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ABSTRACT

Three Generations of Intergenerational Transmission of Neighbourhood Context

The literature on intergenerational contextual mobility has shown that neighbourhood status is partly "inherited" from parents to children where children who spend their childhood in deprived neighbourhoods are more likely to live in such neighbourhoods also as adults. It has been suggested that such transmission of neighbourhood status also is relevant from multiple generation approach. To our knowledge, however, this has only been confirmed by simulations and not empirical research. This study uses actual empirical data covering 25 years and the full Swedish population to investigate intergenerational similarities in neighbourhood status of three generations of Swedish women. Findings suggest that the neighbourhood environments of Swedish women are correlated with the neighbourhood statuses of their mothers and, to some extent, grandmothers. We also find an effect of distance where intergenerational transmission is stronger for those remaining close. Whereas women whose mothers and grandmothers live in high-income areas benefit from staying close, women whose mothers and grandmothers live in low-income areas do better if they live further away. These results are robust over two different analytical strategies – comparing neighbourhood status of the three generations at similar ages and at the same point in time – and two different spatial scales. We argue that the finding of such effects in (relatively egalitarian) Sweden implies that similar, and possibly stronger, patterns are likely to exist in other countries as well.

JEL Classification: I30, J60, R23

Keywords: intergenerational transmission, neighbourhood, low-income neighbours, register data, Sweden

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Introduction

The literature on intergenerational transmission suggests that the socio-economic status of children is linked to that of their parents. A vast bulk of this literature has focused on issues such as class, occupation, education and earnings (for overviews see Solon 1999; D'Addio 2007) but there is also a small but growing number of studies looking at the spatial dimension. Especially, a number of recent studies have linked the neighbourhood status of children to those of their parents. These studies have repeatedly found that children who are born in and/or spend their childhood in a deprived neighbourhood are more likely to live in such areas as adults (de Vuijst et al 2017; Duncan and Raudenbush 2001; Gustafson et al 2017; Sharkey 2008; van Ham et al 2014; Vartanian et al 2007). In a 2016 Guardian article, the argument was brought home starkly: "[if] you are born poor in Britain, in a poor area, the chances are that you will remain poor for the rest of your life. If you are born rich, in a rich area, the likelihood is that you will find a way – or will have ways come to you – to stay wealthy and privileged throughout your life, and your children will do the same" (Hanley 2016).

This spatial dimension of intergenerational transmission is highly relevant for our understanding how socio-spatial inequalities are produced and reproduced. According to the neighbourhood effects literature, the life chances and opportunities of an individual, and hence his/her social position, are affected by the geographical opportunity structure determined by the neighbourhood in which he/she lives and related higher-level geographical entities (see Galster and Sharkey 2017). Through mechanisms like socialization, influence of local role models, access to and quality of institutions and relative location within the city, the geographical opportunity structure produces and reproduces existing inequalities on the individual level. However, it is not only the current geographical position that matters but the literature is increasingly stressing that opportunities vary by duration, timing and sequence of exposure (Musterd et al 2012; Wodtke 2013; Wodtke et al 2011) and that past experiences linger to shape future outcomes (Hedman et al 2015; Sampson et al 2008). Sharkey and Elwert (2011; see also Sharkey 2008; 2013) add that experiences of previous generations, or experiences resulting due to the location decisions made by previous generations, also may have an effect on individual outcomes. For example, children growing up in poverty areas may have limited housing opportunities as adults due to lasting effects from childhood, resulting in intergenerational similarity in residence. They may also face penalties due to effects on parents' opportunities and behaviour. Similarly, children growing up in more resourceful environments may experiences long-lasting benefits.

The intergenerational transmission of neighbourhood status has been confirmed for several countries. For example, based on data from the US, Vartanian, Buck and Gleason (2007) show that childhood neighbourhood disadvantage is correlated with adult neighbourhood quality for those living in the lowest quality neighbourhoods. Also using US data, Sharkey (2008; 2013) came to similar conclusions, adding that intergenerational transmission of what he terms contextual mobility is especially prevalent among poor African-American families. In two separate studies both using data from Sweden, Gustafson, Katz and Österberg (2017) and van Ham and colleagues (2014) find that the neighbourhood status of children is correlated to that of parents and that immigrants are more likely than natives to remain in disadvantaged areas over two generations. Using data from the Netherlands, de Vuijst, van Ham and Kleinhans (2017) add that higher education can reduce intergenerational transmission but that this is less prevalent among the immigrant population. These studies all support the idea that neighbourhood outcomes are influenced by the residential histories of previous generations and hence that individual life opportunities are correlated not only with ones' own neighbourhood experiences, but also with the experiences of previous generations.

It is further suggested that the intergenerational argument can be extended further in time so that the same family experience similar neighbourhood environments for multiple generations. In his book "Stuck in place" from 2013, Patrick Sharkey argues that this might indeed be the case among poor African-American families in the United States. "The problem of urban poverty […] is not only that concentrated poverty has intensified and racial segregation has persisted *but that the same families have experienced the consequences of life in the most disadvantaged environments for multiple generations*" (Sharkey 2013, p.26, italics in original). Sharkey provides compelling theoretical arguments to support his claim and he uses two-generation data from the US to simulate how many generations it would take a family from a poor neighbourhood to reach a more affluent environment (a full century, or five generations). Although this simulation is thought provoking, the study does not actually use data for more than two generations for backing the argument of the transmission of neighbourhood poverty over multiple generations.

This is the first paper, as far as we know, that empirically tests the hypothesis of multiple-generational transmission of neighbourhood status. Using detailed Swedish register data, we investigate the extent to which the neighbourhood statuses of young women are related to the neighbourhood environments of their mothers and grandmothers. Sweden is internationally known for its low level of income inequalities, including relatively small differences between neighbourhoods (although socio-economic residential segregation levels have rapidly increased, see Andersson and Kährik 2016). The country is also characterized by a welfare system which is set up to assist people to "move up", for example, by providing free education for all, including university education, and student loans. This implies that it is relatively easy to move across different neighbourhoods in Sweden compared to other countries (see Nieuwenhuis et al 2017). Sweden should thus be among the countries where it is the least likely to find families trapped people into lower social categories and deprived neighbourhoods for generations. Hence, any patterns of multigenerational transmission of neighbourhoos status in Sweden are likely to be generalizable to other countries with fewer opportunities for social mobility experience.

Neighbourhood deprivation and affluence as multigenerational phenomena

Since the seminal book *The Truly Disadvantaged* by William Julius Wilson (1987) the literature on neighbourhood effects has advanced in a large body of research which uses increasingly sophisticated data and methods. More recently, research acknowledges the importance of timed effects and longer time frames (e.g. Wheaton and Clarke, 2003; Sampson et al, 2008). Recent research has extended the time argument to also include intergenerational transmission. For example, using data from Sweden, Hedman and colleagues (2015) find that the composition of the parental neighbourhood, defined as the neighbourhood in which the individual lived just before leaving the parental home, still affects individual income 17 years later, over and above exposure to poverty during all years in-between (see also Sharkey, 2008). Sharkey and Elwert (2011) take the analysis one step further and show that cognitive abilities of children are substantially reduced (by more than half a standard deviation) if their families have been exposed to poverty for two consecutive generations. That is, children suffer negative effects form a residential environment *they have not experienced themselves*. Sharkey and Elwert suggest that a plausible explanation is that parents' childhood environment negatively affect their educational attainment, occupational choices, income, marriage partner, and mental health, which in turn has an independent effect on the cognitive abilities of their children. Another possibility is that the neighbourhood functions as a proxy for unmeasured characteristics of the family.

Sharkey's and Elwert's (2011) findings stress the importance to better incorporate multigenerational mechanisms into understanding the residential deprivation context where people live in. This need is further highlighted by the increasing empirical evidence of intergenerational transmission of living in poverty neighbourhoods over two consecutive generations. As shown by Sharkey (2008; 2013), socio-economic segregation and racial inequalities in the United States need to be analysed along family lines since the same families tend to remain in the poorest neighbourhoods for generations. More than 70% of the African-American children who grow up in the most deprived areas live in similar types of neighbourhoods also as adults. As mentioned in the introduction, the inheritance of living in poverty neighbourhoods is not restricted to the United States but is also prevalent in countries with a very different welfare state arrangement, such as Sweden and the Netherlands (de Vuijst et al 2017; Gustafson et al 2017; van Ham et al 2014).

Whereas the multi-generational perspective has been more or less missing in the segregation and neighbourhood effect literatures, it has been somewhat better acknowledged in the broader literature on intergenerational transmission of socio-economic status where a number of theoretical and empirical papers have illustrated and empirically tested how and if multigenerational transmission occurs (although the two-generational perspectives dominates here as well). A critical debate in the literature has been to what extent grandparents influence their grandchildren over and above parental influence. Much of the "early" research argued that high social fluidity would result in null (Piketty 2000; for empirical studies see Cherlin and Furstenberg 1992; Warren and Hauser 1997) or even negative (Becker and Tomes 1986) associations between grandparents and grandchildren once parental characteristics are controlled for. Although supported by some later studies (Bol & Kalmijn 2016) there are also several examples of work that have found evidence of direct grandparental influence, such as Hällsten's (2015) analysis of grades, length of education and cognitive abilities using Swedish 1st and 2nd cousins (see also, e.g., Chan & Boliver 2013; Lindahl et al 2015; Modin et al 2013). Mare (2011) suggests that multigenerational influence might be context-dependent (most of the early research focused on mid-19th century United States) and adds that even if the main path of transmission is from one generation to the next (which is generally confirmed by empirical studies), a multigenerational approach is useful since the second generation will influence their children. Hence, regardless of whether grandparents influence is direct or only indirect, the result will be multigenerational inequality.

The literature on multigenerational socio-economic transmission discusses several mechanisms through which parents and grandparents may exert an influence on their (grand)children's future outcomes (for lengthier discussions, see Mare 2011; Piketty 2000). Many of these mechanisms should be applicable to the housing/neighbourhood field. Among the most important mechanisms for transmission of socio-economic status and housing are economic transfers, either through inter-vivo transfers or as after-life heritages (d'Addio 2007; Mare 2011). Such transfers may consist of (larger sums of) money passing between generations or direct investments in (grand)children's housing. Economic transfers are especially important for explaining entrance into the housing ownership[1] for those whose ancestors are owners themselves (Helderman and Mulder 2007). Transfers and investments provide the opportunity for the older generations to directly influence the quality of the home and its surroundings, the timing of the purchase and the mortgage setup (Engelhardt and Mayer 1994). (Grand)children to renters and low-income earners, or to owners in more

[1] In Sweden in this context, the ownership segment also includes tenant-owned cooperatives

deprived neighbourhoods characterized by a smaller housing prize increase, naturally lack these advantages and are consequently generally less able to buy into more affluent neighbourhoods when first entering the housing market (Jenkins and Maynard 1983; Mulder and Smits 1999).

Besides direct economic transfers, (grand)parents also have an indirect influence on their (grand)children's socio-economic status (and hence housing market resources). They transfer knowledge, abilities and "cultural resources" (including, among other things, reading habits, engagement in "high-cultural activities" and language habits, Bol and Kalmijn 2016), and function as role models, all of which may affect the (grand)child's socio-economic choices and performance. In their study of Danish grandchildren's education success, Møllegaard and Meier Jæger (2015) found effects of grandparents' cultural capital, but not economic or social capital, and argue that their results are expected in the Scandinavian context characterized by high levels of income redistribution and free education. Their results may however be less relevant for the costly housing sector. (Grand)Parents also share some of their genetic setup with their (biological) (grand)children and may hence share genetic advantages or disadvantages in relation to socio-economic status. According to findings by Rowe and colleagues (1998), a substantial part of the variation in IQ, education level and income can be explained by heritability, i.e. genetic variance.

(Grand)parents are also likely to affect housing-related norms, attitudes and behaviours of their (grand)children. It has been argued that children "learn" what is appropriate housing and strive to reach the social housing status of their parents (and potentially also previous generations) (Henretta 1984; see also Helderman and Mulder 2007). Socialization is not only related to housing type but also to the larger residential environment. It has been shown that parents and children tend to live in similar types of environments, for example inner city, suburb or countryside (Blaauboer 2011; Feijten et al 2008). By growing up in, or pay regular visits to, a certain type of environment, children internalize the characteristics of that kind of environment and imbed them into their own housing aspirations.

To sum up, we know from the literature that there is a strong link between the neighbourhood trajectories of parents and their children. Therefore it is likely that the neighbourhood trajectories of grandparents influences the trajectories of their children, and subsequently of their grandchildren (either directly or indirectly, via the mid generation). This could be due to aspects that are directly related to housing (such as direct investments in children's housing) or to transmission of norms or resources that eventually affects housing and neighbourhood decisions. Mare (2011) also points to the importance of acknowledging demographic aspects. In the multigenerational context, issues of timing of birth and longevity become especially important. Physical distance and degree of interaction are also likely to affect (grand)parent-(grand)children relation, interactions and level of transmission. Fig. 1 illustrates these different forms of transmission as well as the partly overlapping neighbourhood trajectories of grandparent, parents and (grand)children. The figure also shows how the influence of the parental neighbourhood lingers on from childhood into adulthood, which (potentially) results in multigenerational transmission of neighbourhood status.

FIG. 1 ABOUT HERE

Data and methods

The data we use for this study is derived from the GeoSweden database, which is owned by the Institute for Housing and Urban Research, Uppsala University and bought from Statistics

Sweden. The database consists of a compilation of datasets covering demographic, geographic and socio-economic characteristics of all individuals registered in Sweden. Up until this date, the data encompasses 25 years: 1990-2014. Because the data is based on registers there is no dropout of cases (unless people die or move abroad), which makes the data especially suited for a project of this kind.

The population selected for the study includes all females who in 2002 had reached the age of 20 and had left the parental home and whose mother and grandmother were both alive in 2002 but the grandmother could not be older than 75. The age restrictions of daughter and grandmother ensure that we only compare adult individuals whose living situation is independent from that of their parents, and who are not "too old" to reduce the likelihood of having moved into elderly care centres. Our data set encompasses 181,431 family lines, consisting of independent observations of daughters, born between 1970 and 1982, as well as their mothers and maternal grandmothers[2]. We restrict the population to the female line for reasons of simplicity and because females on average live longer than males. Also, previous (American) research has pointed out that intergenerational contacts are more frequent through the female line (Cherlin and Furstenberg 1992; Kivett 1991). In addition to being alive and younger than 76, the mother and grandmother must also live in Sweden in both 1990 and 2002 for the family to be in the research population. Unfortunately, this requirement excludes most of the immigrant from the research population since the number of third generation immigrants in the data is very low (about 6 %) and includes mainly people born in Finland and Denmark. This is unfortunate given that the previous research has found that non-western immigrants, or people with an immigrant background, are more likely than natives to remain in poverty areas over two generations (van Ham et al, 2014, see also Sharkey 2008; 2013 for a U.S. Black-White comparison). Yet again, finding evidence of intergenerational transmissions of neighbourhood deprivation among the natives, the most unlikely group to experience it, provides a strong signal of the importance of this phenomena.

We employ two different analytical strategies for comparing the three generations. The first strategy (*strategy 1* hereafter) is to compare the three generations at as similar ages as possible. Demographic features such as age (and related features such as partnership status and child-bearing) are among the most powerful predictors of both intra-urban mobility and neighbourhood sorting. Using the full range of data, we compare the neighbourhood status of the youngest generation (*daughters* hereafter) in 2014 to "mothers" (the mid generation) in 2002 and to "grandmothers" (the oldest generation) in 1990. However, even though we reduce the age gap as much as possible, given the data at hand, the three generations are still of very different ages: the daughters are in their late 30s (in 2014) whereas the grandmothers are in their early 60s (in 1990) (see table 1). These different life stages may influence neighbourhood sorting processes but, importantly, all three generations are captured at working ages and at a point in life when mobility rates are low. Hence, we argue that although not perfect, the comparison still has merit. Another downside of strategy 1 is that it is sensitive to structural changes. During the 24 years that have passed between 1990 and 2014, Sweden has gone through economic boom and bust periods, with a severe economic crisis during the early 1990s. In 1990, Sweden had almost full employment, with unemployment levels of about 1.5 %. During the crisis of 1992-1994, unemployment levels rose rapidly and have never fully recovered to their old level. In 2014, unemployment levels were at about 6% (Statistics Sweden). Other important macro level changes relate to increased income inequalities and increased socioeconomic residential segregation. Between 1991 and 2013, the

[2]The total number of unique women in the dataset is 402,266, of which 123,990 are mothers and 96,845 are grandmothers.

Gini Index has increased from 0.209 to 0.281 which is a dramatic development compared to countries like Finland and Denmark, but also compared to a country like the United States (OECD). In order to control for the effect of these and other changes on the macro level that may affect both the characteristics of neighbourhoods of different categories and the likelihood for different groups to reside in them, we employ a second analytical strategy (*strategy 2* hereafter), namely to compare the three generations at the same time point, in 2002. Obviously, these results suffer from an age bias where the daughters are quite young and have just left the parental home while the grandmothers are relatively old (see table 1). However, by combining the two strategies, we argue that more robust conclusions can be drawn.

Our research population resides all over Sweden. In order to make neighbourhoods as comparable as possible, both over space and over time, we make use of a *k*-nearest neighbour approach to define bespoke neighbourhoods. Using the software EquiPop (for a description of the software, see Östh 2017), we created bespoke neighbourhoods based on *k*-nearest neighbours. The neighbourhood computation is based on geographical coordinates, 100x100m. For each coordinate pair, the software calculates the share people of a certain characteristic among the *k*-nearest neighbours, by adding the population of surrounding coordinate pairs. In this study, we use share of low-income people among the working-age population (20-64) as our neighbourhood variable. This share is based on income from work, including work-related benefits. We argue that income from work, or the share with a low income from work, provides a good reflection of education and employment levels in the neighbourhood which are important signals of the neighbourhood's social status or deprivation level. A low-income person is defined as someone whose income from work belongs to the three lowest deciles among the national distribution. This distribution is calculated separately for each year (1990, 2002 and 2014). We work with two different neighbourhood definitions, 500 and 3,000 nearest neighbours, in order to control how transmission of neighbourhood status is related to geographic scale. The 500 nearest neighbours represent the immediate surrounding where the individual might know or recognize a substantial share of the neighbours. The 3,000 nearest neighbours scale aims to capture larger districts of shared local resources.

Descriptive statistics of the neighbourhood environments of daughters, mothers and grandmothers, using the two analytical strategies and the two geographical scales, are shown in table 1. The share low-income people in the neighbourhood of the mother is equal using strategy 1 and 2: tautologically since the mother's neighbourhood environment in measured in year 2002 using both research strategies. The grandmothers' neighbourhood status is also fairly similar over the two strategies, despite measuring in 1990 using strategy 1 and in 2002 using strategy 2. The daughters do, however, live in neighbourhoods with on average a lower share low-income people using strategy 1 than strategy 2. This is expected given that the daughters are older using strategy 1 (measuring their neighbourhood status in 2014), about 37 years on average, compared to 25 using strategy 2.

TABLE 1 ABOUT HERE

Table 1 also presents descriptive statistics for the control variables used in the linear regression model that will complement a set of descriptive tables and graphs. Using the share low-income people in the neighbourhood of the daughter as dependent variable, we model the effects of the share low-income neighbours of the mother and grandmother, controlling for distance between daughter and mother/grandmother, the size of municipality and a number of demographic and socio-economic variables, all measured as characteristics of the daughter.

Distance is measured as Euclidean distance. Table 1 reveals that daughters and mothers live on average about 85 km from each other, while grandmothers live on average slightly further away from their granddaughters (about 120 km). Distances are slightly longer using strategy 2. A likely explanation is that many of the daughters, who have just left the parental home, have moved to study. Municipalities are categorized into three groups: large (>100,000 inhabitants or part of a metropolitan area), medium (25,000–100,000 inhabitants) or small (< 25,000 inhabitants). Size of municipality is important given that income levels generally are lower in smaller municipalities. In addition, low-income neighbourhoods are likely to be different in character in municipalities of different size, which is why we run separate models for daughters living in larger municipalities. The demographic and socio-economic control variables are age, income from work, education level and family type. Education level is categorized into four types: less than 12 years of schooling, 12 years (equivalent to a high school degree), 13-14 years (some post-schooling) and 15+ years (university degree). Family type is categorized into single, single with children, couple and couple with children.

Results

The main variables of interest in this study are the share low-income neighbours of daughter, mother and grandmother respectively. Table 2 displays the correlation coefficients of these respective variables, using strategy 1 and 2, and the two geographical levels. The table reveals, not surprisingly, that there is a stronger correlation between mother and daughter (0.13 to 0.20) than between grandmother and (grand)daughter (0.06 to 0.11). Hence, women tend to live in neighbourhood environments that are more similar to those of their mothers' than to their grandmothers'. Comparing the two analytical strategies, we generally find stronger correlations using strategy 1, especially for the mother-daughter comparison. This is to be expected given that strategy 1 reflects fairly similar life stages for mothers and daughters. For grandmothers-(grand)daughters comparisons, the difference in results between strategies 1 and 2 are smaller and on the 3,000 nearest neighbours scale, strategy 2 provides a stronger correlation. When measuring at the same point in time, as per strategy 2, the daughters are young and relatively new on the housing market whereas the mother generation are in their 50s (see table 1) and have consequently stablished themselves on the housing market. Grandmothers, however, live on average in neighbourhoods with a higher share low-income neighbours (see table 1) and as they grow older, they move to neighbourhoods with a slightly higher share low-income neighbours. The different results by scale indicate that whereas the immediate surroundings of grandmother and (grand)daughters differ, the characteristics of the larger area are more similar. This could, for example, be the result of daughters and grandmothers living in different types of dwellings or surroundings (for example, some of the daughters might live in student areas) but that their larger neighbourhoods have a similar place in the urban hierarchy.

TABLE 2 ABOUT HERE

The share low-income neighbours of the daughter is the dependent variable in our regression models[3]. Table 4 presents results on the 500 nearest neighbours scale using strategy 1. Models I and II test how the share low-income neighbours of the daughter is correlated with that of mother and grandmother, respectively. Both correlations are positive, but with a larger coefficient for the mother in line with previous results. We also find a positive effect for

[3] Analyses using deciles of share low-income neighbours as dependent variable support the linear setup of the model. The linear regression approach was chosen due to higher R-squared values.

distance, meaning that the share low-income neighbours of the daughter will be higher if she lives far away from her mother (model I) or grandmother (model II). However, the negative interaction effect suggests that this is only valid is the mother/grandmother lives in a neighbourhood with a high share of low-income people. If the share low-income neighbours exceed 31% for the mothers, or 40% for the grandmothers, distance turns negative. 31% low-income neighbours of mothers is less than one standard deviation above the mean. For grandmothers, 40% is about 1.5 standard deviations above the mean. Put differently, if the mother/grandmother live in neighbourhoods with high shares low-income neighbours (but not necessarily the poorest areas) and the daughter live far away, she will fare better in terms of neighbourhood environment compared to if she had remained close. Daughters whose mothers/grandmothers live in areas with a lower share low-income neighbours, however, are predicted to live in better neighbourhoods (in terms of share low-income neighbours) if she remains close than if she lives far from her relatives.

Living in a large or medium-sized municipality is negatively correlated to the share low-income neighbours, likely a result of national income differences. The other control variables work as expected. The likelihood of residing among a high share low- income neighbours is negatively correlated with age, income from work and a higher level of education, whereas being single, with or without children, has a positive effect on with the share low-income neighbours.

In model III, table 3, both the share of low income neighbour of the mother and the grandmother are included. We find that the coefficients related to the mother are very similar to those of model I whereas those related to the grandmother are reduced compared to model II. The explanatory power of the model is also basically the same as for model I (0.1441 in model III, compared to 0.1426 for model I). This suggest that the neighbourhood of the mother is the most important to explain the outcome of the daughter whereas adding neighbourhood information of the grandmother only changes the outcome on the marginal. As previously discussed, a low-income neighbourhood has a different meaning in a small municipality compared to a larger municipality. In a larger municipality where income levels generally are higher, we could expect that a low-income neighbourhood reflects patterns of local polarization and segregation, whereas in a smaller municipality, it might rather be an effect of national income segregation. Hence, as a final exercise, we re-run model III using only individuals living in a municipality defined as large. The coefficients for the mother/grandmother and distance, presented in model IV, are almost identical to model III. There are some changes in size of control variables, and in order of the education variable, but the overall pattern remain.

TABLE 3 ABOUT HERE

The final model, using only the large municipalities, are repeated for the 3,000 nearest neighbours scale (results shown in the Appendix, model I). The overall pattern is the same using the larger scale but coefficients are bigger. Hence, the regression confirms the results of table 2 with stronger coefficients on the large geographical scale. In order to get a better understanding of how the share low-income neighbours of the daughter is correlated with the share low-income neighbours of the mother and grandmother respectively, we have filled in the equation using varying levels of mothers' (Fig.2) or grandmothers' (Fig.3) low-income neighbours. We set the control variables to their means, or modes for education and family status, and use two different estimates of the neighbourhood environment of the individual (mother or grandmother) whose neighbourhood environment is not shown on the x-axis. A high share low-income neighbours (in the graph defined as a "low-income neighbourhood") is

equivalent to two standard deviations above the mean whereas a "high-income neighbourhood" is a neighbourhood where the share low-income neighbours is set to two standard deviations below the mean. Fig. 2 shows how the share low-income neighbours of the daughter is correlated with that of the mother, using the high- (grey lines) and low-income (black lines) neighbourhood scenarios of the grandmother, and the two different geographical scales (solid lines represent 500 nearest neighbours, dashed lines 3,000 nearest neighbours). The lines of Fig.2 are bundled very close together, suggesting limited effect of geographical scale and, interestingly, whether the grandmother lives in a high- or low-poverty neighbourhood, given the mother's neighbourhood composition. However, grandmothers' neighbourhood environment is correlated with that of their granddaughters on the marginal: daughters whose grandmothers live in high-income neighbourhoods live in areas with lower percentages low-income neighbours. The effect of the mother is however relatively strong; as the share low-income neighbours of the mother increase from 0% to 100%, the share low-income neighbours of the daughter double (from about 20% to about 40%). Fig.3 is equivalent to Fig.2 but shows the correlation between daughters and grandmothers, using two different neighbourhood scenarios of the mother. The graph confirms the limited extent of grandmother's influence, given the neighbourhood environment of the mother. Changing the share low-income people in the grandmother's neighbourhood from 0% to 100% will only result in a 5% increase in the share low-income neighbours of the (grand)daughter.

FIGS. 2 AND 3 ABOUT HERE

Apart from the mere share low-income people in the neighbourhood, we have also found an effect of distance. Figs. 4-5 show the predicted share low-income neighbours of daughters using eight different scenarios: where the distance between daughter and mother or grandmother is short (5km) or long (500km), split by the neighbourhood status of the mother/grandmother. All results of Figs. 4-5 are calculated for the 500 nearest neighbours scale. Fig.4 shows results for mothers and grandmothers in low-income neighbourhoods (defined as above) whereas Fig.5 does the same for mothers and grandmothers in high-income neighbourhoods. If having a mother and grandmother living in neighbourhoods with a high share low-income people (a low-income neighbourhood), living close to both results in a substantially higher predicted share low-income neighbours than if living far from both. Living close to the mother but far from the grandmother provides a larger predicted share of low-income people than the reverse situation but there is still an almost 2 percent difference if the grandmother lives close (and the mother far away) compared to when both live far away. The opposite trend is found for daughters whose mother and grandmothers live in high-income neighbourhoods (have a low share low-income neighbours). These women benefit from living close to their family members and the highest predicted shares low-income neighbours are found for those living far from both mother and grandmother.

FIGS. 4 AND 5 ABOUT HERE

All the above results are obtained using strategy 1, comparing the three generations of women at more similar ages but at different points in time. The relatively weak results for grandmothers' influence is not very surprising when kept in mind that their residential environments are measured 24 years prior to those of their granddaughters. In fact, many of the grandmothers had already passed when estimating the neighbourhood environments of the daughters. This is not the case using strategy 2, comparing the three generations at the same point in time. However, using this strategy, it should be kept in mind that the three generations are in very different life stages.

The analytical approach is the same for strategy 2 as for strategy 1: we run the same regression and then fill in the equation for different scenarios. The results for the 500 nearest neighbours scale are found in table 4. The results for large municipalities for the 3,000 nearest neighbours scale are found in the Appendix (model II). The general pattern using strategy 2 is similar to strategy 1: we find a clear positive correlation between the share low-income neighbours of daughters and mother and of daughters and grandmothers, although the former is substantially stronger. The size of the coefficients is however larger using strategy 2 for mothers and grandmothers alike, but with a somewhat larger increase for grandmothers. For example, in model IV (with both mothers and grandmothers, using only the large municipalities), the coefficients for the share low-income neighbours of the grandmother has increased from 0.077 using strategy 1 (table 3) to 0.111 using strategy 2 (table 4). The corresponding increase for mothers is 0.199 to 0.226. A potential explanation of the stronger correlations for grandmothers using strategy 2 is related to grandmothers being less likely to live in the best-off neighbourhoods[4]. This may signal that those who actually remain have a higher socio-economic status on average than those who for some reason have moved to other neighbourhood categories. Hence, the difference might reflect socio-economic stratification of the grandmothers over neighbourhood categories where only the most successful remain in the high-income areas also at older ages. These women may also have a better ability to provide housing-related assistance to their granddaughters, resulting in greater similarity over generations. We test this hypothesis by estimating median family disposable incomes of grandmothers for different shares of low-income neighbours in 2002. We find that there indeed are significant differences in income levels but that the income levels overall are rather moderate, also among those living in neighbourhood environments where the share low-income neighours is below one standard deviation from the mean (median income of SEK 11,450 per month, compared to SEK 8,700 for those in neighbourhoods above one standard deviation from the mean)[5].

Fig. 6-7 shows the predicted share of low-income neighbours of daughters by variation in mother's/grandmother's neighbourhood environment. Like in Fig. 2-5, they are calculated for a mean individual but it should be noted that the means of Fig. 6-9 correspond to the means for strategy 2. Hence, the predicted share of low-income neighbours is calculated for an individual of age 25.42, with a monthly income of 13,400 SEK, a high school degree, and who is single. These are very different characteristics compared to the individual using strategy 1 where the individual is 37.42 years old and have a much higher income (see table 1 for means and modes). Using strategy 2 and the corresponding means and modes, the predicted share of low-income neighbours is naturally much higher. Otherwise, the pattern in Fig. 6 is very similar to corresponding Fig. 2, with all lines close together. Comparing Fig. 7 and Fig. 3 (which both illustrates the effect of the grandmother's neighbourhood composition) however, yields a difference in the impact of scale between strategies 1 (Fig.3) and 2 (Fig.7). Using strategy 2, comparing at the similar point in time, we find that the two spatial levels produce more similar results than using strategy 1. A possible explanation is that the young and elderly (which we capture using strategy 2) live in area units that better match their larger surroundings than do women in their mid-ages. This could be partly a result of different age groups residing in different housing forms in combination with population density. For example, people in their mid 30s to 60s are more likely than younger individuals to live in

[4] Based on authors calculations using neighbourhood deciles. Using strategy 1 on the 500 nearest neighbours scale, 8.4% of grandmothers live in the top decile, compared to 5.0% using strategy 2.

[5] We acknowledge, however, that the hypothesis might still be valid, given that socio-economic stratification among elderly women may not be primarily related to (own) present earnings but to accumulated capital (own or partner's).

detached housing. Although such areas tend to be homogenous on the small scale, population density is relatively low why it might be necessary to include neighbouring areas to reach 3,000 individuals. By contrast, young individuals are overrepresented in the more densely populated rental segment why 3,000 neighbours might be reached within a smaller geographical area. The likelihood of homogeneity is thereby larger.

The effect of distance is stronger using strategy 2 and perhaps more importantly, the point at which distance turns negative is at a much higher share of low-income neighbours. Using strategy 2, distance starts to have a negative effect on the share low-income neighbours of the daughter when the share low-income neighbours of the mother exceeds 41%, compared to 27.5% using strategy 1 (see model IV). Corresponding numbers for grandmother is 38% using strategy 2 and 28% using strategy 1 (but it should be kept in mind that for grandmothers, the mean has increased slightly, from 30.8% to 31.3%). Hence, when comparing at the same point in time, i.e. when the daughters are younger, they benefit from staying near their mother and grandmother also when the mother/grandmother lives in neighbourhoods that are slightly less off. A possible explanation is that daughters living further away at this age to a large extent have moved to study and hence live in less resourceful neighbourhoods. Another possible explanation is that daughters staying closer receive more help, also on the housing market. This effect is visualized in Fig. 8, showing that unlike for strategy 1 (Fig.4), distance only affect predicted share low-income neighbours of daughter on the marginal if the grandmother and mother both dwell in a low-income neighbourhood. Daughters whose mothers and grandmothers live in high-income neighbourhoods, however, benefit from staying close (Fig.9).

FIGS. 6-9 ABOUT HERE

Conclusions

In this paper, we set out to test the hypothesis that intergenerational transmission of neighbourhood status not only occurs from parents to children, but is extended to multiple generations. Our findings suggest that transmission between two consecutive generations is substantially stronger than between grandmother and granddaughter, which is in line with previous literature on transmission of socio-economic status. Controlling for the neighbourhood environment of the mother, there is only a limited effect of the grandmother's residential environment on her granddaughter's location. However, rather than emphasizing the marginal effect of the grandmother, it could be stressed that we *do* find empirical evidence for multigenerational transmission of neighbourhood status. In addition, as argued by Mare (2011; see also fig.1), multigenerational transmission could also be seen as multiple events of two-generational transmission where the elder generation influence their children which in turn transmit their status to their children. Hence, it is possible that the grandmother has an additional indirect influence over the neighbourhood environment of her granddaughter. It should be stressed that our results do not measure causality. More research is needed to work out the causal transmission patterns and mechanisms over multiple generations. The finding of multigenerational correlations are however robust. They hold over different geographical scales and comparison strategies also when controlling for some of the most common predictors of where people live.

We find that comparing the three generations at the same point in time (i.e. at different points in the life course) yields stronger estimates than when comparing at as similar ages as possible but at different points in time, when controlling for other variables. This is likely due to both

timing and opportunities for the transfer of neighbourhood context. When estimating at the same time point, the youngest generation (daughters) is still very young – in their mid20s – and hence more likely to be under parental influences. In their mid- to late 30s (the age when we compare them at similar ages, strategy 1), most people have entered the labour market, started a family and moved into a more permanent home. The influence from older generations could be assumed to be smaller at such a stage in life. In addition, when comparing neighbourhood contexts at similar ages, the situation of the daughters is compared to that of their mothers 12 years prior and of their grandmothers 24 years prior. Obviously, the (grand)parental influence diminishes with time, especially since many grandmothers are no longer alive at the time when we measure the (grand)daughters' neighbourhood environments. Rather than thinking in terms of small effects, one could argue that it is striking that we find even small correlations between the neighbourhood deprivation levels of adult women and their mothers and grandmothers, given all the time that have passed.

We also find a clear effect of distance. Daughters whose mothers/grandmothers live neighbourhoods with a high share of low-income neighbours have a lower likelihood of living in similar areas themselves if they live further away. Daughters whose mothers/grandmothers live neighbourhoods with a low share of low-income neighbours, on the other hand, benefit from staying close, i.e. are more likely to live in areas with a low share low-income neighbours. Hence, we find that intergenerational transmission of neighbourhood status is stronger over short distances. There are several possible explanations for this finding. One is simply that daughters who move far do so for a purpose, for example to study, which is associated with a dip in neighbourhood status for those from wealthier areas, at least in the beginning, while it represents an upward move for those from less resourceful areas. Other possible explanations are more related to the ability to transmit neighbourhood status, where resources such a knowledge or contacts are not easily transmitted to other housing markets. Mothers/grandmothers may also be more willing to transmit resources to daughters staying close.

Our empirical results tentatively support the simulations by Sharkey for the U.S. suggesting the existence of multigenerational transmission of neighbourhood status. Not surprisingly though, our results are at a much lower level. One reason to this difference in results is of course the context. Although rising, Sweden has substantially lower levels of segregation, polarization and poverty compared to the U.S. In addition, the neighbourhood definition used in this study, based on the share low-income neighbours among the nearest 500 or 3,000 individuals, leaves us with areas quite far from an extreme poverty neighbourhood by a U.S, standard. Not only does a low-income Swedish person (according to our definition) fair relatively well compared to low-income earners in many other contexts; most of the Swedish low-income neighbourhoods are most likely well-functioning areas inhabited by low-income workers. It is possible that we would have found stronger patterns had the analysis been restricted to the poorest segments on the housing market. Another caveat is that for data reasons, our analysis is almost exclusively restricted to native Swedes and immigrant families from neighbouring Nordic countries. Hence, we completely miss out of a part of the population that is increasingly associated with relative poverty and residence in low-income areas. This is especially unfortunate given that two-generational transmission of neighbourhood status has been found to be strongest among immigrant families in the poorest neighbourhoods (van Ham et al 2014).

However, in a sense, these caveats only strengthen our results. We have found (weak) evidence of three-generational transmission of neighbourhood status in a context where "low-income neighbourhoods" are not characterised by extreme poverty and where an important

part of the population that tends to dominate several of the most deprived areas (the immigrant population) is not included. We could thus expect patterns of transmission to become stronger in the future, in the context of both increasing levels of income segregation in Sweden and as immigrant families living in the most deprived areas grow older and have grandchildren.

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Table 1. Descriptive statistics

		500 nearest neighbours				3000 nearest neighbours			
		Strategy 1		Strategy 2		Strategy 1		Strategy 2	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Age, daughter		37.42	3.34	25.42	3.34	37.42	3.34	25.42	3.34
Age, mother		50.53	4.76	50.53	4.76	50.53	4.76	50.53	4.76
Age, grandmother		63.83	6.33	75.83	6.33	63.83	6.33	75.83	6.33
% Low-income neighbours, daughters		26.05	9.70	33.11	13.07	27.64	7.93	32.39	10.04
% Low-income neighbours, mothers		27.73	8.46	27.73	8.46	28.80	6.96	28.80	6.96
% Low-income neighbours, grandmothers		30.82	6.64	31.28	9.15	30.53	5.06	30.75	7.39
Distance daughter - mother (km)		85.25	156.16	88.82	162.06	85.25	156.16	88.82	162.06
Distance daughter - grandmother (km)		120.66	182.73	122.14	186.61	120.66	182.73	122.14	186.61
Municipality size (1 = large, 3 = small)		1.72	0.79	1.65	0.76	1.72	0.79	1.65	0.76
Income, daughter (10,000 SEK)		2.92	1.63	1.34	0.92	2.92	1.63	1.34	0.92
Education status, daughter (1 = lowest, 4 = highest)		2.85	1.14	2.40	1.02	2.85	1.14	2.40	1.02
Family status, daughter	single	16.64%		65.99%		16.64%		65.99%	
	single w children	12.58%		5.89%		12.58%		5.89%	
	couple	3.11%		3.70%		3.11%		3.70%	
	couple w children	67.68%		24.43%		67.68%		24.43%	

Table 2. Correlation coefficients of daughter-mother and daughter-grandmother

	500 nearest neighbours		3000 nearest neighbours	
	Strategy 1	**Strategy 2**	**Strategy 1**	**Strategy 2**
Daughters - Mothers	0.1844	0.1279	0.2013	0.1876
Daughters - Grandmothers	0.0727	0.0646	0.0882	0.1140

Table 3. Linear regression model using *strategy 1*. Dependent variable = share low-income neighbours of daughter. All control variables relate to the daughter. 500 nearest neighbours.

		Model I		Model II		Model III		Model IV	
		Coeff	**Std. Err.**	**Coeff**	**Std. Err.**	**Coeff**	**Std. Err.**	**Coeff**	**Std. Err.**
% Low-income neighbours of *mother*		0.2058	0.0035			0.1984	0.0036	0.1985	0.0050
% Low-income neighbours of *grandmother*				0.1146	0.0043	0.0695	0.0043	0.0768	0.0062
Distance in km to *mother*		0.0124	0.0006			0.0117	0.0006	0.0110	0.0008
Distance in km to *grandmother*				0.0080	0.0006	0.0046	0.0006	0.0056	0.0008
% Low-income nbs of *mother* * distance to *mother*		-0.0004	0.0000			-0.0004	0.0000	-0.0004	0.0000
% Low-income nbs of *grandmother* * distance to grand*mother*				-0.0002	0.0000	-0.0001	0.0000	-0.0002	0.0000
Size of municipality (ref = small)	large	-2.0651	0.0573	-1.9943	0.0586	-1.9645	0.0578		
	medium	-1.8010	0.0610	-1.7797	0.0618	-1.7585	0.0611		
Age		-0.0985	0.0069	-0.1127	0.0070	-0.1001	0.0067	-0.1325	0.0100
Income from work (100 000 SEK)		-0.8199	0.0166	-0.8593	0.0170	-0.8156	0.0166	-0.7745	0.0212
Education level (ref = LT12yrs)	12 yrs	-1.5526	0.0774	-1.7672	0.0789	-1.5520	0.0773	-2.0724	0.1246
	13-14 yrs	-1.9048	0.0888	-2.1718	0.0902	-1.8956	0.0887	-2.0563	0.1371
	15+ yrs	-1.7169	0.0765	-2.0476	0.0778	-1.7138	0.0764	-1.7549	0.1193
Family type (ref = couple w/ children)	couple	2.8545	0.1346	2.9530	0.1370	2.8586	0.1344	3.7398	0.1992
	single w/ children	4.5684	0.0756	4.7703	0.0769	4.5686	0.0755	4.9477	0.1124
	single	5.5320	0.0674	5.6863	0.0679	5.5334	0.0673	6.1502	0.0913
Constant		27.7769	0.2915	30.7569	0.3052	25.8664	0.3131	24.6832	0.4493
R2		0.1426		0.1212		0.1441		0.1522	
N		166389		166389		166389		82811	

Fig. 1. The linked lives across three generations

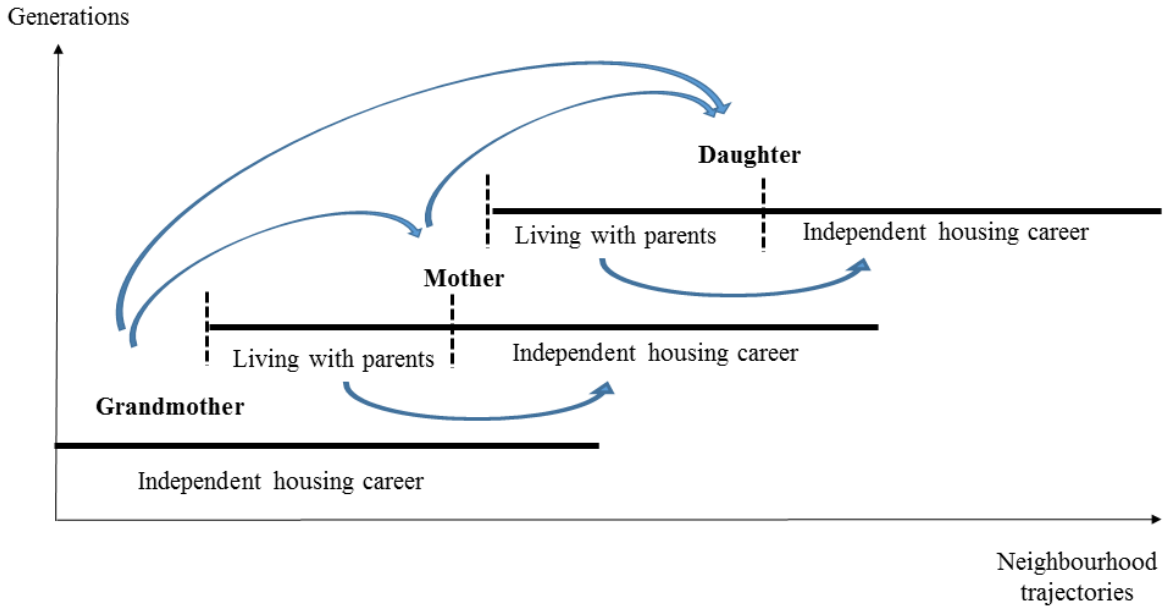


Fig.2. Predicted share low-income neighbours of *daughter* by share low-income neighbours of *mother*, for an individual of mean age, income and distance to mother/grandmother, mode education level and family status. Grandmother in high- or low-income neighbourhood, varying scale. *Strategy 1*.

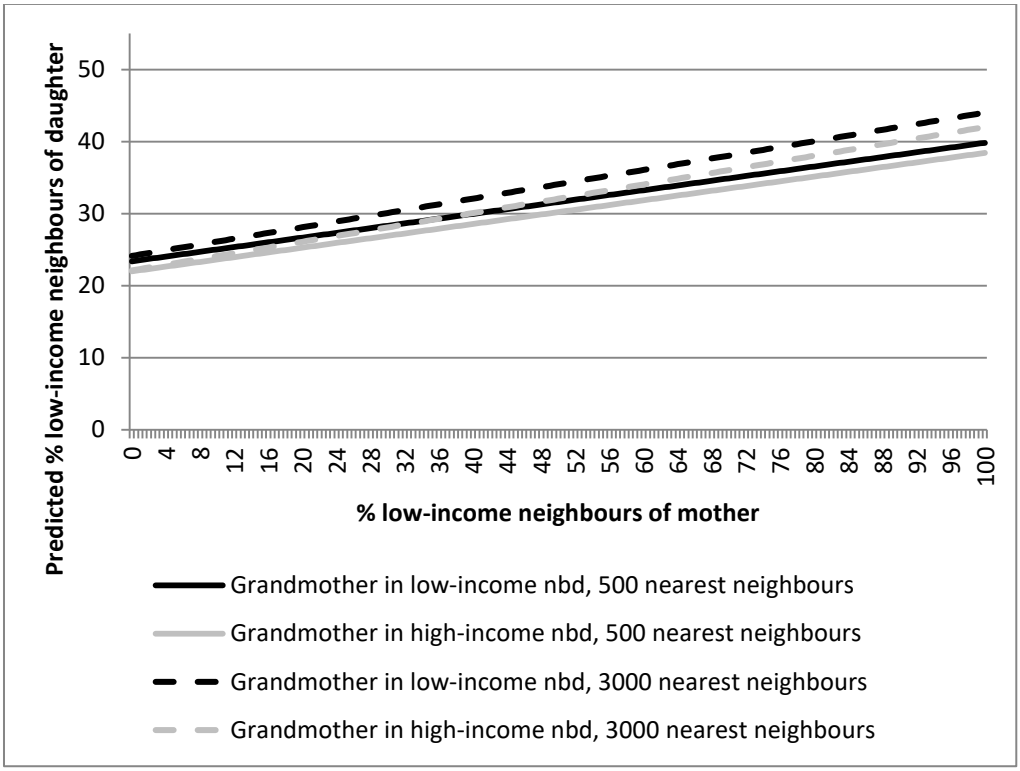


Fig.3. Predicted share low-income neighbours of *daughter* by share low-income neighbours of *grandmother*, for an individual of mean age, income and distance to mother/grandmother, mode education level and family status. Mother in high- or low-income neighbourhood, varying scale. *Strategy 1*.

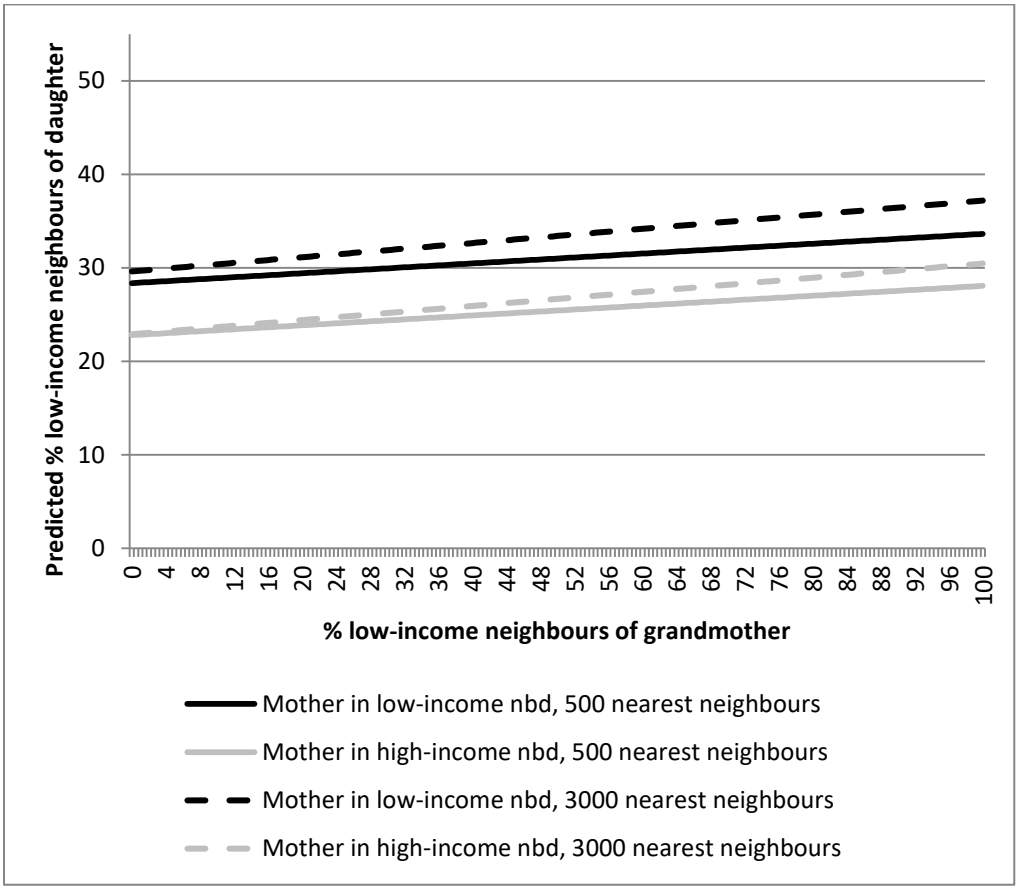


Fig.4. Predicted share low-income neighbours of *daughter* whose mother and grandmother live in *low-income neighbourhoods*, by distance. Calculated for an individual of mean age, income, mode education level and family status. *Strategy 1*. 500 nearest neighbours.

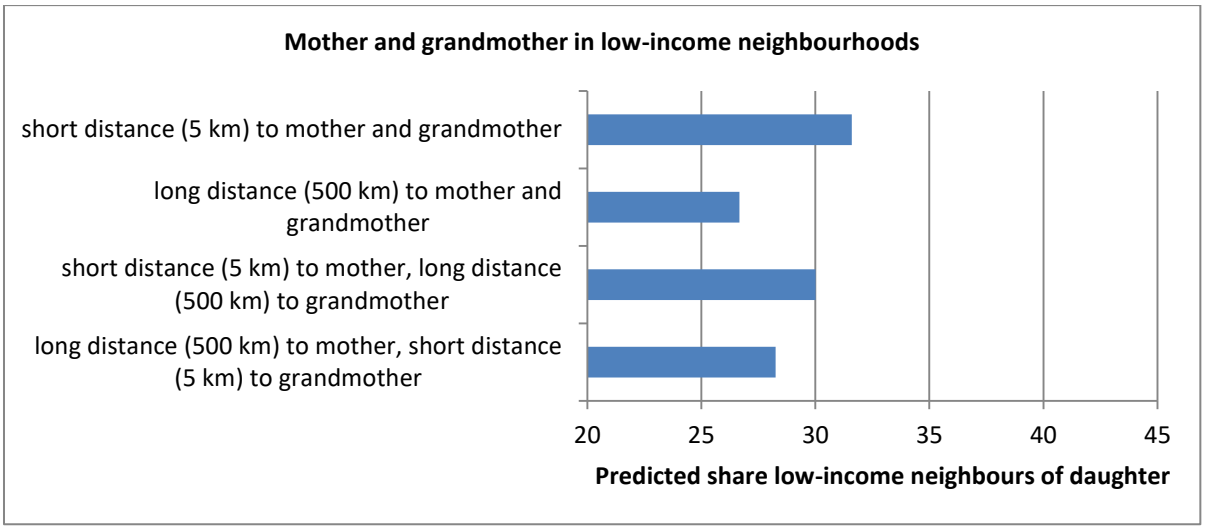


Fig.5. Predicted share low-income neighbours of *daughter* whose mother and grandmother live in *high-income neighbourhoods*, by distance. Calculated for an individual of mean age, income, mode education level and family status. *Strategy 1*. 500 nearest neighbours.

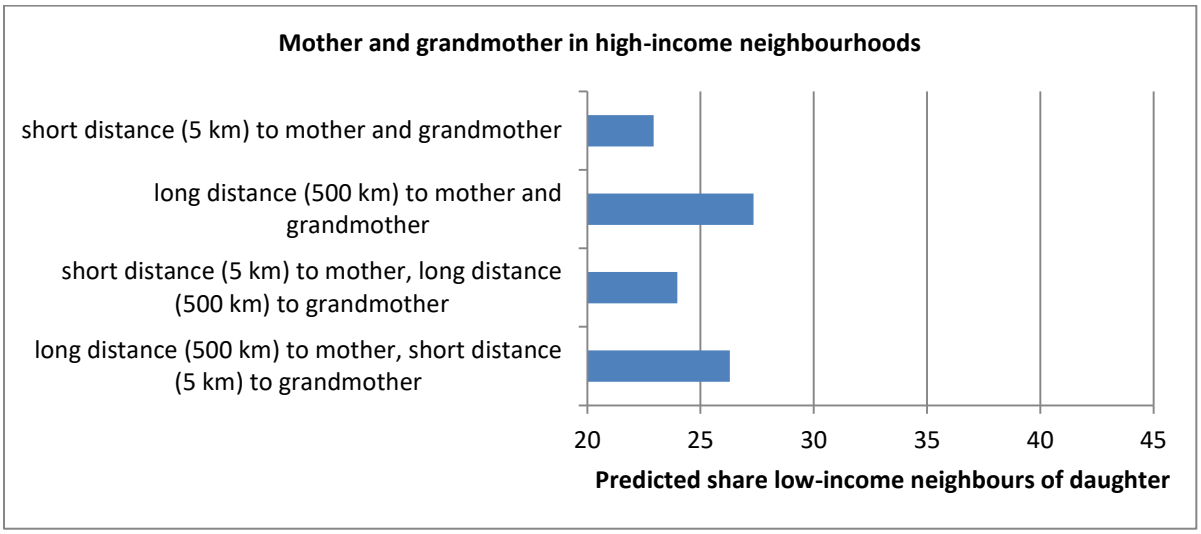


Fig.6. Predicted share low-income neighbours of *daughter* by share low-income neighbours of *mother*, for an individual of mean age, income and distance to mother/grandmother, mode education level and family status. Grandmother in high- or low-income neighbourhood, varying scale. *Strategy 2*.

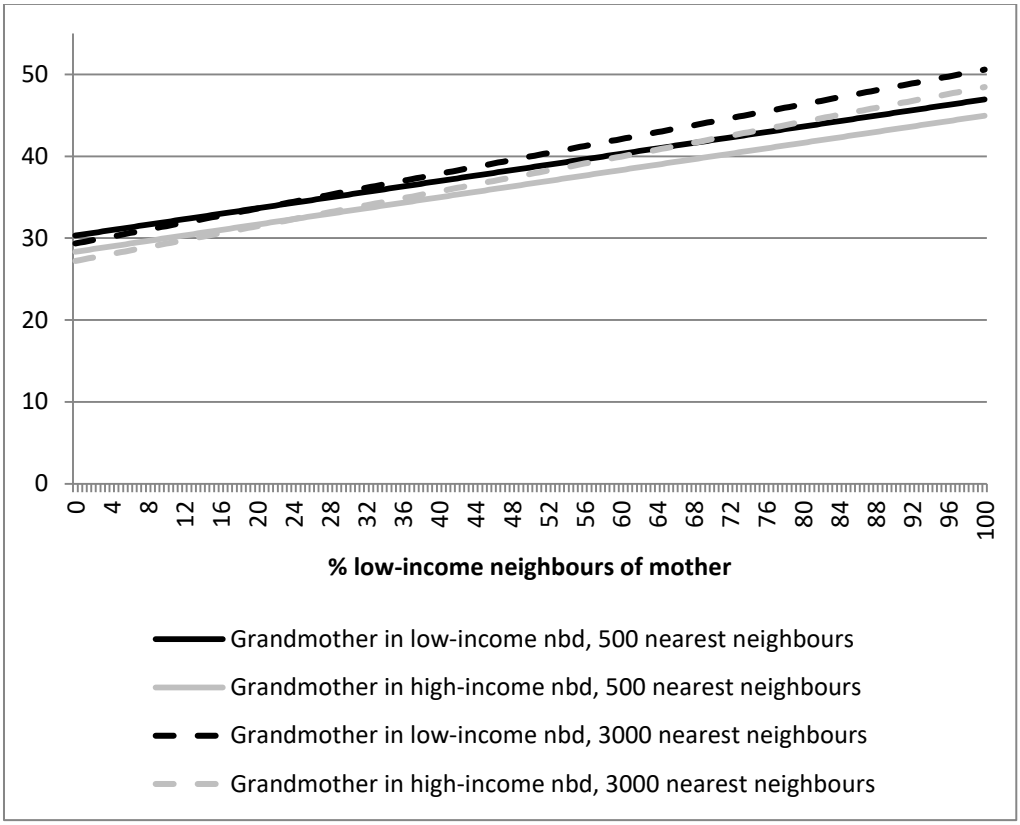


Fig.7. Predicted share low-income neighbours of *daughter* by share low-income neighbours of *grandmother*, for an individual of mean age, income and distance to mother/grandmother, mode education level and family status. Mother in high- or low-income neighbourhood, varying scale. *Strategy 2*.

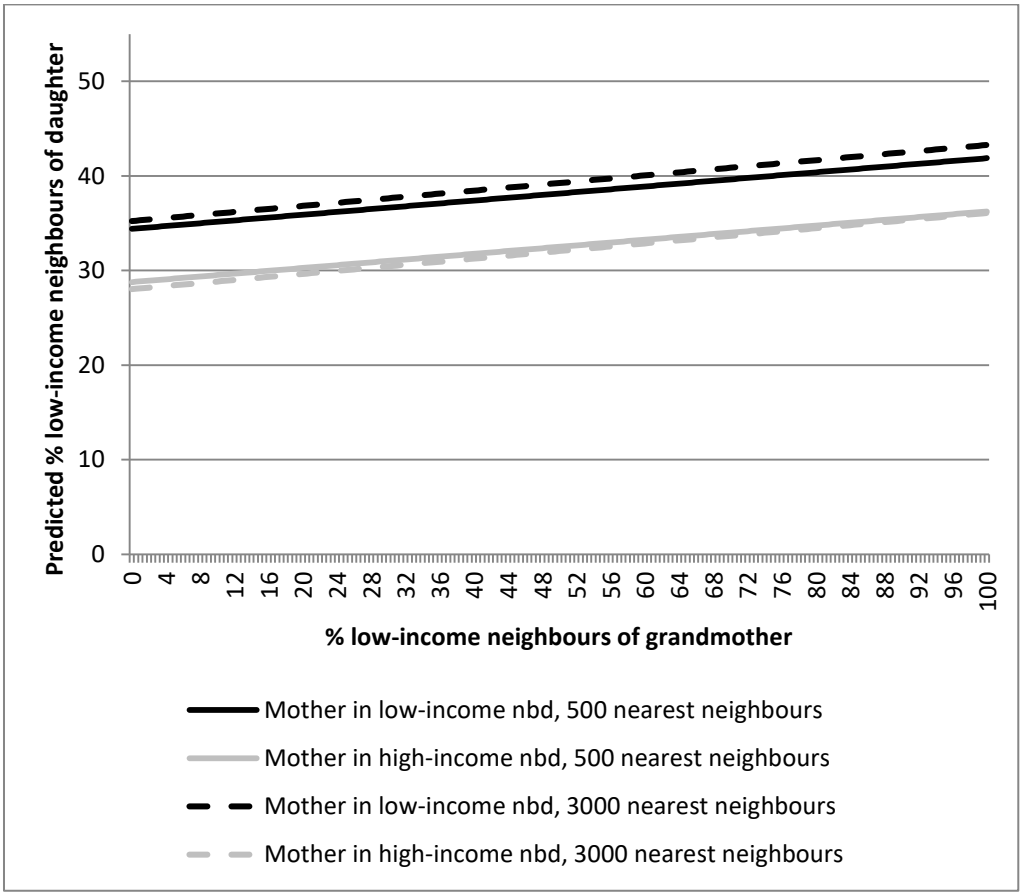


Fig.8. Predicted share low-income neighbours of *daughter* whose mother and grandmother live in *low-income neighbourhoods*, by distance. Calculated for an individual of mean age, income, mode education level and family status. *Strategy 2*. 500 nearest neighbours.

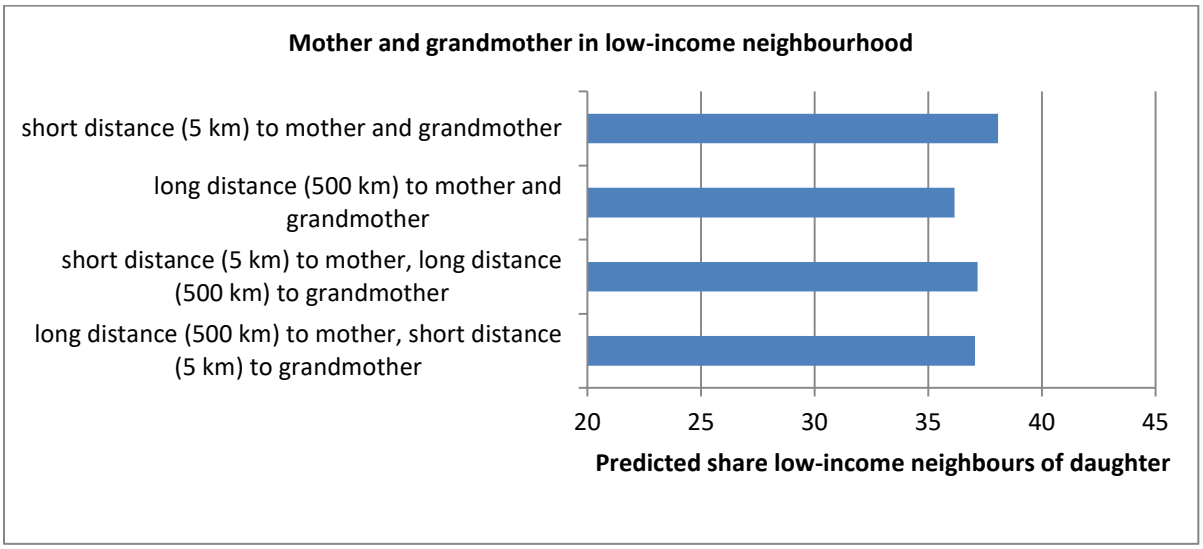
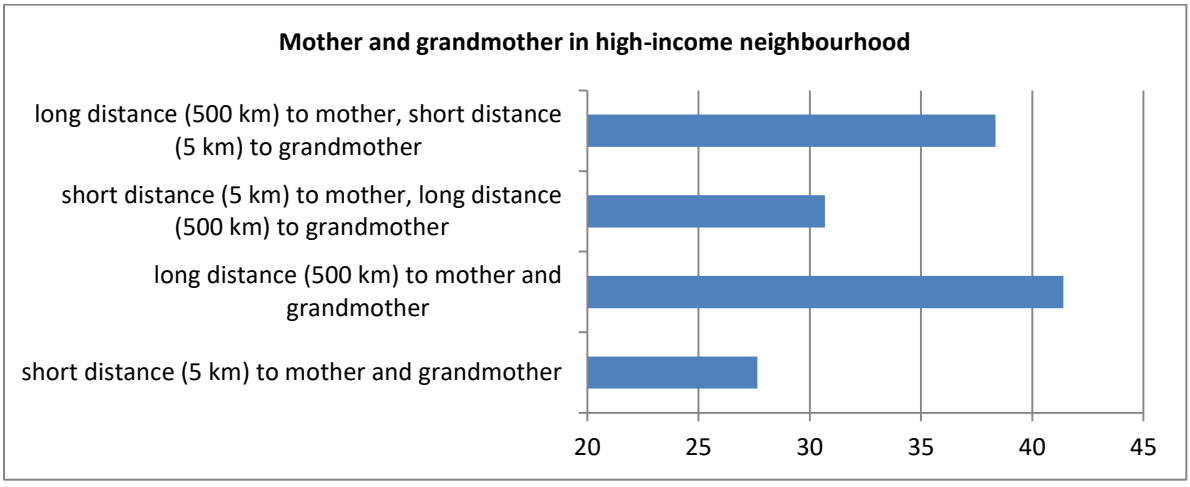


Fig.9. Predicted share low-income neighbours of *daughter* whose mother and grandmother live in *high-income neighbourhoods*, by distance. Calculated for an individual of mean age, income, mode education level and family status. *Strategy 2*. 500 nearest neighbours.



Appendix 1. Linear regression model using *strategy 2*. Dependent variable = share low-income neighbours of daughter. All control variables relate to the daughter. 500 nearest neighbours.

		Model I		Model II		Model III		Model IV	
		Coeff	**Std. Err.**	**Coeff**	**Std. Err.**	**Coeff**	**Std. Err.**	**Coeff**	**Std. Err.**
% Low-income neighbours of *mother*		0.2426	0.0040			0.2194	0.0040	0.2260	0.0057
% Low-income neighbours of *grandmother*				0.1511	0.0038	0.1030	.0037	0.1109	.0054
Distance in km to *mother*		0.0319	0.0009			0.0290	0.0009	0.0290	0.0011
Distance in km to *grandmother*				0.0213	0.0007	0.0104	0.0007	0.0114	0.0010
% Low-income nbs of *mother* * distance to *mother*		-0.0008	.0000			-0.0007	.0000	-0.0007	.0000
% Low-income nbs of *grandmother* * distance to grand*mother*				-0.0005	0.0000	-0.0003	.0000	-0.0003	.0000
Size of municipality (ref = small)	large	3.5389	0.0610	3.4936	0.0618	3.4877	0.0608		
	medium	2.0990	0.0644	2.0456	0.0653	2.0827	0.0642		
Age		-0.5628	0.0010	-0.5818	0.0101	-0.5683	0.0010	-0.6990	0.0155
Income from work (100 000 SEK)		-2.7382	0.0364	-2.8643	0.0368	-2.7177	0.0363	-3.0029	0.0509
Education level (ref = LT12yrs)	12 yrs	-0.4594	0.0683	-0.6150	0.0697	-0.4405	0.0680	-0.4985	0.1125
	13-14 yrs	3.1577	0.1007	3.0375	0.1019	3.1838	0.1005	3.8376	0.1482
	15+ yrs	2.2165	0.0925	2.1939	0.0932	2.2494	0.0923	3.2512	0.1356
Family type (ref = couple w/ children)	couple	2.0156	0.1408	2.1892	0.1426	1.9884	0.1405	2.9937	0.2030
	single w/ children	3.8089	0.1105	4.0133	0.1146	3.7697	0.1098	4.4762	0.1833
	single	4.4353	0.0638	4.6143	0.0649	4.4384	0.0636	5.4627	0.1034
Constant		36.8627	0.2967	39.5903	0.2981	34.3466	0.3091	40.0100	0.4779
R2		0.2023		0.1842		0.2060		0.2064	
N		166610		166610		166610		88943	

Appendix 2. Linear regression model using 3,000 nearest neighbours scale. Only large municipalities: similar to model IV in table 4 (strategy 1) and Appendix 1 (strategy 2).

		Strategy 1		Strategy 2	
		Coeff	**Std. Err.**	**Coeff**	**Std. Err.**
% Low-income neighbours of *mother*		0.2415	00.0054	0.2721	0.0057
% Low-income neighbours of *grandmother*		0.1119	00.0070	0.1287	0.0054
Distance in km to *mother*		0.0164	00.0009	0.0280	0.0012
Distance in km to *grandmother*		0.0089	00.0009	0.0130	0.0010
% Low-income neighbours of *mother* * distance to *mother*		-0.0005	0.0000	-0.0007	.0000
% Low-income neighbours of *grandmother* * distance to grand*mother*		-0.0003	0.0000	-0.0004	.0000
Age		-0.0963	0.0091	-0.4986	0.0127
Income from work (100 000 SEK)		-0.5623	0.0177	-2.1078	0.0407
Education level (ref = LT12yrs)	12 yrs	-1.2979	0.1102	-0.2361	0.0955
	13-14 yrs	-1.2555	0.1215	2.9251	0.1196
	15+ yrs	-0.6688	0.1055	2.9335	0.1117
Family type (ref = couple w/ children)	couple	2.9027	0.1828	2.4085	0.1715
	single w/ children	3.1543	0.0983	2.8877	0.1583
	single	4.3899	0.0819	4.1528	0.0880
Constant		21.5789	0.4276	32.3868	0.4072
R2		0.1184		0.1916	
N		82811		88943	