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Escaping one's disadvantage? Neighbourhoods, socioeconomic origin and children's adult life outcomes

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This study investigates if neighbourhoods can alter the strong relationship between parental background and children's adult outcomes. In particular, we examine if neighbourhood effects are heterogeneous in such a way that they are particularly important for children from disadvantaged backgrounds, and if school quality has a mediating effect in this equation. Using register data and individualized neighbourhoods, we follow five full birth cohorts of individuals born from 1983 to 1987. We examine the interaction between social background and neighbourhoods in shaping (i) the risk of children relying on social welfare when they are aged 30, and (ii) the probability of belonging to the highest income decile at age 30–34. Growing up in a resource-rich neighbourhood is associated with better life outcomes. Contrary to what several neighbourhood theories predict, we find that neighbourhood effects operate similarly regardless of social background. Differences in peer composition of schools does not explain these local neighbourhood effects, whereas own school results attenuate neighbourhood effects substantially. Our findings are in contrast to results from the United States studies but are in line with historical Swedish studies; and contribute to further disentangling the various mechanisms through which the neighbourhood operates.

Introduction

A long strand of research has shown that disadvantage 'runs in the family'. Children growing up in poor families have worse adult socioeconomic outcomes than children growing up in wealthier families (Solon, 1999; Hout and DiPrete, 2006; Jäntti *et al.*, 2006; Hertz *et al.*, 2007; Black and Devereux, 2011; Hout, 2015). Theories aimed at explaining the link between parental socioeconomic status and child outcomes often highlight how highly educated or high-income parents can help their children with homework and other tasks, navigate the school system and function as positive role models (Breen and Goldthorpe, 1999; Jonsson and Eriksson, 2000). If parents lack these kinds of skills or resources, the child will have a more difficult time succeeding in the educational system and, later on, in the labour market.

The aim of the present study is to investigate whether neighbourhood resources can alter the well-known relationship between parental background and adult outcomes. In particular, we want to study whether the association between neighbourhood characteristics and adult outcomes differ for children from different socioeconomic origins. We also examine the extent to which neighbourhood differences in school quality can mediate this pattern. Theories and research on residential segregation suggest that peers, neighbours, and neighbourhood institutions, such as schools, sports clubs, or kindergartens, may improve individual level outcomes (Jencks and Mayer, 1990; Sampson, Morenoff and Gannon-Rowley, 2002; Galster, 2008; Chetty *et al.*, 2016). So far, however, research addressing neighbourhood effects has mainly focused on average effects, with less discussion on how neighbourhoods may alter the dependency between family background and later life outcomes. This is the main scope for this study.

We use the longitudinal Swedish population registers with geocoded information on individuals'

neighbourhood context on 100 × 100 m accuracy and include fixed effects models for administratively defined small areas (SAMS) in order to adjust for sorting into neighbourhoods (Hedman and Van Ham, 2012). Five birth cohorts of individuals are followed, from adolescence to adulthood, and we examine whether the neighbourhood composition during adolescence has the potential to alter the well-known association between children's family of origin and their grown-up outcomes, and how much of this neighbourhood effect can be explained by neighbourhood differences in school quality. In particular, we address the probability for children of ending up in (i) a disadvantaged position (i.e. relying on social welfare) and (ii) an advantaged position (top income decile) when they are adults.

Background

Theoretical starting points

In order to understand whether neighbourhood resources may alter the association between parental background and adult outcomes, we start with a short review of the theoretical mechanisms between neighbourhoods and children's adult outcomes. Using a rich body of literature (Jencks and Mayer, 1990; Sampson, Morenoff and Gannon-Rowley, 2002; Galster, 2008), these can be summarized into the following three broad categories: (i) Peer influence suggests that children in the same neighbourhood or the same school influence each other. Children who see their peers skip school, or fail to invest in school work, may normalize such behaviour and start behaving in an equal fashion. Similarly, children who grow up in neighbourhoods where a majority has high-educational aspirations will be inspired to similar aspirations. Behaviour and ambition are seen as contagious, where the dominant behaviour in one area will affect those exposed to it (Jencks and Mayer, 1990). (ii) Collective socialization is about neighbourhood residents being encouraged to conform to local social norms, as conveyed by (adult) role models or by other social pressure in the area (Galster, 2008). Children who are surrounded by highly educated adults might have, at least partly, access to their resources in terms of information, attitudes to higher education, their network characteristics, and so on. Hence, highly educated adults can serve as role models not only for their own children, but also for other children in the neighbourhood. (iii) Institutional resources emphasize the importance of neighbourhood institutions such as schools, libraries, and sport clubs for individual outcomes. As school quality as well as schools' socioeconomic composition varies between neighbourhoods (Jencks and Mayer, 1990; Hermansen, Borgen and Mastekaasa, 2020), this may affect individual school results and later life outcomes.

In fact, some studies show that school quality may explain more of the variance in educational outcomes than neighbourhood characteristics, though the neighbourhood does matter (Jargowsky and El Komi, 2009). As has long been acknowledged in the literature (Pickett and Pearl, 2001; Galster, 2012) it is difficult to distinguish between the mechanisms that underlie neighbourhood effects. In our analyses, our main interest is to test if neighbourhood effects are heterogeneous in such a way that they are particularly important for children from disadvantaged backgrounds, and the mediating role of the school, as an institutional resource, in this equation.

None of these mechanisms imply that children are equally affected by their neighbourhood. Rather, it is likely that children differ in susceptibility, and that these differences can be attributed to differences in their upbringing (Jencks and Mayer, 1990). The link between parents' and children's socioeconomic status is often attributed to two types of pathways—endowments and investments (Jencks and Mayer, 1990; Jonsson and Mood, 2008). Parental endowments include knowledge and information to help navigate the school system, the ability to help with homework and the like, access to professional networks, genetic predisposition as well as the transfer of educational and work–life norms. Investments refer to 'intentional parental behaviour, aimed at influencing child outcomes' (Erola, Jalonen and Lehti, 2016: p. 34). This includes both monetary investments in schooling and time investments in supporting their offspring. If parents lack these kinds of skills or resources, the child might have a more difficult time succeeding in the educational system and, later on, on the labour market. Building on the argument put forward by Jencks and Mayer (1990), it is reasonable to assume that children whose parents lack the skills and resources needed to support them might be more affected by the neighbourhood in which they grow up. For instance, it has been suggested that low-SES children are more affected than high-SES children from living in a deprived neighbourhood, due to cumulative disadvantage stemming from both the family and the neighbourhood (Wodtke, Harding and Elwert, 2016; Levy, 2019). In a similar vein, it is likely that children from low-SES families might be more positively affected by growing up in a favourable neighbourhood than other children. A contrasting argument could be that children from more advantaged families have more to lose in deprived neighbourhoods, meaning that they might be more affected than low-SES children (Levy, 2019).

Previous studies

An extensive literature has examined neighbourhood effects on individual outcomes. Even though findings are mixed in terms of how strong neighbourhood

effects actually are, when adjusting for selection into neighbourhoods, the overall findings suggest that neighbourhood characteristics matter for children's IQ, teenage births, school-leaving, social welfare, and educational outcomes (Brooks-Gunn *et al.*, 1993; Mood, 2010; Sampson, 2012; Sharkey and Faber, 2014; Andersson and Malmberg, 2015; Hedefalk and Dribe, 2020). In particular, neighbourhood effects on socioeconomic outcomes appear to be strong when focusing on neighbours living in close proximity to an individual, rather than defining neighbourhoods by administrative borders (Andersson and Malmberg, 2015). Research also suggest that neighbourhood effects are smaller in Europe compared to the United States, possibly due to overall lower levels of segregation (Musterd, 2005).

The role of schools is under-examined in the neighbourhood effects literature (Kauppinen, 2008) and results are inconclusive. Recent research from the United States suggest that school quality is not a driving force behind neighbourhood differences in the academic achievement of first graders, although the authors argue that school quality may become a more important mediator the older children become (Wodtke *et al.*, 2020). Kauppinen (2008) found that neighbourhood effects on educational choice mainly operate via the school context in Helsinki. Hermansen, Borgen and Mastekaasa (2020) found very little evidence that variation in adolescent school and neighbourhood contexts affect adult earnings and educational outcomes in Norway. Also in Sweden, school admittance typically occurs by the proximity principle, and even though exceptions exist, children in general attend school close to where they live (Mutgan, 2021). Schools with many low-SES pupils are often of lower quality than high-SES schools, for instance, due to fewer certified teachers (Skogstad, 2019), higher turn-over rates of principals (SOU, 2020), lower overall school quality, and more children with special needs (Holmlund, Sjögren and Öckert, 2019). This means that children growing up in resource-rich neighbourhoods are likely to experience a better overall learning environment, which in turn may impact their adult outcomes.

Most studies on neighbourhood effects focus on average effects from neighbourhood characteristics (Brooks-Gunn *et al.*, 1993; Sampson, Morenoff and Gannon-Rowley, 2002). Even though they generally adjust for socioeconomic characteristics of families, the main focus is rarely how neighbourhood characteristics can alter the dependency between family background and children's adult outcomes, hence, potentially reducing inequality by socioeconomic background. Research on the link between neighbourhood effects and socioeconomic background has mainly focused on how neighbourhoods can explain social

immobility, that is, how much of the overall patterns of social mobility stems from people with different socioeconomic backgrounds living in different kinds of neighbourhoods (Page and Solon, 2003; Raaum, Salvanes and Sørensen, 2006). Interestingly, already in 1999, Solon listed neighbourhood effects as a priority task for the research field of intergenerational social mobility; primarily with regard to identifying the mechanisms behind the neighbourhood's importance for social mobility, focusing on role models in the environment, school and peer group effects (Solon, 1999). Still, many important pieces of this puzzle are missing.

A few studies have addressed heterogeneous effects of neighbourhood characteristics by focusing on how neighbourhood characteristics matter differently for children from different socioeconomic backgrounds. Chetty *et al.* (2014) found heterogeneous neighbourhood effects on intergenerational social mobility across the United States. Chetty and Hendren (2018) continued this line of work by examining whether these effects are causal, by studying children's exposure time to a specific neighbourhood context for those who later moved to a new area of residence. They concluded that a substantial fraction of the differences in outcomes remained, net of selection into regions (Chetty and Hendren, 2018). These conclusions were also supported by findings from the moving to opportunity project, where children who moved to more affluent neighbourhoods when young had experienced better adult outcomes than children who moved to more affluent neighbourhoods when they were older, or children who did not move at all (Chetty, Hendren and Katz, 2016). Rothwell and Massey (2015) studied neighbourhood effects on intergenerational economic mobility in the United States and found that neighbourhood income levels had about half the effect on the future income compared to parents' income. They calculated that the expected total life income would be 635,000 USD lower for a person who grew up in a neighbourhood located at the bottom of the income scale instead of a neighbourhood located at the top of the income scale. Wodtke *et al.* (2016), using the same data, found that children from poor families are more affected by growing up in resource-poor neighbourhoods when it comes to progressing to a higher education.

For the Swedish context, Andersson and Malmberg (2015) used individualized neighbourhoods to examine whether the association between the neighbourhood and children's educational attainment differed by parental education. Their results are not entirely clear as to whether the neighbourhood may be inequality-enhancing or not. They find, for example, that neighbourhood effects are stronger for men with highly educated parents than for other men, and interpret this as if the neighbourhood may

be the last push required for groups who have already thought about getting a university education. Hedefalk and Dribe (2020) studied the city of Landskrona in Sweden and found an association between the social class of the nearest same age neighbours while growing up and own educational outcomes at the age of 40, regardless of own class origin. Another recent Swedish study (Böhlmark and Willén, 2020) finds effects that appear to be causal, on how ethnic neighbourhood segregation is linked to educational outcomes. The authors identify tipping points, that is, at what percentage of immigrants the native-born population ceases to move into an area or begins to move out of it (between 18 and 19 per cent immigrants, depending on city). Findings suggest a slight deterioration in school outcomes for those living in areas just above a breakpoint. The effects were greater for children with lower educated parents and for boys. However, the authors found no effects on employment levels and income (Böhlmark and Willén, 2020).

Building on these sets of literature, we first hypothesize that the neighbourhood is associated with later life outcomes, as a result of peer influence, collective socialization, and institutional resources. Hypothesis 1: *Children who grow up surrounded by resource-rich neighbours have better adult socioeconomic outcomes than other children*. Building on theories on heterogeneous neighbourhood effects, hypothesis 2 reads: *The association between resource-rich neighbours and adult outcomes is stronger for children from low-SES families*. Finally, we want to see if institutional resources related to school quality might mediate the potential heterogeneous neighbourhood effects. Thus, hypothesis 3 is as follows: *The association between resource-rich neighbourhoods and adult outcomes is partly mediated by neighbourhood differences in school quality*.

Data and methods

Our analyses are based on Swedish register data including all individuals born between 1983 and 1987, who lived in Sweden when they were aged 10–15 (in the period 1993–2002), and also lived in Sweden when they were aged 30, in the period 2013–2017. The children were linked to their parents through the Multi-Generation Register. All children and parents have unique identifiers that allowed us to link individual register data on education, income, place of residence and more between 1993 and 2017.

Neighbourhood characteristics

Often, neighbourhood effect studies are forced to define neighbourhoods using administrative boundaries. This is associated with the Modifiable Area Unit Problem and risks underestimating neighbourhood effects

(Spielman and Yoo, 2009). Lately, the use of individualized neighbourhoods and *k*-nearest neighbours has been suggested as a remedy (see e.g. Andersson and Malmberg, 2015, 2018). The present study follows this stream of research and uses coordinate data on 100 × 100 m accuracy to create individualized neighbourhoods. Individualized neighbourhoods were calculated using the Geocontext script (Hennerdal, n.d.), and measured characteristics among the 500 nearest neighbours when the individual was aged 15. In practice, it means allowing an algorithm to gradually increase a circle around each individual until the circle contains 500 adults. Thereafter, the proportion of these neighbours with certain attributes are calculated. Such a small neighbourhood size represents the number of people one might recognize, meet in the neighbourhood, schools, and local services (Amcoff *et al.*, 2014), and therefore, is a likely neighbourhood size to affect an individual's socioeconomic situation. The use of small individualized neighbourhoods distinguishes our study from studies by for instance Chetty and Hendren (2018), who use larger, administratively defined areas.

Our main interest is whether the resources of adults living nearby are associated with the life chances of children, net of their parental resources. We are particularly interested in whether neighbours can compensate for the lack of resources from the parental home. As valuable resources, we include neighbours' educational levels, employment, and their income. These variables are measured by whether individuals are registered to be employed in November a given year; their completed level of education (SUN level, which is the Swedish equivalent of ISCED); and their disposable income (as reported to the Swedish Tax Agency).

We used five definitions of the neighbourhood: the share of the 500 nearest neighbours aged 25–64 (in Sweden the official retirement age is 65) who are

(1) Highly educated (having at least a tertiary education).
(2) Very low educated (having completed only the 9 years of compulsory education).
(3) Are not employed and have a disposable income in the 1st decile (deciles are constructed based on the population of individuals aged 25–64 at that given year).
(4) Are employed and have a disposable income in deciles 2–9.
(5) Are employed and have a disposable income in the 10th decile.

In order to make full use of all neighbourhood characteristics in multivariate models, we performed a principal component factor analysis on the five neighbourhood variables. The factor analysis, which clusters

individualized neighbourhoods with similar characteristics, resulted in two factors explaining 87 per cent of the total variance in the socioeconomic composition of the nearest neighbours. Table 1 presents the factor loadings for the two factors (which are automatically standardized, with a mean of 0 and a standard deviation of 1). High loadings on factor 1 are related to a high share of neighbours who are higher educated, who have very high incomes and neighbours with very low shares of the very low educated. We labelled this factor *elite*. Factor 2 is related to high shares of neighbours that are not employed and have very low incomes, and very low shares of neighbours that are middle earners. We labelled this factor *marginalization*, although it can also be understood as the inverse of a middle-income neighbourhood.

Socioeconomic resources in adolescence and adulthood

We operationalized children's socioeconomic background by their parents' average individualized disposable household income the years when the child was aged 10–15. The measure summarizes all family members' income from employment and benefits, after taxes and social transfers have been deducted, divided by the total consumption weights for the family members. We set negative and zero incomes to missing (Breen, Mood and Jonsson, 2016). Individuals whose both parents had missing information for all the years when the child was aged 10–15 were excluded from the analyses ($n = 87$). We divided all children into deciles, based on the income of parents to children born in the same cohort.

Table 1 Factor loadings

Share of the nearest neighbours who are	Factor 1	Factor 2
Highly educated	0.9482	
Very low educated	-0.8652	
Not employed and very low income	-0.4515	0.8293
Employed, income in decile 2–9	-0.4963	-0.8172
Employed, income in highest decile	0.9150	
Explained variance	58.7 per cent	28.4 per cent

Note: only factor loadings higher than 0.4 are displayed. Bold cells show the factor where the variable has the highest loading. The table displays factor loadings after Oblique Oblimin rotation. Oblimin rotation was preferred over Orthogonal rotation as we assumed the factors may be correlated.

We focused on two individual outcomes on opposing sides of the income spectrum; (i) being a social welfare recipient the year one turns 30 and (ii) having a disposable income in the top income decile of one's birth cohort at the age of 30–34. Disposable income is measured at the individual level, and averaged over the ages we have data for, for the respective cohorts. In Sweden, social welfare is a means-tested financial support which is given to households that cannot support themselves. It is applied for and approved on a monthly basis and could be considered the closest we can get to a measure of poverty in a Scandinavian welfare state. Social benefits should, when combined with other income, cover basic costs of daily maintenance, such as housing, groceries, clothes, phone bills, and insurance (National Board of Health and Welfare, 2019). In 2019, 0.4 per cent of all households received social welfare in Sweden (National Board of Health and Welfare, 2020). Given that social assistance is approved at the household level, we excluded individuals who lived with their parents at age 30.

The third hypothesis concerns whether school quality mediates neighbourhood effects. School quality is a complex concept which encapsulates both peer composition and hard-to-measure school characteristics such as teachers' skills and ambition. We operationalize school quality by the average GPA of the individual's 9th grade school peers. This is the last year of primary school, when pupils are usually 15 years. Grades are assigned by teachers, and skills are matched to standardized requirements. Students can be assigned six different grades, corresponding to a numerical value: 0; 10; 12.5; 15; 17.5; and 20. The grade sum is based on the 16 highest grades, suggesting a maximum grade sum of 320. We also test how own GPA mediates neighbourhood effects.

Control variables

In all models, we controlled for *year of birth, gender and family status* at age 15. *The highest education of parents* is based on the Swedish equivalent of ISCED, the so-called SUN-level. *Immigrant background* distinguishes between (i) Swedish born to Swedish parents, (ii) Swedish born to one Swedish and one immigrant parent, (iii) Swedish born to at least one non-western parent, (iv) Swedish born to two western parents, (v) foreign born in a non-western country, and (vi) foreign born in a western country[1]. Adopted children and children born abroad to Swedish parents were grouped with Swedish born to Swedish parents. *Type of region* was specified as the area around Stockholm, Malmö, Gothenburg, respectively, and the rest of Sweden. Table 2 includes descriptive statistics for all our included variables. Our initial population of interest consisted of 435,756 individuals. After excluding individuals with

Table 2 Descriptive statistics

Variable	Categories	Means/Per cent
Outcome variables (per cent)	Social welfare age 30	2.6
	Highest income decile age 30–34	10.1
Factor score (mean)	Factor 1 elite	0.31
	Factor 2 marginalization	0.19
GPA (mean)		203.4
Peers' GPA (mean)		201.4
Parents' highest education at ego's age 15 (per cent)	Compulsory school less than 9 years	1.6
	Compulsory school of 9 years	6.3
	Secondary school of 1–2 years	34.6
	Secondary school of 3 years	14.6
	Post-secondary school of less than 3 years	19.1
	Post-secondary school of 3 years or more	22.1
	PhD	1.6
	Missing	0.1
Parents' income at ego's age 10–15 (per cent)	Decile 1	9.8
	Decile 2	9.9
	Decile 3	10.0
	Decile 4	10.0
	Decile 5	10.0
	Decile 6	10.0
	Decile 7	10.0
	Decile 8	10.0
	Decile 9	10.0
	Decile 10	10.1
Sex (per cent)	Man	50.0
	Women	50.0
Year of birth (per cent)	1983	18.8
	1984	19.3
	1985	20.1
	1986	20.7
	1987	21.1
Immigrant background (per cent)	Swedish background	82.0
	2nd gen, 1 Swedish parent	9.1
	2nd gen, Non-western background	3.0

Table 2. Continued

Variable	Categories	Means/Per cent
	2nd gen, Western background	1.5
	1st gen, Non-western background	4.0
	1st gen, Western background	0.4
Family status at ego's age 15 (per cent)	Intact family	67.8
	Lived with mother	25.5
	Lived with father	5.9
	Did not live with any parent	0.8
Urbanization degree (per cent)	Stockholm area	17.0
	Malmö area	12.3
	Gothenburg area	16.9
	Rest of Sweden	53.9
Housing situation (per cent)	Multifamily housing, first quartile income	6.8
	Multifamily housing, second quartile income	6.9
	Multifamily housing, third quartile income	6.9
	Multifamily housing, fourth quartile income	7.0
	Detached housing	72.4
N		424,547

missing values, our analytical sample equals 424,547 individuals. The variables with most missing values were those capturing individual GPA and school quality (8,978 missing values) and own disposable income at age 30–34 (2,057 missing values).

Analytical strategy

We performed linear probability models on (i) being a social welfare recipient and (ii) having an income in the top decile of one's cohort. Our main interest is how these two outcomes are associated with parental background and neighbourhood composition during adolescence, and how this association, in turn, is mediated by school quality.

The main methodological issue to tackle when studying neighbourhood effects with observational data is that families are not randomly distributed across neighbourhoods. For instance, poor children who live

in neighbourhoods with low scores on marginalization may differ from poor children living in more marginalized neighbourhoods, in terms of their parents having unobserved and often immeasurable skills, abilities, or ambitions. One may deal with this problem by applying family fixed effects models. However, this requires variation in neighbourhood characteristics between siblings. In this data, the sibling variation in neighbourhood characteristics is low. Another approach is to use time spent in a given residential area, to estimate exposure effects (Chetty and Hendren, 2018). One potentially underlying problem with such an approach is that mobility between neighbourhoods with different income profiles never is random. We therefore risk introducing another kind of bias to our models with these kinds of approaches.

We acknowledge that any causal interpretation of the results presented in this article must remain tentative, and that the overall design ultimately is of a descriptive nature. We have however taken two measures to account for the most obvious possible confounders, in addition to the control variables specified earlier. Most importantly, in all our analyses we include neighbourhood fixed-effects based on the most common neighbourhood definition accessible in Swedish registers, the SAMS areas. SAMS areas are small (on average 1,000 individuals) and constructed to be homogenous in terms of population and housing (Amcoff, 2012). They refer to areas that are similar in terms of physical structure, barriers, and the organization of different types of services. They often correspond well to people's ideas about neighbourhoods and are therefore likely to affect people's choices on the housing market (Hedman, 2012). It may appear counter-intuitive to examine neighbourhood effects while keeping the SAMS fixed. However, families living in different parts of the same SAMS area will have a different composition of their 500 nearest neighbours, based on how close they live to other SAMS areas (or by yearly variation). This is the variation we use to estimate neighbourhood effects in the SAMS fixed effects models. After including SAMS fixed effects, any remaining effects from individualized neighbourhoods are not due to sorting into certain SAMS-areas by parents with certain unmeasurable resources (Hedman and van Ham, 2012). In Supplementary Figure 1, we show the variation in the elite and marginalization scores within SAMS areas.

In addition, we conducted sensitivity checks on a subset of our sample, consisting of individuals who lived in apartment buildings when they were aged 15. We categorized all such buildings into quintiles by the mean disposable income of its residents. The income profile of the building could be seen as a combined measure of affordability and attractiveness of a neighbourhood. Some of these low-income apartment buildings are located in neighbourhoods with high-elite scores, whereas others

are found in neighbourhoods with lower elite scores. When we control for the income levels in the building, we therefore adjust for that parents with similar measurable socioeconomic attributes may differ in their unmeasurable ability to live in a more or less wealthy neighbourhood. In Supplementary Figure 2, we present the variation in scores on the elite and marginalization factor by the income structure of the apartment building.

Results

Figure 1 includes two histograms describing the distribution of neighbourhood contexts at age 15, as measured by the two factors (see Table 1), by parents' income deciles when the children were aged 10–15. In the interest of readability, we only contrast parents' income in the first (low income), fifth (mid income) and tenth (high income) decile. The figure confirms that the neighbourhood context which a child is exposed to when growing up is associated with their parental background. For the elite factor (left), the curve is of similar shape for both low- and mid-income families but moved slightly to the right for mid-income families. For high-income families, the curve is substantially moved to the right and flatter, implying larger variation in elite neighbourhood characteristics for the high-income group. For the marginalization factor (right), the pattern is clearly different, as the three income groups are more or less overlapping. However, children from low-income families are slightly overrepresented in neighbourhoods with high levels of marginalization (a factor score of around 3 and above) whereas for children from high-income families, growing up in these kinds of neighbourhoods is very uncommon.

Next, we examine the association between neighbourhood contexts and children's later life outcomes. All models control for parents' education, immigrant background, year of birth, gender, and whether the individual lived with both parents at the age of 15. Figure 2 includes average predicted probabilities of being a social welfare recipient at the age of 30 (top row) and of being in the highest income quintile by the age of 30–34 (bottom row), by the parents' income decile while growing up (age 10–15) and the neighbourhood's elite (left) and marginalization (right) scores at the age of 15 (a total of four models). For both neighbourhood factors, the dashed lines represent neighbourhoods with a score of 0 (i.e. mean factor score) whereas the solid lines represent neighbourhoods with a score of 1 (i.e. one standard deviation above the mean). The different scales of the Y-axes are due to differences in the prevalence of the two outcomes. Full models are presented in Supplementary Tables 1 (elite score) and 2 (marginalization score), Models 2 and 5. Similar models
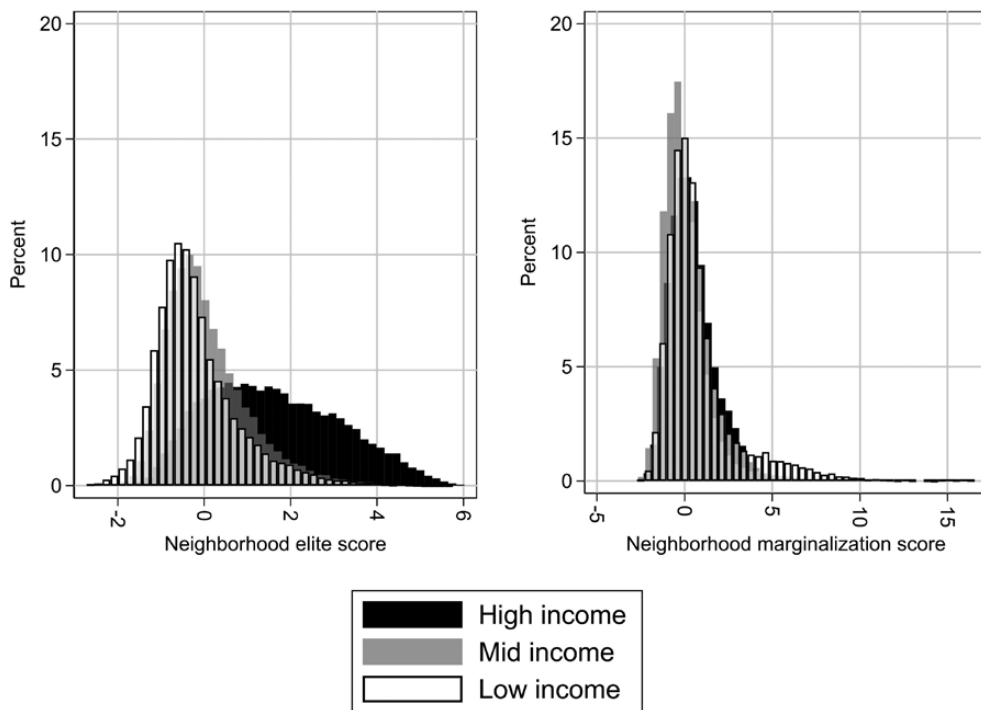
Figure 1 Distribution of neighbourhood elite score (left) and marginalization score (right) by parents' income decile.

including the five characteristics that the two neighbourhood scores are based on are presented in the Supplementary Figures 3 and 4.

From the two upper figures, we unsurprisingly note that individuals with parents in the lower income deciles have a substantially higher risk (3–4 per cent compared with about 1 per cent) of relying on social welfare at the age of 30. This pattern applies to both neighbourhood factors.

Individuals growing up in neighbourhoods that score one standard deviation higher than average on the elite factor, have a lower probability to be on social welfare (upper left). This is true for all income groups, but the differences are slightly larger for children with parents in the lower and middle-income groups. For children with parents in the top deciles, the risk is constant at around 1 per cent regardless of their neighbourhood. On the other hand, for the poorest group, D1 and D2, the risk is reduced by almost a fourth, from 4 to 3 per cent, when we compare neighbourhoods with a 1 unit change in their elite score. Even though the absolute differences are small, the relative differences are substantial. For instance, a child with parents in the first income decile (D1) who lived in a neighbourhood with an elite score of 1 has a similar risk of relying on social welfare at the age of 30 compared to a child from the fourth income decile (D4) who lived in a neighbourhood with an elite score of 0.

The upper right graph shows how the neighbourhood's marginalization score is associated with the probability of receiving social benefits. Compared to an average neighbourhood (marginalization factor score equals 0), growing up in a marginalized neighbourhood (i.e. with score 1 on the marginalization factor), is associated with around 0.5–1 percentage point increase in the risk of social welfare. These differences are small, but given the overall low risk of social welfare, they are not negligible. For instance, for children from D6, this is an increase with almost 50 per cent. Children with parents in income deciles D1 and D10 are less affected than children from the mid income groups. So, for the majority of children, being surrounded by a high share of neighbours who are not employed and have very low income, and a low share of neighbours that have incomes in the middle-range is associated with a higher risk of becoming disadvantaged when grown-up, even when controlling for several family and individual characteristics, and including SAMS area-fixed effects.

The lower panels show the probability of belonging to the highest income decile within one's birth cohort at age 30–34. Again, not surprisingly, we find strong associations between parental background and the predicted probability of having a high income at age 30–34. We find clear evidence of an association between the neighbourhood elite score and the probability of belonging to the highest income decile (lower left) but the association is weaker than for social

Social welfare age 30
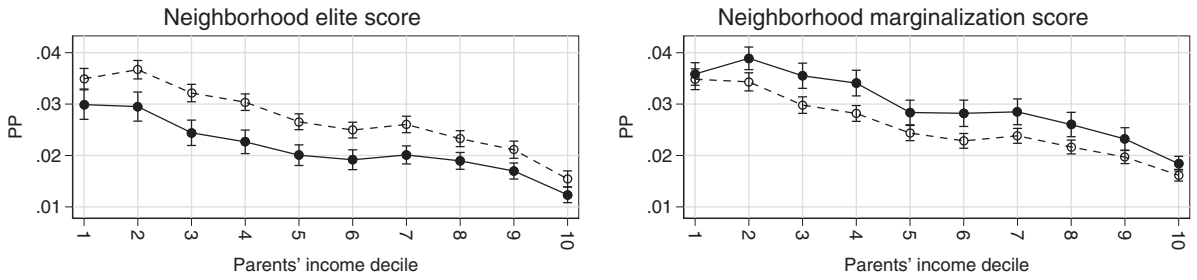
Highest income decile age 30–34
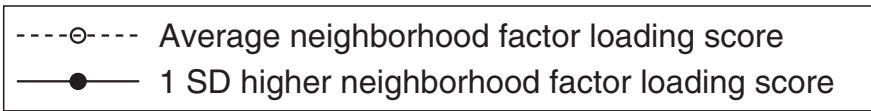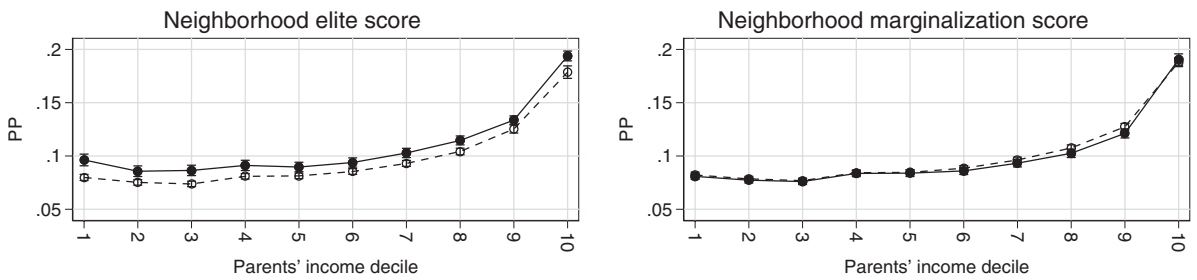
Figure 2 Average predicted probabilities of being a social welfare recipient at the age of 30 (top row) and of being in the highest income quintile by the age of 30–34 (bottom row) by parental background and neighbourhood characteristics. Fully controlled models including SAMS fixed effects.

welfare. We find no clear associations between the level of marginalization in a neighbourhood and the probability of belonging to the highest income decile at age 30–34 (lower right)—the two lines overlap more or less completely.

Hypothesis 3 suggested that neighbourhood effects may operate through school quality. Figure 3 shows how the estimates from the same models as above change after first adjusting for one's own GPA and, second, when also adjusting for one's peers' school performance. For the sake of readability, the figure does not include the baseline differences between the income groups, but rather shows how a one-unit change in neighbourhood exposure is associated with adult outcomes across groups, and how these neighbourhood effects change when we control for own GPA, and school quality. Full models are presented in Supplementary Tables 1 and 2, Models 3, 4, 7, and 8.

We first note that the estimates are attenuated substantially after adjusting for own GPA, particularly for

the association between elite score and later-life outcomes. Within each parental income decile, the impact from the neighbourhood *net of the individual's educational outcomes in 9th grade* is markedly smaller. For some groups it even approaches zero, suggesting that one's own school results are an important reason for the previously found association between neighbourhood characteristics and later-life outcomes. The inclusion of school quality, measured as the average GPA of one's peers, however, does not alter the neighbourhood coefficients. We find a similar pattern if we include peers' GPA prior to own GPA to the model.

Finally, we examine whether the association between socioeconomic background and adult outcomes is mitigated by neighbourhood effects and its potential differential effects. Figure 4 (full models are presented in Supplementary Table 3) first shows a baseline model with only individual level controls. Second, we show the same model also including neighbourhood factors, that is, the elite factor and the marginalization

Social welfare age 30
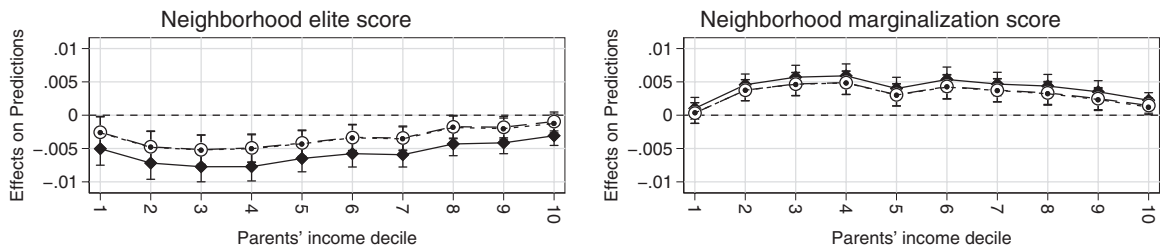
Highest income decile age 30–34
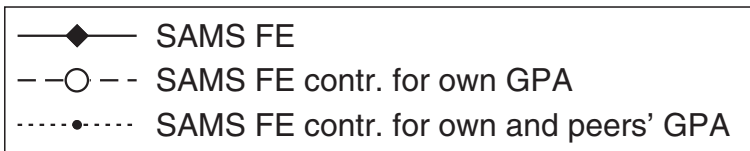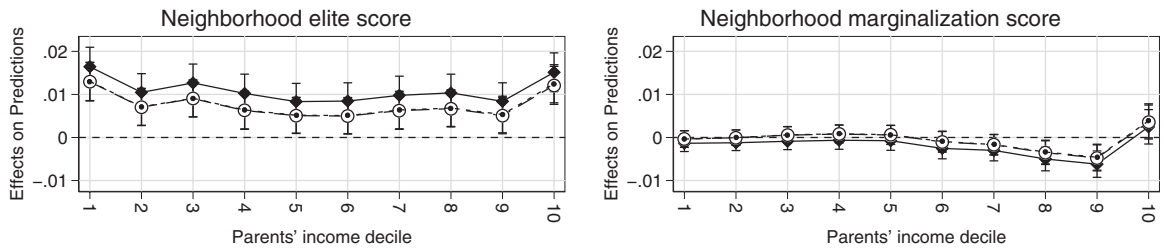
Figure 3 Differential effects from neighbourhood elite- and marginalization score by parents' income decile. Without and with control for school quality.

factor, interacted with parental income and SAMS-fixed effects.

The two curves in Figure 4 are overlapping to a large extent, implying that neighbourhood context explains only a small fraction of the association between parental income and adult socioeconomic outcomes. This is particularly the case for the risk of depending on social welfare at the age of 30. For the probability of belonging to the highest income decile, neighbourhood characteristics do explain some of the baseline differences by parental background. In the uncontrolled model, the predicted probability to end up in the highest income decile was 8 per cent for those growing up with parents in the lowest decile and 21 per cent for those growing up with parents in the highest decile, that is, a difference in probability of 3. In the controlled model, this changes to 8 per cent and 18 per cent, respectively, that is, a difference in probability of 2.6. However, the most notable pattern is that most differences remain. So, even if a child from a lower income group can experience absolute advantages by living in an elite neighbourhood, the neighbourhood has only minor effects

on the differences in outcomes between children with different parental socioeconomic background.

Sensitivity check: Analysis for subsample living in apartments

In sensitivity checks, we repeated our analyses including a subset of individuals who lived in apartment buildings when they were 15 years old. For this group, in addition to the standard controls and SAMS fixed effects, we included a control for the disposable income quartile of the residents in the apartment building. Individuals growing up in "wealthy" apartment buildings have a lower probability to receive social welfare and a higher probability to belong to the highest income decile (Supplementary Table 4). However, the sensitivity check does not alter our main conclusions. Most patterns depicted in Supplementary Figure 5 are similar to those in Figure 2, although confidence intervals are sometimes overlapping, and the absolute risk of social welfare is higher, given that these analyses exclude all who lived in detached housing when they were 15 years old. The only substantial difference
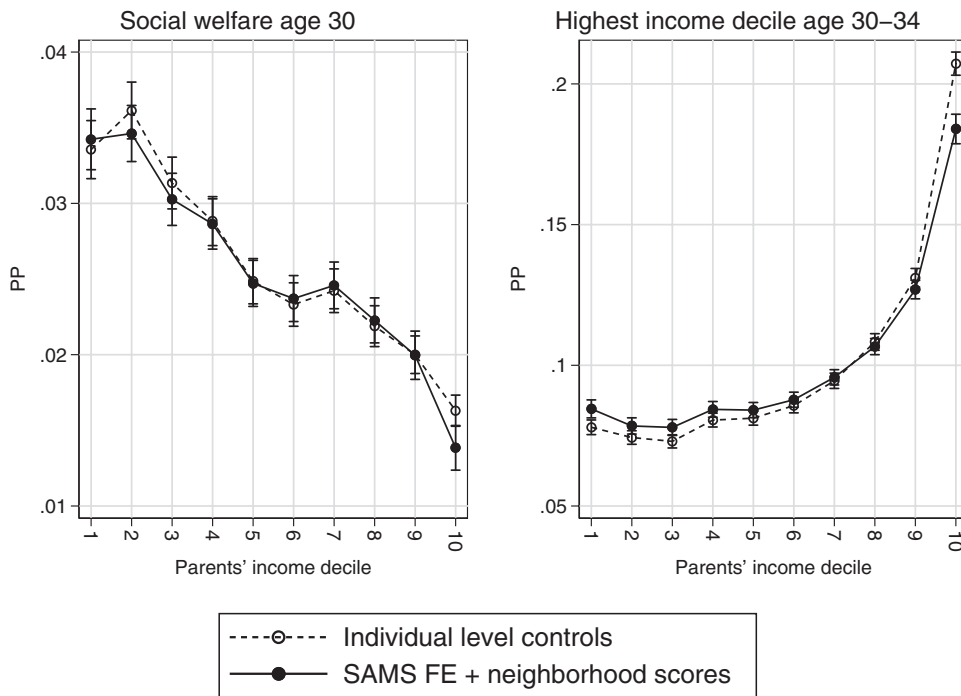
Figure 4 Average predicted probabilities of being a social welfare recipient at the age of 30 (left) and of being in the highest income quintile by the age of 30–34 (right). With and without controls for neighbourhood elite score interacted with parents' income, neighbourhood marginalization score interacted with parents' income, and SAMS fixed effects. Note: In the analyses without neighbourhood characteristics, we include a control for type of region at age of 15 (Stockholm, Malmö and Gothenburg areas, respectively, versus the rest of Sweden).

is that for D1, the neighbourhood elite score has no effect on the risk of social welfare when adjusting for the income profile of the apartment building.

Discussion

Research on socioeconomic inequalities and neighbourhood effects has been disproportionally focused on average effects from neighbourhood characteristics on individual life outcomes, even though most theories, implicitly or explicitly, suggest that the neighbourhood may have the largest potential to alter the life path of children from lower socioeconomic backgrounds. Using longitudinal Swedish register data with high-geographic granularity, we therefore examined whether neighbourhood context at age 15 has the potential to alter the association between family of origin and adult socioeconomic outcomes, and whether school quality potentially has a mediating role in understanding this association. By doing so, we appeal to the call for studies to include both school and neighbourhood characteristics, as by omitting either of them, one runs the risk of overstating or misstating either effect (Jargowsky and El Komi, 2009).

We hypothesized that neighbourhood characteristics would be associated with adult outcomes (hypothesis

1), and particularly so for children from low-income families (hypothesis 2). We find that for children from low- and mid-income families, a high share of elite neighbours is associated with a lower risk of depending on social welfare, and that the share of elite neighbours is associated with higher probability of having a disposable income in the highest decile, regardless of parental background. Growing up in marginalized neighbourhoods is associated with an increased risk of receiving social benefits in adulthood, but the effects are small, and negligible for the most disadvantaged children. In terms of the probability of ending up in the highest income decile, we find negligible neighbourhood effects from living in marginalized areas, for all income groups.

Thus, with some minor exceptions, neighbourhood effects are small, and operate similarly regardless of social background, rejecting hypothesis 2. Our findings also suggest that parents' socioeconomic background remains strongly associated with children's socioeconomic outcomes later in life (e.g. Solon, 1999; Hout and DiPrete, 2006; Jäntti et al., 2006; Hertz et al., 2007; Black and Devereux, 2011; Hout, 2015). The lack of heterogeneous neighbourhood effects distinguishes our results from results from the United States context

(Wodtke, Harding and Elwert, 2016); yet our results are in line with Hedefalk and Dribe (2020) who find similar patterns for historical educational outcomes in a Swedish town. The fact that also children with parents in the highest income decile are positively affected by resource-rich neighbours is interesting, since these children are likely to already have the instrumental resources needed to succeed in life. Albeit small effects, our findings emphasize the need for future research to disentangle the mechanisms through which neighbourhoods operate in more detail. For instance, our results could suggest that one important mechanism through which neighbourhood characteristics shape adult outcomes is via the networks children form when growing up, which they may take advantage of in, for instance, job search in adulthood, given that social networks are likely to be important regardless of socioeconomic background (Galster, 2008). Even though we do no not find any support for heterogeneous neighbourhood effects in the Swedish context, research in other countries may very well show other patterns, and we encourage more studies on this topic. Examining the simultaneous importance of family of origin and neighbourhoods for children's adult life outcomes may improve our understanding of the mechanisms through which neighbourhood effects operate.

Previous research (Jencks and Mayer, 1990; Sampson, Morenoff and Gannon-Rowley, 2002; Hermansen, Borgen and Mastekaasa, 2020), found that one major pathway through which neighbourhood effects seem to operate in shaping later life outcomes is through school quality. However, our results suggest that peer achievement in school does not explain our findings at the neighbourhood level, thereby rejecting hypothesis 3. It is only the individual's own school results that attenuate the coefficients substantially. One possible explanation is that we focused on the very local neighbourhood, by studying the 500 nearest neighbours, and by including SAMS area fixed effects. Given that children who grow up in the same SAMS area often attend schools with similar characteristics, the within-SAMS variation in peer composition is likely to be small.

Although our results give novel insights into how neighbourhoods operate in shaping the socioeconomic outcomes for children from different backgrounds, the study is not without limitations. Most importantly, we cannot rule out the risk of unobserved confounders. By including SAMS fixed-effects, selection effects into neighbourhoods are minimized, but we could not adjust for potentially strategic residential choices within a given SAMS area. Given that SAMS areas are small (on average 1,000 residents) we believe that such selection should be minor, but this is not something we could account for. It could also mean that we were abler to adjust for selection in larger cities, where SAMS areas are smaller. Also,

even though individual school outcomes arguably are an important mechanism for the found neighbourhood effects, a substantial portion of the neighbourhood effects remain unexplained. In addition, with the current analytical design, we cannot identify the exact mechanisms behind the association of neighbourhood characteristics and school quality, and their effects on children's later life outcomes. For instance, an individual's GPA could also be a consequence of neighbourhood characteristics, through collective socialization, of parental characteristics not controlled for here, or institutional mechanisms other than school quality.

Being able to disentangle the various mechanisms through which the neighbourhood operates is an important task for future research (Sampson, Morenoff and Gannon-Rowley, 2002). For instance, our measure of neighbourhood context is based on the 500 closest neighbours aged 25–64, but we do not know if these are the individuals the children actually are exposed to. Also, we do not know to what extent neighbourhood effects reflect peer-effects, or rather the accessibility to meaningful after-school-activities, to name one example. Knowing more about the daily mobility patterns of children and their families, the interaction between children and significant adults, after-school-activities, as well as the structure and locality of their social networks, would improve our understanding of the way the neighbourhood operates in shaping different outcomes.

Notes

1 Countries defined as western countries include the Nordic countries, Western Europe, Great Britain, North America, Australia, and New Zealand.

Supplementary Data

Supplementary data are available at *ESR* online.

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Data Availability Statement

The data underlying this article cannot be shared publicly due to ethical reasons. Individual register data is only available after ethical vetting of research projects by the Swedish Ethical Review Authority, and a confidentiality assessment by Statistics Sweden.

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