the residential context of Swedish compulsory school students in a very refined way, and thus, to provide new insights into the role played by residential segregation for differences in educational outcomes. By adding neighbourhood context to the school context we get a better coverage of the time spent by students on different every-day activities (Kwan, 2012). We also argue that with improved measures it becomes possible to capture effects from school context and residential context simultaneously (Harris *et al.*, 2007, Lubienski *et al.*, 2009, Singleton *et al.*, 2011). It could be that studies concluding that the effects from the school level are more important than neighbourhood level effects have dismissed neighbourhood effects on somewhat unstable grounds.

School effects and Neighbourhood effects

In educational research, analysing the impact of school context on student performance has been, and still is, an important area of studies (Raudenbush and Willms, 1995; Van Ewijk and Sleegers, 2010). At the same time, analysing how residential context influences educational outcomes has been a central question in neighbourhood effect studies.

As for school effects, they are often called class or peer effects and thus indirectly originate from peers' parental background (Hanushek *et al.,* 2003). School effects from peers differ between schools since children are sorted into different schools depending on school choice, residence, profiling etc. Reasons for sorting differ by school system but can result in effectively maintained inequality according to theory (Marks, 2013). If school choice was performed equally across families and based on school quality there would not be sorting from the school choice process. Also, earlier research has demonstrated the unequal school choice (Authors, 2012; Butler and Hamnett, 2010, Oría *et al.*, 2007; Maloutas, 2007).

Another reason for school effects is underlying residential segregation that casts its shadow over neighbourhood schools. Despite having school choice, many students go to the school closest to home. In addition, the status of a surrounding neighbourhood will influence the reputation of the school (Bunar and Ambrose, 2016). For a recent Swedish study and overview of school peer effects, please see Nordin (2013).

The theoretical inspiration for neighbourhood effect studies is built on concepts such as collective efficacy, institutional resources, stigmatization and norms (Ainsworth, 2002, Friedrichs, 2016, Leventhal and Brooks-Gunn, 2000, Sampson, 2012) and, thus, is markedly different from the theoretical frameworks that underlie studies of school effects. Still, the assumed correlations can be similar. Usually, high socio-economic status in the neighbourhood is associated with advantageous educational outcomes, while low neighbourhood socio-economic status is associated with poorer educational outcomes in

youths (Authors, 2006; Brattbakk and Wessel, 2013, Kauppinen, 2007, Leventhal and Brooks-Gunn, 2000).

Since neighbourhood effects research has its roots in concerns about the consequences of segregation, the aspect of race and ethnicity has been an important factor in explaining grades, particularly in the United States. Minorities such as Latinos and African Americans are analysed with respect to educational outcomes (Caughy *et al.*, 2013, Wilson, 1987). In Europe instead, multi-ethnic and foreign-born dominated areas are found to be negative environments for youths' education (Authors, 2015; 2015, Brattbakk and Wessel, 2013) but the opposite of producing positive effects on education is also found (Fekjaer and Birkelund, 2007).

Moreover, in the neighborhood effects literature, an important issue is the extent to which measured effects of residential context constitute causal effects (van Ham, Manley, Bailey, Simpson, and Maclennan, 2012). Recent studies have shown that selection into neighbourhoods influences estimated contextual effects, but not the extent to which non-adjusted estimates become un-informative. Thus, based on a rigorous research design, Chetty et al. (2008) conclude that around 2/3 of non-adjusted contextual effect estimates can in fact be causal. We acknowledge this debate, but in this paper it is not our aim to provide empirical evidence for or against selection-based explanations of neighbourhood effects. Instead, by providing more refined measures of residential context, we add to the empirical evidence that successful selection-based theories and causal theories of contextual effects should be able to account for.

In spite of the fact that both schools and neighbourhoods have a potential for influencing educational outcomes there are relatively few studies that include measures of both residential context and school context. One reason could be that neighbourhood effects are seen as mediated through the school or that residence is seen as decisive for the

inclusion/exclusion in different contexts, be they neighbouring adults, peers, schools, or the community (Kauppinen, 2008, Leventhal and Brooks-Gunn, 2000). Another explanation could be that students sampled from school registers can lack good data on student's residential context, whereas students sampled in neighbourhoods lack good data on student's school context.

Studies that have assessed both school context and residential contexts report that the school environment is of greater importance than the residential area (Brännström, 2008, Kauppinen, 2008, Sykes and Musterd, 2011). This could 'point to schools as a pathway through which the influence of the neighbourhood may be transmitted' (Sykes and Musterd, 2011: p. 1307) even if this conclusion is contradicted by Bergsten (2010). However, it could also be the case that measures of neighbourhood context that are based on aggregates for fixed geographical subdivisions such as census tracts fail to capture the relevant residential context correctly (Authors, 2015).

Data and study design

In the analysis we used data from Statistics Sweden via Micro data on line access (MONA) in the so-called Geostar-project at Stockholm University. The data included longitudinal individual micro data in Swedish registers including geo-coordinates (Geostar, 2015). The total number of students ending grade 9 during the 22 years we studied was 2,356,695. However, due to missing data in the register regarding family background, the loss of students was between six and 13% during the time period from 1991 to 1997. This loss decreased to 5% in 1998, and since 2001 until the end of the study period the loss of data each year was below 2%. This implies that the pre-1998 results should be considered with some caution. Also, the number of student cohorts leaving compulsory school increased up to 2006 when the number was well above 120,000 and then decreased to the last year of

measurement. The decrease of students from 2006 to 2012 in combination with a close to constant number of schools in the same period could have led to more competition in recruitment between schools.

Below we present the dependent variable; grades when leaving compulsory school. After that, individual, school and peer context variables are presented. All variables can be found in Table 1. All variables (except grades) are collected the end of December the year before students graduate from the ninth grade.

Dependent variable

The student grades in year 9 are summarized into one value, and on the basis of this summarized value, students enter upper secondary school. However, before year 9, there is not as much student selection as in upper secondary school or for that matter university, and, from 1994, every student follows the same curriculum, though with some teaching done in ability-based groups (Rudolphi and Erikson, 2016). According to Bourdieu (2008) much greater selection of students occurs at the later stages in the school system, which is difficult to control for in analyses of outcomes. Since student grades in year 9 are given at the end of compulsory education we believe that such selectivity is less of a problem in the present study. There was an important reform in 1994 having effects on the students graduating a few years later. There was a shift from a grading scale of 1 to 5 to another with a maximum of 320 credits (adding 0, 10, 15, and 20 for different subjects). Therefore we use the percentile rank of the grade of the students that year instead of the grade as the variable. The student with the highest overall grade was given the value 1.0 while the student with the lowest overall grade was given the value 0.0. Grades are reported in June. Using grades instead of test scores has disadvantages since grades are not always measured against an absolute scale and can have biased results (Tyrefors Hinnerich and Vlachos, 2013). Moreover, test scores are not available for the entire 1990-2012 period. Also, the current study uses grades not

solely as a measure of competences but as an entrance ticket to some educational careers. However the drawbacks of using grades should be taken into account when the results are evaluated.

Individual level data

As individual controls we included the individual's sex, country of birth, whether the parents have social allowances, tertiary education, whether parents are non-employed, and whether they live in single parent households. Furthermore, we included individual controls for foreign-born parents, the family's disposable income, and whether they live in single family housing, see Table 1. In the Geostar database we have occupational categories but not for the entire population since this data is survey based. Therefore, we have not been able to include a standard social-economic classification in our study.

In earlier research, there are studies that support the choice of variables included in this study and we briefly explain the reasons for our choice below. Female students usually achieve better in school in Sweden whereas students with parents on social allowances, who have parents born abroad, or who have single parents usually get lower grades (Authors, 2006). Furthermore, students with parents having tertiary education perform better in school than their counterparts, as do students with high income parents and students living in single family housing. On the other hand, variables such as parental non-employment and students born abroad are likely to affect students negatively concerning educational achievements (Authors, 2015).

Of the students in our sample, about 60% lived in single family housing, a figure that does not change much over time. Girls and boys are evenly represented in the material and further tertiary education among parents rises from about 30% in 1991 to more than 40% of parents in 2012. Over the years, the proportion of parents who are foreign-born increased, as did the proportion of single parent households. The average percentile for the parents'

disposable income in relation to the rest of the Swedish population remained unchanged during the study period, except for the variation due to the change of equalising weights for children when constructing the variable after 2004. (See supplementary Figures A, B and C).

School level data

The school population consists of students that have finished ninth grade (around 15 and 16 years old) every year. To cater for more than just that particular year's students we included those finishing the ninth grade both the year before and after the particular cohort of students. For students finishing the ninth grade in, for example, the year 2000, not only students finishing the same year but also the students that finished ninth grade in the year before (1999) and the year after (2001) were considered as constituting the school context population, see Table 1. Students in schools with less 15 students (including the year before and after graduation) per school were excluded from the sample.

A problem with the school variables is that several are highly correlated. Thus, to address possible multicollinearity problems, we have extracted principle components that can be used as explanatory variables instead of the original school context variables. The first two components could account for 70% of the total variance in the school variables. Component 1 captured 52% and had high positive loadings on foreign-born individuals, parents with social allowances, foreign-born parents, and non-employed parents. The same component 1 had negative loadings on education and in particular income. Component 1 schools are called *disadvantaged* schools in the following. The second component captured 18% of the variance and had high positive loadings on education and income. This second component is called *highly-educated-high income* schools in the following. Both components had negative loadings on single family housing and single parent households, which suggests that both were associated with urban and metropolitan areas.

Neighbourhood level data

The population in the residential neighbourhood surrounding each 15-year-old student is defined in this study as the peers aged 13 to 17 years (in the beginning of the year) who live closest to the student, see Table 1 for variables. Tests with alternative measures indicate that the result reported below would essentially be the same if all neighbours, not only peers had been used to calculate the socio-demographic composition of the neighbourhoods (compare Åslund *et al.*, 2011). With a multiscalar approach we have been able to gradually expand the neighbourhood from the 12 closest peers (k = 12) to the 800 closest peers (k = 800) for every individual. We found lower –2*log likelihood values for models using lower k-values. For all the 22 years, the lowest –2*log likelihood values were for either k = 12 or k = 25, (see supplementary Figure C). This suggests that contextual influences are strongest for those k-values. Because of this and the theoretical motivations mentioned above, we have chosen to use contextual measures based on k = 25 to evaluate the effect of residential context on educational performance. Using aggregates for fixed geographical subdivision, so-called SAMS areas, does not, however, substantially change the results.

It can be noted that choosing k = 25 neighbourhoods implies that the measure of residential context is based on a smaller sample than our measure of school context. In the residential context the number of exact age peers is five (on average), but the number of exact age peers in the school is around 60 (on average). This implies that one can expect the variance in residential context variables to be larger than the variance in school context variables.

Segregation measure

Recently, (Jones *et al.*, 2015) have argued that modelling segregation as variance around a mean is helpful for assessing the spatial scale at which segregation processes operate. Using variance to measure segregation is also helpful when the aim is to assess the impact of

segregation on individual level outcomes. If, for example, there is little variance in neighbourhood context, residential context will not be an important factor for determining differences in outcomes even if the estimated parameters for the contextual variables are significant. But if variation in context is large, this will make context a more important factor for determining differences in outcome (Authors, 2018a). Therefore, in this paper we will use the standard deviations of school context and residential context variables as measures of school and residential segregation.

Multilevel regression models

The data is analysed using a multilevel regression approach that takes into account that students are nested in schools. We have, however, not used a cross-classified model of schools and neigbourhoods. The reason is that with individualised neighbourhoods, the students do not share the same neighbourhood with all the other peers that are residents in that students' neighbourhood.

For each studied year, seven different models are estimated, starting with an empty model, followed by a model with individual and parental level variables added, and then five models with different combinations of contextual variables included, see Table 2 for a detailed specification of the models. The structure of the models and an illustration to explain the parts of the model are shown in Figure 1. By building models for each year separately, we are able to see how the parameter estimates change over time.

Results

Variance in school and peer context

Figure 2 shows trends in the standard deviations for residential context variables and school context variables from 1991 to 2012. The diagrams show that the variation in residential context is larger than the variation in school context. This was expected, taking into account that the residential context variables are aggregates across 25 individuals.

With respect to the trends in segregation, the graphs show a consistent increase in variation over time only for *percentage of female students (small change)* and *percentage of students with foreign-born parents*. Three more indicators show stability over time: *percentage in single family housing*, *percentage from single parent households*, and *percentage having parents with tertiary education*. For percentages from single parent households there is even a slight decline in the variance across schools, whereas for parents with tertiary education there is a slight increase. Finally, for *percentage from families with social allowance*, *percentage from families with a non-employed parent*, *family disposable income*, and *percentage of foreign-born individuals*, trends varied over time with increasing standard deviation in the early 1990s and after 2008, but with declining or constant variation from the late 1990s until about 2008.

Thus, these results go against the common ideas in research about a general aggravation of segregation and variation between schools concerning indicators that might have a negative effect on adolescents' educational performance. Certainly, after 2006, segregation has been increasing for most indicators, but there are important exceptions and for a number of indicators there have also been periods of declining variation.

The graphs also show that variation across neighbourhoods and segregation across schools have largely developed in parallel. But there are differences between indicators. One

simple measure of how schools mix children compared to neighbourhoods is to look at the standard deviation across schools compared to the standard deviation over neighbourhoods, and to ask whether the trends are coming together or diverging. This measure shows that school mixing has increased, especially for those from a single parent background and to some extent for those from a single family housing background. But school mixing has decreased for non-employed, social allowance, tertiary educated parents, and to some extent for foreign-born parents. Of these variables the mixing is strongest for those from a single parent background and weakest for tertiary educated parents and foreign-born parents.

Multilevel models

Table 2 shows the seven multilevel regression models types, exemplified with the year 2012. By adding controls for each of the levels in our models, there is an increasing goodness of fit. This can be read from the log likelihood and Akaike information criterion (AIC) values for the year 2012 in Table 2. Compared to the empty Model 1, individual level variables in Model 2 decrease the log likelihood values and AIC importantly, as do controls added in Models 3, 4, and 5.

Model comparisons using AIC

In order to compare the relative importance of parental background, school context, and residential context we rely on a comparison of – 2 log likelihood values for the empty model (Model 1) and the models including individual level and different sets of contextual variables. We base this use of – 2 log likelihood values on (Menard, 2000) who, building on (Nagelkerke, 1991), argues that '-2[ln(Lo)] represents the 'error variation' of the model with only the intercept included, analogous to the total sum of squares SST in OLS; -2[ln(L~)] similarly, the 'error variation' for a model with all of the predictors is included, analogous to the OLS error sum of squares SSE' (p. 20). To adjust for the number of parameters estimated,

Figure 3A and Figure 3B present the AIC values for Model 1 to Model 5 and how they changed between 1991 and 2012. The AIC is equal to the -2log likelihood value adjusted for the number of parameters estimated.

Figure 3A shows the AIC for the empty model (Model 1) and for the models with different controls (Model 2 to Model 5). As can be seen from this graph it is the introduction of parental background controls that adds most to the explanation of student grades. Adding controls for school context and residential context has a comparatively small effect on how much is explained. Figure 3A also shows that in 1991 about half the variation in student grades as measured by the AIC was left unaccounted for when the controls were included (distance in graph below Models 2, 3, 4, 5). In 2012, by comparison, only about one fifth of the variation in student grades was still unaccounted for when the controls were included. This suggests a strong increase in the influence of parental background on school performance between 1991 and 2012.

Figure 3B shows the AIC values for Model 3 to Model 5 (parental background, school context and residential context controls) expressed as differences from the AIC of Model 2 (only parental background control). Model 3, with school level controls, shows a decrease in AIC compared to the model with individual level controls. Interestingly for our study, there is a further decrease when peer residential context is added (Model 4). That is, even when controlling for school level context, residential context adds explanation to the variation in grades among students. Finally, Model 5 shows that a model with only residential context and no school context included outperforms Model 3; that is, a model with only school context and no residential context. This is true for the entire 1991 to 2012 period, but the difference is especially large in the period 2000–2005. Summing up, the important result from comparing AICs is that models including the peer residential context do a better job of explaining grades than the model including school context alone. This contradicts earlier results where school

and residential contexts are compared as regards their importance for educational performance (Brännström, 2008, Kauppinen, 2008). One reason for this result could be that with *k*=25 neighbourhoods there will be higher variance in the residential context measure compared to studies using larger statistical areas. On the other hand, higher variance as such would not result in a reduction of model log-likelihood unless the context variable is of importance.

As noted above, individual level variables (Model 2) make by far the most important contribution to explaining students' grades. However, the explanation added by Models 3, 4, and 5 is important to consider and there is also a pattern of increased importance for school context and residential context over the years, evidenced by larger declines in the AIC values compared to Model 2 with only the parental background control. The AIC values also suggest that school socio-economic context was relatively unimportant before 2006 but increased in importance after 2006. However, this does not change the fact that, judged by the AIC value of Model 5 compared to Model 3, the residential context measured by the 25 closest peers with families is more important for grades than school context.

Parameter estimates

The parameter estimates for the parental background, school context, and residential context variables, are presented graphically in Figure 4 and with statistical details in Table 2 (only for 2012).

Table 2 shows that the estimates for individual level controls are significant and have the expected signs. Being foreign-born as a student has a significant, negative effect on grades. Read from Table 2, the negative estimate is .045 for foreign-born students, which means final grades that are 4.5 percentile points lower than average (Model 2). Negative

effects are also found for parental social allowance and non-employment as well as for having single parents as a student.

Figure 4 shows changes in these parameter estimates over time. Thus, over the 1991-2012 period there is a strong increase in the positive effect on students' grades of having high income parents (1991 estimate (0.060; 95% CI: 0.05, 0.069); 2012 estimate 0.162; 95% CI: 0.155, 0.170), and the negative effect of having a single parent decreases over time (1991 estimate (-0.056; 95% CI: -0.061, -0.051); 2012 estimate 0.029; 95% CI: -0.033, -0.025).

Figure 4 also shows the parameter estimates over the 22 years (x-axis) for Model 4 with school context and neighbourhood peer context variables added, and for Model 7 with school context measured using principal components. Statistical details for these estimates are provided in Table 2 (only year 2012).

Figure 4 clearly shows that estimates are smaller for neighbourhood peer context (lowest-row diagrams) than for school context (middle-row diagrams). They are also more stable over time. The lower size of the neighbourhood context can be related partly to the estimates' larger variance. This comparability problem was tested with beta-values, that is, parameter values adjusted for the standard deviation of the variables. The difference in beta-values is still large between neighbourhood and school context variables but the difference is smaller when standard deviations are adjusted for. However, adjusting for the standard deviation does not reduce the volatility of the parameter estimates of the school context variables. One interpretation of this volatility is that there is multicollinearity. Compare, for example, the estimates for income and education in the school. Here there is a pattern that high positive parameter estimates for income are associated with low and even negative estimates for education.

The level of education in the residential neighbourhood has a positive effect on the grade of the student. This is also the case for parental income among the closest living 15-

year-olds, with a drastic increase after 2004. Having peers with single parents or peers with social allowances is from time to time negatively associated with grades over the period.

The volatility of the school context variables is a little perplexing but it is possible that there is a relation between this volatility and the failure of school context variables to account for the increase in between-school variance up to 2006 (referring to ICC in Figure 5). Of particular interest here are the negative estimates for parental education level up to 2008.

In order to cater for the volatility in school level parameter estimates we performed a PCA and tested the same models (6 and 7) but with two components of school variables instead. The result of that test showed that the PCA factors were not as good at explaining the variance in grades at the school level compared to the previous model with nine school level variables. However, the pattern seen in Figure 4 shows a stronger negative effect on grades for students in disadvantaged schools (component 1) whereas the so-called highly-educated-well-paid school component 2 shows a radically increased positive effect on grades for students in those schools since 2005.

The individual level parameter estimates are presented in the top diagrams of Figure 4 and show much less of the volatility in the school context parameters. However, there is an increase in the estimates for parental disposable income over the period and fewer negative estimates for single parents over the period, Figure 4. Furthermore, income and education show the two most interesting trends in Figure 4. Parental education decreases in importance for the outcome of the grade (perhaps because an increasing proportion of the students have parents with higher education, which makes it a less exclusive measurement). Interestingly, the disposable incomes of the household have an increased importance for the outcome.

Intra-class correlation for schools

The top line in Figure 5 shows how the between-school variance in final grades, measured as the proportion of total variance (intra-class correlation, ICC) changed between 1991 and 2012. What is shown here is a steady upward trend in the variation in grades between schools, and the results confirm earlier findings both in studies using student grades and test results (Authors, 2013).

Figure 5 also presents variation at school level by year, for the model with controls for individual level (2), school level (3), residential peer context (4) and for residential peer context excluding school level variables (5). What the graph shows is that up to 1998, very little of the ICC/variance in grades can be explained by individual level variables, school context, or residential context. This can be read in the graph as almost no difference between the empty model's top line and the other lines. In 2005, individual level variables still explain some variance in grades but note also that a smaller proportion of the between-school variance can be explained by school level variables. After 2006, individual level factors explain an increasing share of the ICC (diff. between Models 1 and 2) and also the variance explained by school level variables pushes down the ICC/variation in the graph. Thus, in 2012, almost half of the explained between-school variance can be accounted for by individual level variables. The residential context factor (4) makes essentially no contribution to explaining the between-school variance; the Model 4 line including residential context is in fact covering the school level ICC (Model 5).

Concluding discussion

In this paper, we have raised the question of whether educational and societal changes since 1990 have strengthened or weakened the reproduction of educational inequality in Sweden.

Looking at the results presented above, the effects of parental background, school context and residential context there are clear signs of a school system that no longer has the same equalising power as before. Most importantly, there has been an increase in the importance of parental background for student performance. In 1991, parental background accounted for about 52% of the variation in performance. In 2012, this proportion had risen to 76%, Figure 3A. Thus, Swedish compulsory education today is less efficient in compensating for family background than it was before the liberalization of school choice. In addition to this change, the socio-demographic composition of students' residential neighbourhoods has also become more important for educational outcomes. In fact, our findings indicate that residential context is a stronger determinant of student's grades in the final year of compulsory schooling than the socio-demographic composition of the school, and this result holds despite the fact that the effect of school composition on student's grades has increased over time. One reason why peer residential context is more important/explains more than student composition in schools could be that in schools, differences in peer composition can be mitigated by compensatory efforts by teachers and by need-based resources allocation. In neighbourhoods, such compensation efforts can be more difficult to implement.

Taken together, these results suggest that the restructuring of Swedish compulsory education, including many components, working reciprocally over some time, has had some negative consequences for educational equality. Thus, influences on student's school performance are increasingly located not in the school but elsewhere.

In many ways, the findings we present in this paper resonate with the results of earlier studies looking at the effect of liberalization of educational equality. This said, the contribution of this paper is two-fold. First, we have provided strong evidence that educational reforms in Sweden, in combination with other societal trends, have reversed a longstanding trend towards educational equality. Second, we have demonstrated that

discussions about how educational inequality is created cannot be restricted to the direct effect of parental background and the effect of school factors. There is also, as our results have shown, a need to consider the role played by residential context and residential segregation in the reproduction of inequalities in educational outcome.

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References

Ainsworth, James W. 2002. "Why Does It Take a Village? The Mediation of Neighborhood Effects on Educational Achievement." Social Forces 81(1):117-52.

Alegre, Miquel Angel and Gerard Ferrer. 2010. "School Regimes and Education Equity: Some Insights Based on Pisa 2006." British Educational Research Journal 36(3):433 - 61.

Andersson, E. K. and Malmberg, B. (2018). Segregation and the effects of adolescent residential context on poverty risks and early income career: A study of the Swedish 1980 cohort, Urban Studies, 55, 365-383.

Andersson, Eva and S. V. Subramanian. 2006. "Explorations of Neighbourhood and Educational Outcomes for Young Swedes." Urban Studies 43(11):2013-25. doi: 10.1080/00420980600897834.

Andersson, Eva K. and Bo Malmberg. 2015. Contextual Effects on Educational Attainment in I ndividualised, Scalable Neighbourhoods: Differences across Gender and Social Class. Urban Studies 52(12):2117-33. doi: 10.1177/0042098014542487.

Andersson, Eva, Bo Malmberg and John Osth. 2012. "Travel-to-School Distances in Sweden 2000-2006: Changing School Geography with Equality Implications." Journal of Transport Geography 23:35-43. doi: 10.1016/j.jtrangeo.2012.03.022.

Åslund, Olof, Per-Anders Edin and Peter Fredriksson. 2011. "Peers, Neighborhoods, and Immigrant Student Achievement: Evidence from a Placement Policy." American Economic Journal: Applied Economics 3(2):67-95.

Barthon, Catherine and Brigitte Monfroy. 2010. "Sociospatial Schooling Practices: A Spatial Capital Approach." Educational Research and Evaluation 16(2):177-96.

Bergsten, Zara. 2010. Bättre framtidsutsikter? Blandade bostadsområden och grannskapseffekter : En analys av visioner och effekter av blandat boende (Better prospects through social mix? Mixed neighbourhoods and neighbourhood effects : An analysis of the purpose and effects of social mix policy). Uppsala University, Department of Social and Economic Geography, Uppsala

Bernelius, Venla, and Mari Vaattovaara. 2016. "Choice and segregation in the 'most egalitarian'schools: Cumulative decline in urban schools and neighbourhoods of Helsinki, Finland." Urban Studies 53(15):3155-3171.

Böhlmark, Anders, and Mikael Lindahl. 2015. "Independent Schools and Long-run Educational Outcomes: Evidence from Sweden's Large-scale Voucher Reform." Economica.

Böhlmark, Anders, Helena Holmlund, and Mikael Lindahl. 2016. "Parental choice, neighbourhood segregation or cream skimming? An analysis of school segregation after a generalized choice reform." Journal of Population Economics:1-36.

Bourdieu, Pierre and Jean-Claude Passeron. 2008. "Reproduktionen." Bidrag till en teori om utbildningssystemet, Lund: Arkiv förlag.

Brännström, Lars. 2008. "Making Their Mark: The Effects of Neighbourhood and Upper Secondary School on Educational Achievement." Eur Sociol Rev:jcn013. doi: 10.1093/esr/jcn013.

Brattbakk, Ingar and Terje Wessel. 2013. "Long-Term Neighbourhood Effects on Education, Income and Employment among Adolescents in Oslo." Urban Studies 50(2):391-406. doi: 10.1177/0042098012448548.

Breen, Richard and Jan O Jonsson. 2005. "Inequality of Opportunity in Comparative Perspective: Recent Research on Educational Attainment and Social Mobility." Annu. Rev. Sociol. 31:223-43.
Broady, Donald and Jan-Eric Gustafsson. 2000. Välfärd Och Skola: Antologi Från Kommittén Välfärdsbokslut. Sou 2000:39: Fritzes offentliga publikationer.
Bunar, Nihad and Anna Ambrose. 2016. "Schools, Choice and Reputation: Local School Markets and the Distribution of Symbolic Capital in Segregated Cities." Research in Comparative and International Education. doi: 10.1177/1745499916631064.
Bunar, Nihad. 2010. "The Controlled School Market and Urban Schools in Sweden." Journal of School Choice 4(1):47 - 73.
Butler, Tim and Chris Hamnett. 2010. "You Take What You Are Given': The Limits to Parental Choice in Education in East London." Environment and Planning A 42(10):2431-50.
Caughy, Margaret O'Brien, Tammy Leonard, Kurt J Beron and James C Murdoch. 2013. "Defining Neighborhood Boundaries in Studies of Spatial Dependence in Child Behavior Problems."
Downey, Douglas B, and Dennis J Condron. 2016. "Fifty years since the Coleman Report: Rethinking the relationship between schools and inequality." Sociology of Education 89(3):207-220.
Erikson, Robert, and Frida Rudolphi. 2009. "Change in social selection to upper secondary school—primary and secondary effects in Sweden." European Sociological Review 26(3):291-305.
Erikson, Robert, and Jan O Jonsson. 1996. Can education be equalized?: The Swedish case in comparative perspective. Westview Press.
Fekjaer, Silje Noack and Gunn Elisabeth Birkelund. 2007. "Does the Ethnic Composition of Upper Secondary Schools Influence Educational Achievement and Attainment? A Multilevel Analysis of the Norwegian Case." Eur Sociol Rev 23(3):309-23. doi: 10.1093/esr/jcm003.
Forsberg, Håkan. 2015. Kampen om eleverna: Gymnasiefältet och skolmarknadens framväxt i Stockholm, 1987–2011. Doctoral dissertation, Acta Universitatis Upsaliensis.
Friedrichs, Jürgen. 2016. "Neighbourhood Effects: Lost in Transition?". Analyse & Kritik 38(1):73-90.
Gamoran, Adam. 2001. "American schooling and educational inequality: A forecast for the 21st century." Sociology of education:135-153.
Geostar. 2015. "Geographical Context; New Ways of Measuring the Significance of Surrounding for the Life Course of Individuals (Geografisk Kontext: Ett Nytt Sätt Att Mäta Vad Omgivningen Betyder För Individens Livsbana)." MONA (Micro Data on-line Access) Statistics Sweden accessed via Department of Human Geography, Stockholm University: Statistics Sweden.
Gorard, Stephen and Emma Smith. 2004. "An International Comparison of Equity in Educational Systems." Comparative Education 40(1):15-28.
Hällsten, Martin and Fabian T. Pfeffer. 2017. "Grand Advantage." American Sociological Review 82(2):328-60. doi: 10.1177/0003122417695791.
Hanushek, Eric A., John F. Kain, Jacob M. Markman and Steven G. Rivkin. 2003. "Does Peer Ability Affect Student Achievement?". Journal of Applied Econometrics 18(5):527-44.
Harris, Richard, Ron Johnston and Simon Burgess. 2007. "Neighborhoods, Ethnicity and School Choice: Developing a Statistical Framework for Geodemographic Analysis." Population Research and Policy Review 26(5-6):553-79.

Hedman, Lina and Roger Andersson. 2015. "Etnisk Segregation Och Inkomstsegregation I Sveriges Tio Största Arbetsmarknadsregioner 1990–2010." Pp. 15-38 in Mångfaldens Dilemman : Boendesegregation Och Områdespolitik. Malmö: Gleerups Utbildning AB.

Helgøy, Ingrid, Anne Homme, and Sharon Gewirtz. 2007. Local autonomy or state control? Exploring the effects of new forms of regulation in education. SAGE Publications Sage UK: London, England.

Holme, Jennifer Jellison. 2002. "Buying Homes, Buying Schools: School Choice and the Social Construction of School Quality." Harvard Educational Review 72(2):177-206.

Jackson, Michelle, Jan O Jonsson, and Frida Rudolphi. 2012. "Ethnic inequality in choice-driven education systems: A longitudinal study of performance and choice in England and Sweden." Sociology of Education 85(2):158-178.

Jones, Kelvyn, Ron Johnston, David Manley, Dewi Owen and Chris Charlton. 2015. "Ethnic Residential Segregation: A Multilevel, Multigroup, Multiscale Approach Exemplified by London in 2011." Demography 52(6):1995-2019.

Kauppinen, Timo M. 2007. "Neighborhood Effects in a European City: Secondary Education of Young People in Helsinki." Social science research 36(1):421-44.

Kauppinen, Timo. 2008. "Schools as Mediators of Neighbourhood Effects on Choice between Vocational and Academic Tracks of Secondary Education in Helsinki." European Sociological Review 24(3):379-91.

Kosunen, Sonja, Venla Bernelius, Piia Seppänen, and Miina Porkka. 2016. "School Choice to Lower Secondary Schools and Mechanisms of Segregation in Urban Finland." Urban Education:0042085916666933.

Kwan, Mei-Po. 2012. "The Uncertain Geographic Context Problem." Annals of the Association of American Geographers 102(5):958-68. doi: 10.1080/00045608.2012.687349.

Lareau, Annette. 2011. Unequal Childhoods: Class, Race, and Family Life: Univ of California Press.

Leventhal, Tama and Jeanne Brooks-Gunn. 2000. "The Neighborhoods They Live In: The Effects of Neighborhood Residence on Child and Adolescent Outcomes." Psychological Bulletin 126(2):309-37.

Liu, Shuning and Michael W Apple. 2016. "Parental Choice of School, Class Strategies, and Educational Inequality: An Essay Review of School Choice in China—a Different Tale?(X. Wu, New York, Ny: Routledge, 2014, 168 Pp. Isbn 978-0-415-81769-1)." Educational Policy 30(6):940-55.

Lubienski, Christopher, Charisse Gulosino and Peter Weitzel. 2009. "School Choice and Competitive Incentives: Mapping the Distribution of Educational Opportunities across Local Education Markets." American Journal of Education 115(4):601-47.

Lucas, Samuel R. 2001. "Effectively Maintained Inequality: Education Transitions, Track Mobility, and Social Background Effects." American journal of sociology 106(6):1642-90.

Lundahl, Lisbeth. 2002. "Sweden: decentralization, deregulation, quasi-markets - and then what?" Journal of Education Policy 17(6):687-697.

Lundahl, Lisbeth. 2016. "Equality, inclusion and marketization of Nordic education: Introductory notes." Research in comparative and international education 11(1):3-12.

Malmberg, B., Andersson, E. K., Nielsen, M. M., & Haandrikman, K. 2018. Residential Segregation of European and Non-European Migrants in Sweden: 1990–2012. European Journal of Population, 34(2), 169-193.

Malmberg, Bo, Eva K. Andersson and Zara Bergsten. 2014. Composite Geographical Context and School Choice Attitudes in Sweden: A Study Based on Individually Defined, Scalable Neighborhoods. Annals of the Association of American Geographers 104(4):869-88. doi: 10.1080/00045608.2014.912546.

Maloutas, Thomas. 2007. "Middle class education strategies and residential segregation in Athens." Journal of Education Policy 22(1):49-68.

Marks, Gary N. 2013. "Evaluating Effectively Maintained Inequality: School and Post-School Transitions, Socioeconomic Background, Academic Ability and Curricular Placement." Social science research 42(6):1635-49.

Menard, Scott. 2000. "Coefficients of Determination for Multiple Logistic Regression Analysis." The American Statistician 54(1):17-24.

Nagelkerke, Nico JD. 1991. "A Note on a General Definition of the Coefficient of Determination." Biometrika 78(3):691-92.

Nordin, Martin. 2013. "Immigrant School Segregation in Sweden." Population Research and Policy Review 32(3):415-35.

Oría, Angela, Alejandra Cardinib, Stephen Balla, Eleni Stamoua, Magda Kolokithaa, Sean Vertigana and Claudia Flores-Morenoa. 2007. "Urban Education, the Middle Classes and Their Dilemmas of School Choice." *Journal of Education Policy* 22(1):91-105.

Östh, John, Eva Andersson and Bo Malmberg. 2013. School Choice and Increasing Performance Difference: A Counterfactual Approach. *Urban Studies* 50(2):407-25. doi: 10.1177/0042098012452322.

Palme, Mikael. 2008. *Det Kulturella Kapitalet : Studier Av Symboliska Tillgångar I Det Svenska Utbildningssystemet 1988-2008*. Uppsala: Acta Universitatis Upsaliensis (AUU) :.

Poupeau, F., J. C. Francois and E. Couratier. 2007. "Making the Right Move: How Families Are Using Transfers to Adapt to Socio-Spatial Differentiation of Schools in the Greater Paris Region." *Journal of Education Policy* 22(1):31-47. doi: 10.1080/02680930601065858.

Rangvid, Beatrice. S. 2007. "Living and learning separately? Ethnic segregation of school children in Copenhagen." *Urban Studies* 44(7):1329-1354.

Raudenbush, Stephen W., and J. Dougolas Willms. 1995. "The Estimation of School Effects." *Journal of Educational and Behavioral Statistics* 20(4):307-335.

Reay, Diane and Stephen J. Ball. 1997. "'Spoilt for Choice': The Working Classes and Educational Markets." *Oxford Review of Education* 23(1):89-101. doi: 10.1080/0305498970230108.

Regeringskansliet. 2010. *Skollag 2010:800 (Education Act) Utbildningsdepartementet (Ministry of Education and Research)*Congress, Svensk författningssamling (SFS) (Lika tillgång till utbildning, 8 §):20, http://www.skolverket.se/content/1/c6/02/05/52/kap1.pdf.

Resh, Nura and Yechezkel Dar. 2012. "The Rise and Fall of School Integration in Israel: Research and Policy Analysis." *British Educational Research Journal* 38(6):929-51.

Rudolphi, Frida and Robert Erikson. 2016. "10. Social Selection in Formal and Informal Tracking in Sweden." *Models of Secondary Education and Social Inequality: An International Comparison*:165.

Sampson, Roert J. 2012. *Great American City: Chicago and the Enduring Neighborhood Effect*. Chicago: University of Chicago Press.

Saporito, Salvatore and Deenesh Sohoni. 2007. "Mapping Educational Inequality: Concentrations of Poverty among Poor and Minority Students in Public Schools." *Social Forces* 85(3):1227-53.

Singleton, Alex D., Paul A. Longley, Rebecca Allen and Oliver O'Brien. 2011. "Estimating Secondary School Catchment Areas and the Spatial Equity of Access." *Computers, Environment and Urban Systems* 35(3):241-49. doi: http://dx.doi.org/10.1016/j.compenvurbsys.2010.09.006.

Skolverket. 2017. "Siris, the National Agency for Education's Online Information System on Results and Quality, Has Been in Operation since 21 September 2001.". http://siris.skolverket.se/siris/f?p=Siris:1:0: Skolverket (National Agency for Education).

Sykes, Brooke and Sako Musterd. 2011. "Examining Neighbourhood and School Effects Simultaneously: What Does the Dutch Evidence Show?". *Urban Studies* 48(7):1307-31.

Van Ewijk, Reyn, and Peter Sleegers. 2010. "The effect of peer socioeconomic status on student achievement: A meta-analysis." *Educational Research Review* 5(2):134-150.

Van Ham, Maarten, David Manley, Nick Bailey, Ludi Simpson, and Duncan Maclennan. 2012. *Neighbourhood effects research: new perspectives*. Springer.

Van Zanten, Agnès. 2005. "New Modes of Reproducing Social Inequality in Education: The Changing Role of Parents, Teachers, Schools and Educational Policies." *European Educational Research Journal* 4(3):155-69.

Wiborg, Susanne. 2013. "Neo-liberalism and universal state education: The cases of Denmark, Norway and Sweden 1980–2011." *Comparative Education* 49(4):407-423.

Wilson, William Julius. 1987. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago and London: The University of Chicago Press.

Table 1. Individual level, school context, and residential context variables used in the model estimations.

Individual variables	
Grade	Percentile rank of the summarized grade in year 9
Female (student)	1 = female, 0 = male
Foreign born (student)	1 = foreign born, 0 = born in Sweden
Parent on social allowance (parent)	1 = social allowance the previous year, 0 = not social allowance
Parent with tertiary education (parent)	1 = university/college, 0 = not university/college
Parent non-employed[2] (parent)	1 = non-employed in November the previous year, 0 = employed
Single parent household[1] (parent)	1 = single parent, 0 = not single parent
Family disposable income, percentiles[3] (parent)	Percentile rank in relation to the total adult population, family disposable income
Single family housing	1 = Single family housing, 0 = other types of housing
School variables	
Municipality	The municipality of the school
Female (student)	Share of the students that are females
Foreign born (student)	Share of the students that are born outside of Sweden
Parent on social allowance (parent)	Share of the students that had a parent on social allowance the previous year
Parent with tertiary education (parent)	Share of the students that had a parent with tertiary education
Parent non-employed[2] (parent)	Share of the students that have a parent without employment in November the previous year
Single parent household[1] (parent)	Share of the students living in a single parent household
Foreign born parent	Share of the students with parents born outside of Sweden
Family disposable income, percentiles[3] (parent)	Mean value students, percentile rank in relation to the total adult population, family disposable income
Single family housing	Share of the students living in single family housing
Neighbourhood variables	
Parent on social allowance	Share of the peers that had a parent on social allowance the previous year
Parent with tertiary education	Share of the peers that had a parent with tertiary education
Parent non-employed	Share of the peers that have a parent without employment in November the previous year
Single parent household	Share of the peers living in a single parent household
Foreign born parent	Share of the peers with parents born outside of Sweden
Family disposable income	Mean value peers, percentile rank in relation to the total adult population, family disposable income
Single family housing	Share of the peers living in single family housing

Notes: 1) Single parent may be living with a cohabiting partner who is not the person's parent. 2) Non-employed can be on parental leave or retired. 3) Values are between 0 and 1.

Table 2. Parameter estimates and standard errors for fixed and random parts of Model 1 (empty), Model 2 (individual level controls), Model 3 (individual and school level controls), Model 4 (individual, school, and residential context controls), Model 5 (individual and residential context controls), Model 6 (same as model 3 school context captured by two principle components), and Model 7 (same as model 3 school context captured by two principle components) using data for 2012.

	Model 1	**SE**	**Model 2**	**SE**	**Model 3**	**SE**	**Model 4**	**SE**	**Model 5**	**SE**	**Model 6**	**SE**	**Model 7**	**SE**
Response	Grade		Grade		Grade		Grade		Grade		Grade		Grade	
Fixed Part														
cons	**.493**	**.003**	**.288**	**.004**	**.144**	**.041**	**.136**	**.041**	**.132**	**.013**	**.282**	**.004**	**.152**	**.013**
Female (individual)			**.120**	**.002**	**.120**	**.002**	**.119**	**.002**	**.120**	**.002**	**.120**	**.002**	**.120**	**.002**
Foreign born (individual)			**–.045**	**.003**	**–.045**	**.003**	**–.041**	**.003**	**–.042**	**.003**	**–.045**	**.003**	**–.042**	**.003**
Parent on social allowance (ind.)			**–.081**	**.004**	**–.080**	**.004**	**–.075**	**.004**	**–.075**	**.004**	**–.080**	**.004**	**–.075**	**.004**
Parent with tertiary education (ind.)			**.124**	**.002**	**.121**	**.002**	**.116**	**.002**	**.116**	**.002**	**.122**	**.002**	**.116**	**.002**
Parent non-employed (individual)			**–.016**	**.003**	**–.017**	**.003**	**–.019**	**.003**	**–.018**	**.003**	**–.016**	**.003**	**–.018**	**.003**
Single parent household (ind.)			**–.029**	**.002**	**–.030**	**.002**	**–.032**	**.002**	**–.032**	**.002**	**–.031**	**.002**	**–.033**	**.002**
Family disposable income (ind.)			**.162**	**.005**	**.156**	**.005**	**.134**	**.005**	**.134**	**.005**	**.157**	**.005**	**.133**	**.005**
Single family housing (individual)			**.036**	**.002**	**.039**	**.002**	**.032**	**.002**	**.033**	**.002**	**.038**	**.002**	**.032**	**.002**
Females (school)					**.095**	**.030**	**.103**	**.030**						
Foreign born (school)					**–.213**	**.041**	**–.229**	**.041**						
Parent on social allowance (school)					–.031	.051	–.040	.051						
Parent with tertiary education (sch.)					**.150**	**.020**	**.110**	**.020**						
Parent non-employed (school)					.018	.043	–.021	.044						
Single parent household (school)					**–.165**	**.035**	**–.198**	**.035**						
Foreign born parent (school)					**.158**	**.023**	**.163**	**.024**						
Family disposable income (school)					**.234**	**.049**	.060	.051						
Single family housing (school)					**–.106**	**.019**	**–.080**	**.019**						
Component 1 (school)											–.001	.002	.001	.002
Component 2 (school)											**.037**	**.002**	**.022**	**.003**
Parent on social allowance (neighb.)							–.005	.014	–.017	.014			–.014	.014
Parent with tertiary edu. (neighb.)							**.064**	**.007**	**.075**	**.007**			**.066**	**.007**
Parent non-employed (neighb.)							**.042**	**.012**	**.049**	**.012**			**.044**	**.012**
Single parent household (neighb.)							**.018**	**.008**	**.022**	**.008**			.013	.008
Foreign born parent (neighbourhood)							.003	.008	**.028**	**.008**			**.018**	**.008**
Family disposable income (neighb.)							**.202**	**.019**	**.246**	**.018**			**.212**	**.018**
Single family housing (neighb.)							**–.022**	**.005**	**–.031**	**.005**			**–.025**	**.005**
Random Part														
Level: School														
cons/cons	.012	.000	.007	.000	.005	.000	.005	.000	.006	.000	.005	.000	.005	.000
Level: Student														
cons/cons	.074	.000	.060	.000	.061	.000	.060	.000	.060	.000	.061	.000	.060	.000
–2*log likelihood:	26065		6209		5796		5326		5560		5983		5489	
AIC	26071		6231		5836		5380		5596		6009		5528	
Schools	1550		1550		1550		1550		1550		1550		1550	
Students	98806		98806		98806		98806		98806		98806		98806	

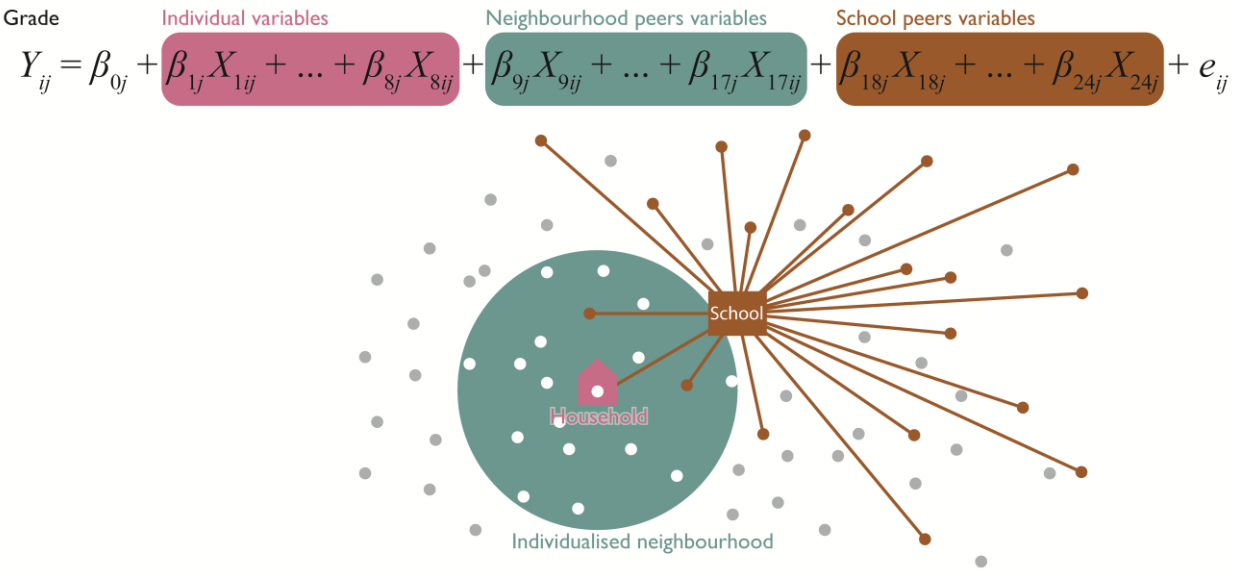


Figure 1. The models of this study are multilevel models utilizing different combinations of individual variables, neighbourhood variables and school variables.

Figure 2 Standard deviations for residential context variables and school context variables, 1991 to 2012.

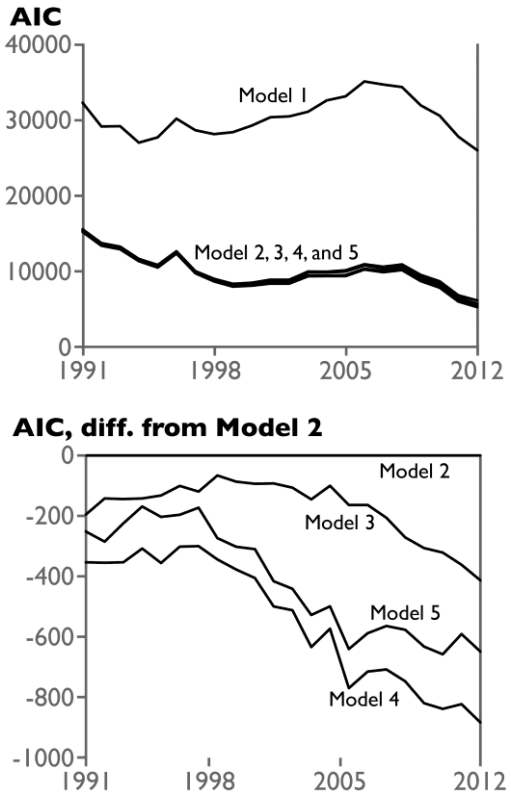


Figure 3 A AIC values for Model 1 to Model 5 estimated separately on data for year 1991-2012.

Figure 3 B Difference in AIC values for Model 3 to Model 5, compared to Model 2 (only individual level controls), 1991-2012.

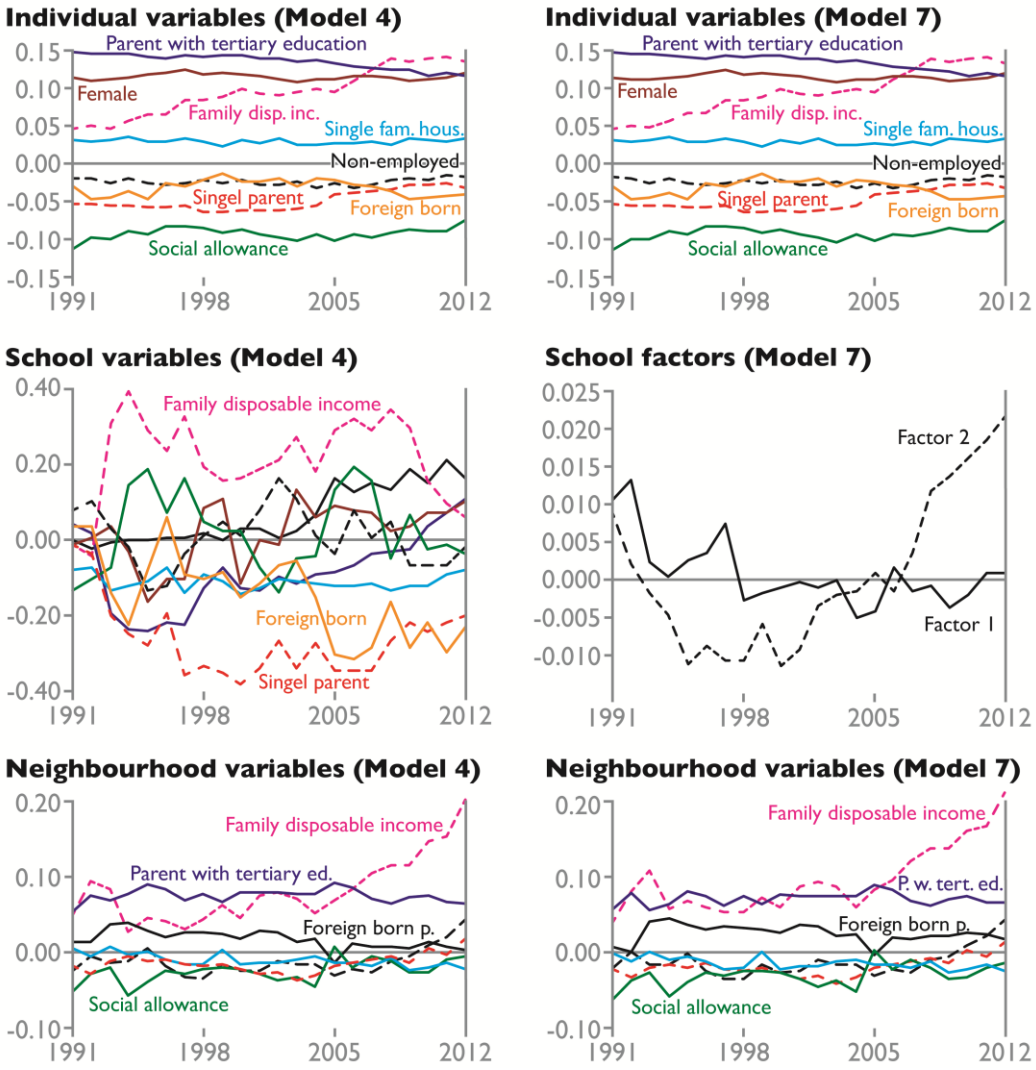


Figure 4. Parameter estimates for the individual level, school level and residential context variables of Model 4 and Model 7 (school context captured by two principle components), 1991 to 2012.

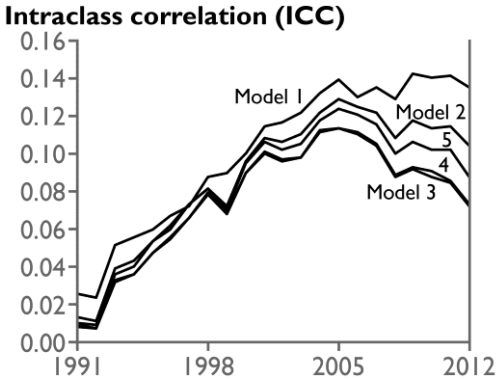
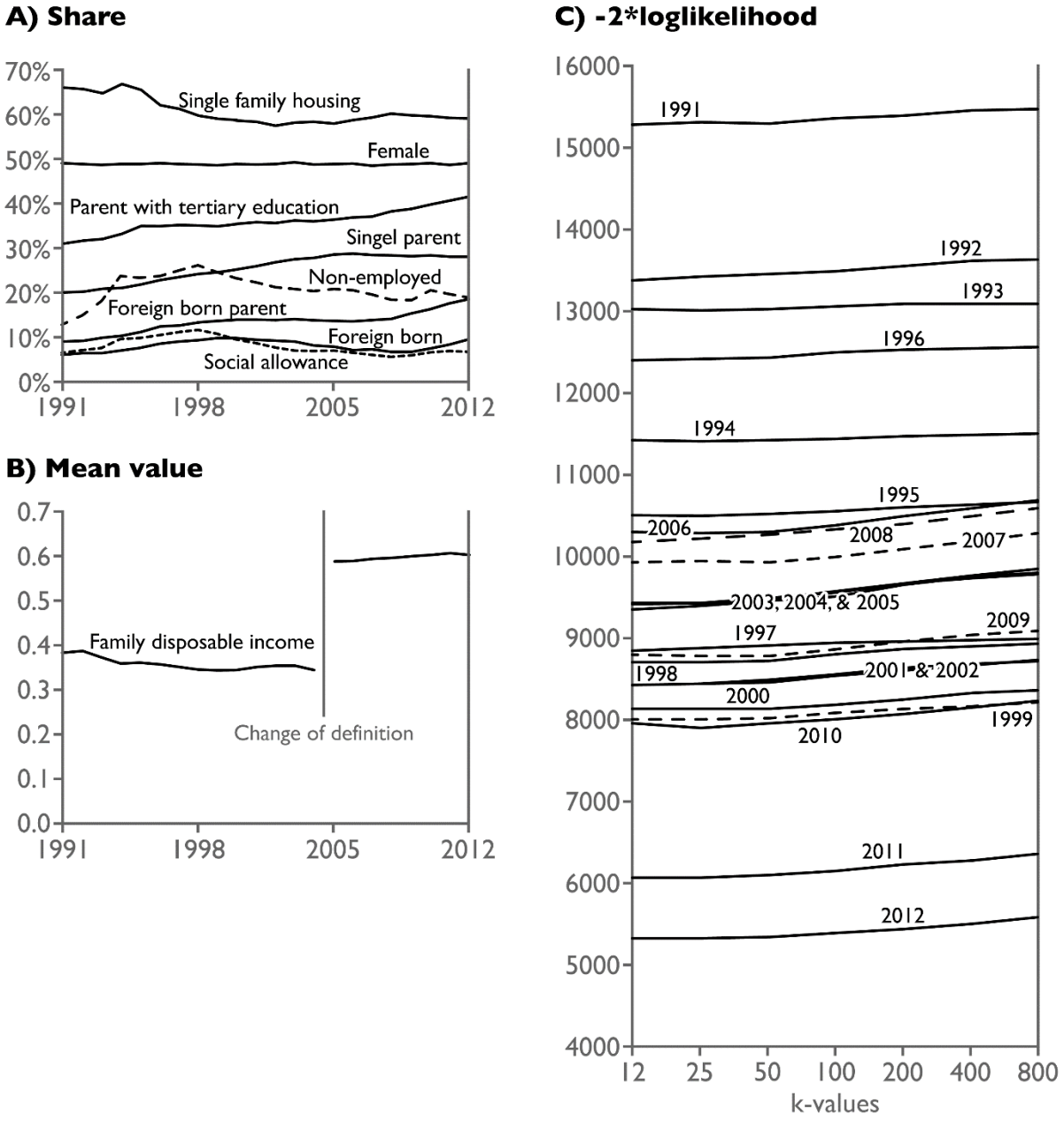


Figure 5 Between-school variance, ICC, for Model 1 (empty), Model 2 (individual level controls), Model 3 (individual and school level controls), Model 4 (individual, school, and residential context controls), and Model 5 (individual and residential context controls). Estimated separately on data for year 1991-2012.

Supplementary figure

Figure A. Shares. Socio-demographic composition of students in the sample, 1991-2012
Figure B. Mean value of family disposable income of students in the sample, 1991-2012.
Figure C. -2*log likelihood for models of different years and different number of closest peers (k-values).



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