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Demographic and Educational Success of Descendants: A Prospective Analysis of the Number of Great Grandchildren and their Education in 19th, 20th and 21st Century Northern Sweden

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Abstract: Demographic behavior and socioeconomic positions are inherited across generations, across both time and place. In this study we examine multigenerational dependencies in these dimensions over some 150 years in Sweden. We use a prospective approach where the eldest generation is the unit of analysis and the outcomes are lineage size and educational attainment in the youngest generation. Our data is a representative population of predominantly farmers born in the Skellefteå region in Northern Sweden in the 1860s and 1870s, and we follow these lineages until 2007. We follow our population during the fertility transition, industrial revolution, and educational expansion of tertiary education. Our results suggest that timing of birth, socio-economic position, and especially level of fertility are all central factors that explain the success of a lineage in terms of size, but also in terms of educational attainment. Later births allows the lineage to make use of social advancements and thus increase the proportion with tertiary education, higher fertility creates vast variation in lineage size, but also involves a quality-quantity trade-off of as the average level of education tend to decrease in subsequent generation. We also find prevailing effects of the eldest generation's occupation which are substantial in creating an educational advantage in the youngest generations. Importantly, these factors operate largely independently of each other in their association with reproductive and socio-economic success.

Keywords: Stratification, kinship, lineages, reproductive success, educational expansion, Sweden, fertility, multiple generations

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Introduction

Demographic behavior and socioeconomic positions are inherited across generations, both in contemporary societies and in pre-industrial populations. Little is however known about how pre-industrial ancestors may influence their kin in contemporary societies. Previous research has tended to analyze these historical settings separately, and often with a two generational rather than multigenerational perspective (Mare 2011). We continue a limited earlier literature on social mobility during the industrial revolution in the Netherlands (Knigge et al 2014b; Zijdeman 2009), on prospective and integrated analysis of multigenerational social mobility and fertility in pre-modern China (Mare and Song 2014; Song et al 2015), and multigenerational studies of fertility in 20th century Sweden (Goodman and Koupil 2009; Goodman et al 2012). We combine these approaches and we expand on them by linking historical and contemporary data.

We analyze a representative population of predominantly agricultural occupations in the northern Swedish region of Skellefteå during the mid-19th century (1860-1870s), and follow their descendants until 2007. Our study thus cover four generations over 150 years ($N_{origin\ generation}$=4 789, $N_{great\ grandchildren}$=27 022). From 1960 we can link our cohorts with registers of the complete population of Sweden, which allows us to follow our cohort as they disperse all over Sweden. Our data begins in the initial phases of the industrial revolution in Sweden and before the fertility transition, and stretches in to present time, allowing us to study intergenerational processes under rapid social change. The changing, economic and social conditions have had enormous implications on socio-economic attainment over time, and have completely reshaped the demographic context. The combined effect of such transformations cannot be reliably understood from studies focusing on a single time point, and it is necessary to use multigenerational data which accounts for the aggregate result of demographic and socioeconomic transformations.

We apply a prospective design where the origin generations is the unit of analysis, and study both reproductive success, defined as the total number of great grandchildren, and their educational attainment (the number and proportion of great grandchildren with tertiary education). Using a prospective design helps us to unravel the impact of fertility in social mobility processes, which often are neglected in the standard retrospective mobility analyses (Mare, 2011). Our study examines how reproductive success and educational attainment is affected by the complex interplay of variance in timing and quantum of fertility over time, and period changes such as educational expansion.

Our results show that there is great variance in birth years of great grandchildren in our origin generation, ranging from the late 1940s to the 1980s. This of course, will have huge impact on the outcomes of these children. Similarly there is huge variance in the number of great grandchildren, with the 1st and 3rd quartile ranging from 2 to 17, with a median of 7. Our regression models show that demographic determinants (primarily birth timing across generations) are often much stronger predictor of educational achievement of descendants than other characteristics such as SES (socioeconomic status) or quantum fertility outcomes (number of siblings, cousins, and 2nd cousins) in origin and intermediate generations. This demonstrates the importance of demographic factors in studies of stratification.

The socioeconomic and demographic transformations of the 19th and 20th century

Industrialism and fertility decline (also known as *the fertility transition*) have had enormous impact on modern societies, and fundamentally altered or created many new social processes of inequality and other demographic behavior. The industrial revolution brought unprecedented levels of wealth, and the fertility decline meant that societies could take a big leap, escaping the pre-industrial Malthusian pressure where most increases in standard of living would be turned in to population growth and eventually higher population size, leaving per capita standard of living in a steady state. The industrial revolution was thought to eradicate old economic structures and in turn bring social fluidity to society (Kerr et al 1960), meaning that individuals would be able to be socially take up social positions very different to that of their parents. Even though infinite social mobility did not happen (Erikson and Goldthorpe 1992), the industrial revolution totally reshaped market institutions, created new social classes and provided opportunities for absolute mobility. The industrial revolution also meant continuously improvements in living standards not only across cohorts, but also across the life-course for many cohorts.

The fertility decline, while thought to be fueled by a wide range of social, economic, cultural, and importantly also medical innovations, which allowed per capita wealth to increase (Kirk 1996), also meant a shift from quantity to quality in child rearing (Becker and Barro 1988). This shift towards investing in children, intentional or not, is an impetus both for further income growth and for social mobility. The degree to which the new fertility behavior is adopted can be important to explain the trajectory of families, not least due to socioeconomic differences in the adoption of low fertility (Dribe et al 2014; Livi-Bacci 1986), and since fertility behavior also is correlated across generations (Anderton et al 1987).

Important institutional developments followed in the changing economic and demographic context. Starting already in the 19th century, education was expanded in westerns societies to encompass eventually the whole population. Soon, the developing world saw ever increasing levels of educational attainment. The economic and social change was rapid, meaning that individuals would face and experience fundamental transformative socioeconomic changes even during their own life-course. This means that timing becomes central: when someone is born will have very strong influence on their future life chances. As a consequence, the length of intergenerational intervals across generations becomes fundamental for life chances when compared to peers who have the same ancestor. The analyses in a studies such as Erikson and Goldthorpe (1992) showed that absolute mobility had large influence on class destinations, but the focus in the later literature has nonetheless been on relative mobility as this is seen as a more 'pure' form of intergenerational transfer (Breen and Jonsson 2005, p. 229). With the relative perspective timing is seen as a confounder, not as an important source of mobility chances per se. As outlined by Mare (2011) analyses of social mobility needs to take demographic behavior into account, but this also means that time and context becomes central. By examining both characteristics of our origin population, as well as the importance of calendar time, we can in a novel way examine how temporal context determines socioeconomic and demographic outcomes across multiple generations.

Given the remarkable changes, we can expect strong monotonic trends in any socio-economic outcomes. At times, there will discontinuous shifts and/or increased intensity of the trend. However, from a prospective and multigenerational perspective, the question is what type of lineage some ancestor leaves behind, and to the extent that timing is such a lucky factor, this will matter. In fact, for many outcomes, any socio-economic gradient can easily be dwarfed by time trends. For example, Barclay and Myrskylä (2016) found that advanced maternal age was associate with lower levels of cognitive and physical outcomes, but the secular positive trend in ability resulting in being born later offset possible physiological effects of being born to an older mother. While the latter effect is not generated within the family, it can have substantial impact. During industrialization and the following structural changes such as educational expansion, a ten year postponement of child-bearing can create substantially better outcomes for the child, and such effectscan be multiplied across many generations. In our analysis, one aim is to estimate the influence of time and shows its contribution vis-a-vis other forces.

Previous research

To get an understanding of the factors which determine socioeconomic outcomes of descendants several generations removed, it is necessary to consider both how groups differ in demographic outcomes such timing of birth, and number of births, as well as how these factors are related to socioeconomic positions. It is also necessary to examine how socioeconomic status is reproduced across generations, as well as how all factors above have changed through time. Below we give an overview of some of this research; first focusing on how socioeconomic characteristics determine fertility, second examining if family size is associated with socioeconomic outcomes, third the degree to which socioeconomic status is associated across generations, fourth if fertility behavior is associated across generations, and fifth and finally, previous research which have examined these questions simultaneously.

Prior literature on socioeconomic status and its relationship to fertility

Both contemporary researchers and historians have been interested in how socioeconomic status determines fertility. This interest goes back to the founders of modern statistics and biology such as Galton and Pearson. Historical and contemporary demographers have produced much knowledge on the determinants of childbearing, and mortality, and have examined how this has varied according to socioeconomic status.

Fertility differences between groups are one of the classical questions of demography. The estimation of the social gradient in childbearing – if poorer individuals have more or fewer children than richer individuals – is the subject of much research (e.g. Dribe et al 2014; Edin and Hutchinson 1935; Skirbekk 2008; Westoff 1954). Overall, research have found how a pre-industrial pattern of a positive gradient between SES and fertility transformed into a negative pattern after the industrial revolution, though this pattern is complicated in the past, and recently there is evidence of a reemergence of a partial positive association in contexts such as contemporary Sweden.

In early modern Europe it appears that parity specific control was largely absent (Coale and Watkins 1986; Knodel 1988) and thus that there were little opportunity for differential marital fertility across social groups[3]. In such a context, entry into marriage is instead a more important determinant of fertility, and the source of social differences in reproduction. Malthus speculated on that there might exist a relationship between scarcity of resources and

[3] However, recent evidence suggest non-trivial parity independent control before the fertility transition (e.g. Kolk 2011)

foregone or postponed reproduction, consistent with a positive socioeconomic gradient (Malthus 1985 [1778]).

Such an idealized Malthusian marriage pattern, in which socioeconomic resources regulates entry and age into marriage, but has little association with fertility inside marriage, appears to be largely accurate in early modern England and Sweden (Boberg-Fazlic et al 2011; Clark and Hamilton 2006). Beyond a positive relationship historically between individual socioeconomic status and fertility, it also appears that at a macro level population growth responded positively to increasing income levels, both historically (Lee 1987) and in contemporary societies (Andersson 2000).

On top of this, socioeconomic differences in mortality might have been important regulating number of descendants, but the association between socioeconomic status and mortality was weak, at least in northern Sweden (Edvinsson 2004; Edvinsson and Lindkvist 2011). At the societal level there is also strong reasons to think that decreasing infant and child mortality was broadly associated with fertility decline, as expected by classical demographic transition theory (Kirk 1996). With decreasing mortality, the inevitable consequence of not decreasing fertility is enormous population growth, such as the global population explosion in the 1960s. While this might be true over a longer time scale it has been very hard to find evidence of such associations between mortality decline and fertility decline at the local level (Van de Walle 1986).

Prior research on the relationship between family size, and the socioeconomic outcomes of children

In addition to the importance of the effect of socioeconomic status on fertility, it is importance to consider that the relationship might be opposite. A large literature deals with effects of family size on children's outcomes. A number of studies have repeatedly found that sibship size has negative association with educational outcomes (Downey 1995) and labor market outcomes (Björklund et al 2004). The resource dilution hypothesis explain this with the quality-quantity trade-off in children (Becker and Barro 1988) and argue that with more siblings, each get less exposed to favorable economic and social resources, which then decreases their later outcomes (Anastasi 1956). Some recent quasi-experimental research however questions the family size effects. Researchers using twin births and preferences for a mixed sibling sex composition as an exogenous source of variation in family size and found no effect of family size on socioeconomic outcomes (e.g., Angrist et al 2010).

These results describe conditions in rich contemporary societies, where both material and time resources are generous. If resources and parenting investments have non-linear effects on child development, the relative effect of dilution is likely lower for parents with more resources. In pre-industrial times with fewer resources and higher fertility, the relative effects should be more marked, and the research on family size during the demographic transition and during industrialization indeed show more strong effects (even though the research designs are mainly associational). Van Bavel et al (2011) found that children of smaller families were considerably more upwardly mobile in occupation in 19th century and early 20th century Antwerp. Klemp and Weisdorf (2011) showed a large and significantly negative effect of family size on children's literacy in 18th and 19th century England.

Some other factors related to fertility are that families have different lengths between births, but the birth interval with other siblings in itself likely has small effects on outcomes (Barclay and Kolk 2015). Medical scholars have had a large interest in the effects of parents' age at birth have attracted attention, yet in a series of paper, Myrskylä and co-authors (Barclay and Myrskylä 2016; Myrskylä et al 2013) argue that the adverse effects of advanced parental age have been overstated, in particular in contexts of rapid change. It seems plausible that negative effects of large family size, and other resources constraints were large in earlier less wealthy societies with less government welfare support.

Another implication of advanced age at parenthood is that the degree of intergenerational overlap will be lower, and kinship networks will be more stretched. When resources are scarce, such as in large and/or poor families, intergenerational overlap may be costly, as parents not only have to rear for children, but also for (co-residing) grandparents, furthering resource dilution (cf. Kreidl and Hubatková 2014), on the other hand large variance in the temporal timing of kin avoid inefficiencies related to difficulties in optimizing parental investment over the life course (Chayanov 1966), and co-residing grandparents (Zeng and Xie 2014) or the presence of aunts/uncles (Jaeger 2012) may benefit their grandchildren's educational attainment. Through direct nepotism, a large family network can create various sort of benefits for their members (Song et al 2015), for example employment in controlled firms (Corak and Piraino 2011).

Prior literature on long term effects of socioeconomic stratification

A central question in the social sciences is to what extent life chances are structured beyond individuals control and to what extent the individual would be free to form his own outcomes. The industrial revolution was thought to eradicate old economic structures and in turn bring social fluidity to society (Kerr et al 1960), meaning that individuals would be able to be socially take up social positions very different to that of their parents. As opposed to early sociologic thinking, industrialism did not eradicate the persistence in social class over generations (Erikson and Goldthorpe 1992), but many researchers nonetheless viewed the persistence to be limited to only one generation, meaning that stratification be much reduced between grandparents to children (Glass 1954; Hodge 1966).[4] The recent wave of studies focused on the (latter half of the) 20th century has rejected this idea, and have shown inequality in labor market outcomes to persist over at least three generation across a large range of national contexts, for example the US and Germany (Hertel and Groh-Samberg 2014) and Sweden (Hällsten 2014; Lindahl et al 2015).

There are also studies of social mobility during industrialization, but this literature has for far largely not taken a multigenerational perspective. Zijdeman (2009) found that hardly any of the macro-level developments associated with industrialization decreased the influence of a father's occupational status on that of his son in the Netherlands between 1811 and 1915, but that on the contrary, a father's status became more influential in the more industrialized areas. Knigge, Maas and Leeuwen (2014a) reach the same conclusion based on brother correlations in status. Dribe et al. (2015) using data from Southern Sweden from 1828-1968 also found evidence of an increase in social mobility over time, though that this was concentrated in the 20th century. Dribe and Helgertz (2015) find multigenerational correlations in occupational status, but not for earnings, for a dataset from 1813 to 2010 with most observations in the 20th century.

Few studies are able to link historical periods with present day society and conditions. One exception is Lippényi, Maas and van Leeuwen (2013), who study intergenerational social mobility in Hungary between 1865 and 1950. They found that total mobility increased over the observed period, with an upward shift in the occupational distribution, and that also relative mobility increased, but class-based inequalities in mobility chances also increased during the first period of industrialization.

The existing Swedish studies have focused on the 20th century into early 21st century, with an emphasis on the latter part of the 20th century. Modin, Erikson and Vågerö (2013) studied individuals born in Uppsala from 1915-1929 and their descendants, and found three generational correlations in school grades. Lindahl et al (2015) analyzed a dataset with

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[4] The implication is that social mobility follows a Markov process, i.e., where resources are transferred sequentially across generation pairs, and where there is no association between grandparents' and grandchildren's outcomes (once parents resources are taken into account)

individuals born in 1928 and their parents and descendants. Lindahl et al found that educational outcomes tend to be structured by four generations, meaning that an individuals' great grandparent is influential in determining life chances.

Hällsten (2014) found substantial cousin correlations, thus spanning three generations, in school grades, cognitive ability and education and occupation, as well as substantial 2nd cousin correlations (spanning four generations) in school grades using modern administrative register data with parent-child links from 1932.

Prior literature on the intergenerational components fertility

While the degrees to which socioeconomic characteristics are inherited have been examined very thoroughly, there has been less research on if reproductive success is associated across generations. Such effects could have important implications over multiple generations for the relative size of descendant groups (Heyer et al 2005; Kolk et al 2014). There was a surprisingly weak socioeconomic gradient in mortality in early modern Europe (DeWitte et al 2016; Edvinsson and Lindkvist 2011), and combined with the trivial role of mortality for intergenerational reproduction in contemporary societies were such gradients exists, suggests that mortality differences likely are less important than fertility differences for multigenerational demographic outcomes. In contemporary societies there is clear evidence for intergenerational correlations in fertility (Murphy 2013). These have a multigenerational component where the size of the entire family network matters and are largely independent of socioeconomic status (Kolk 2014), and are likely related to shared preferences across generations and not the effect of an extra sibling per se (Kolk 2015). In pre-industrial societies the relationship is less clear and the relationship has been shown to be weak before the fertility transition (e.g. Reher et al 2008). The weak relationship in pre-industrial societies are likely related to that marital fertility was largely uncontrolled.

Research integrating demography and stratification

For understanding how demography and stratification processes interact in shaping both socioeconomic and demographic outcomes across multiple generations, one must use an analytical approach which examines both processes jointly.

Almost all of the previous covered research treats intergenerational continuities across two (or more) generations, as a linear process with parent and one child (or grandchild) in each generation. However, as most people have more than one child and have siblings, it is potentially misleading to ignore the role of fertility in shaping socioeconomic reproduction across generations. This is particularly important when the research question is to compare the population frequency of a socioeconomic trait across time. Examples of such research focusing on different outcomes are studies by Mare (1997), Preston and Campbell (1993), and Lam (1986). Such examines simultaneously how different groups have different fertility, but also different probabilities to transmit their own socioeconomic traits to their children.

An important distinction is research modeling SES and fertility over multiple generations that focus on the relative performance of descendants/predecessors within their generation, and research that focus on the absolute number of descendants/predecessors (ie. the "width" of the bottom of a family tree). Below we discuss some earlier research which has engaged with such perspectives of various sorts. Using pre-industrial data from the Qing dynasty imperial lineage and from population registry data for Liaoning for the 17th 18th and 19th centuries, Mare and Song (2014) are able to study more than ten generations, and find large persistence in status over these generation spans. Their approach is also to integrate social mobility process with demographic behavior, and identify the *number* of privileged offspring as the most relevant, which involves processes of marriage, fertility and survival. Since the context is historical China, one of the largest drivers of inequality is polygamy, which is exclusive to advantage positions and vastly increases the number of privileged offspring's in later generations.

Using similar data but a different research design, Song et al (2015) examines the population growth rates and lineage extinction for male lineages. They use a model which examines the population growth rate of a lineage, instead of a generational model used in most stratification research. They find that initial status to a very high degree affects the number of male direct descendants in a given time period, and that much of this advantage is related to extinction rates, rather than additive growth of very successful lineages. Similar for both studies above using Chinese data is that they largely assume that the socioeconomic and demographic context was quite stable over their study period, plausibly a reasonable assumption for 18th to early 20th century China, but very different from the context of this study.

Researchers in human genetic evolution have studied in the joint effect of demography and stratification focusing on quantity and quality of offspring. The number of grandchildren is an often used measure of fitness used in evolutionary biology, as it gives a strong indication of the evolutionary success of individuals with a given trait. Much of this research has been guided by the apparent contradiction between the demographic behavior and low fertility of contemporary humans, and what evolutionary biology would predict. Overall researchers have found that contemporary humans' fertility behavior does not optimize fitness, and that men and women have fewer children than what is optimal to maximize fitness (Borgerhoff Mulder 1998). Two studies applying a similar prospective approach as our from an evolutionary perspective, examining number of grandchildren of descendants born in 1915-1929 after the fertility transition are two studies by Goodman and colleagues. Goodman and Koupil (2009) examines the effect of origin socioeconomic status on eventual number grandchildren, and found effects which were quite moderate with a maximum difference of around 0.4 grandchildren by grandparents SES. Goodman, Koupil and Lawson (2012) found that reproductive success was consistently maximized by high fertility, robust to different measures and descendants across different generations. They also found that low fertility had an association with higher socioeconomic success of descendants.

The three studies by Mare and Song (2014), Song et al (2015), and Goodman et al (2012) illustrate different approaches to multigenerational studies. Mare and Song measure socioeconomic and reproductive success among descendants as independent processes (i.e., marriage, fertility and mobility), and then simulate their joint outcomes. Song et al. only studies change over historical calendar time, and by doing that combines the effect of timing of birth (intergenerational length), fertility and mortality influences, and socioeconomic inheritance and differential fertility. Goodman et al. uses an intergenerational model which follows a narrow range of cohorts prospectively and examines the absolute outcomes among descendants irrespective of when measured. Our approach is closest to Goodman et al. with the key difference that we examine an earlier population with more demographic variance, and that one of our key explanatory variables is not only the origin population's status, but also period variability of when intermediary generations were born as we speculate that this is one of the most important factors to understand determinants of number of descendants and their status.

What is unique about the present study is that these analyses (1) can be extended long into the 19th century, which crucially also covers the period before the fertility transition, and thus link historic and modern conditions, (2) provide rare linkage of data from during industrialization with modern present time data, (3) highlights the importance of calendar time when studying societies which are in a constant flux. Similar to studies above, these data allow for a full-fledged integration of socio-economic and demographic behavior during the critical sociodemographic transitions during the previous two centuries.

Population for our study

The study is based on an exceptional combination of national level administrative register data for the second half of the 20th century until the 2000s, together with digitized parish data from Northern Sweden between the 19th century and 1955. The historical data is collected by the Demographic Database at Umeå University, and cover the Skellefteå region in northern Sweden (Alm Stenflo 1994; Westberg et al 2016). The parishes followed over time are Skellefteå Stad, Skellefteå Land, Byske, Fällfors, Jörn and Norsjö (see the map in figure S1). The recent addition of parish data between 1900 and 1955 (Westberg et al 2016) bridges an important gap in historical demography, and allows for demographic analysis that can combine the perspectives of contemporary family sociology/demography, theories on the demographic transition, and traditional historical demography of pre-industrial populations.

The Skellefteå region experienced rapid population growth throughout the 19th and early 20th century. In the early 19th century the area was dominated by landholding farmers (Alm Stenflo 1994). In the second half of the 19th century this was complemented by some sawmill industry, and during the late 19th and early 20th century Skellefteå industrialized rapidly (Alm Stenflo 1994). Both Västerbotten and Norbotten county had high fertility compared to the rest of Sweden a few decades into the 20th century (Statistics Sweden 1999).

[Figure 1 about here]

We have information on the complete population of Sweden after 1960, including birth records linking children from their parents starting from 1932. Our data consists of two separate parts which have been linked together. The first part consists of all individuals in the previously mentioned parishes in Skellefteå. These individuals are linked with modern administrative registers covering the complete population given that they were in Skellefteå in 1947 and was in Sweden at any point after 1960. From 1932 to 1955 we have information of individuals in both the Skellefteå region, as well as data and individuals born in the rest of Sweden derived from the modern Swedish multigenerational registers, and duplicate data for many individuals in our study population. After 1955 our data consists only of information derived from modern administrative registers. Inclusion in the modern registers is conditioned on presence in the registers at any point after 1960.

In our historical data our population is limited to previously mentioned parishes. Events (such as births of siblings) observed outside this area are thus not included in our analysis. The occupational profile of our early cohorts are described in figures S2 and S3 in the supplemental material, and the educational profile for later descendants is found in S4. In figure S5 we show that by 1960 Skellefteå was largely representative for all of Sweden in occupational structure.

Research Design

Our index or anchor generations are men and women born in Skellefteå between 1860-1879. We will use the terms G1 to refer to this earliest born generation, G2 for their children, G3 for their grandchildren, and G4 to their great grandchildren. We employ a prospective research design, where we take the perspective of the earliest generation G1 as our unit of analyses and analyze the development of the succeeding generations. Our aim is to analyze

a): What demographic and socioeconomic factors affect reproductive success, measured as number of descendants in G4 for the 1860-1879 cohorts?

b): What demographic and socioeconomic factors affect combined reproductive success, measured as number of high SES descendants in G4 for the 1860-1879 cohorts, operationalized as described above using measures of educational achievement?

c): What demographic and socioeconomic factors average educational attainment among descendants, measured as share of descendants in G4 with tertiary education for the 1860-1879 cohorts, operationalized as described above?

As a consequence, we focus on three different outcomes in our regression models. These are: a) number of descendants in G4, b) number of tertiary educated descendants in G4, and c) share of descendants in G4 with tertiary education.

We only follow individuals which are born in Skellefteå and to which we can observe until age 15 in Skellefteå (G1) and which had at least one child (G2) which also stayed in Skellefteå until age 15. The grandchildren of generation G1 are all observed children of generation G2. These can both be a part of the historical dataset limited to Skellefteå region (before 1955), and/or be a part of contemporary Swedish registers (born any time after 1932, conditioned on survival to 1960). Our fourth generation (G4) is the great grandchildren of our original cohorts; these are almost always included in the contemporary section (after 1932) of our data.

Our research design combines joint demographic processes, such as fertility, fertility spacing, and child mortality, with stratification processes, effects on class origin on class outcomes. Since the outcomes that we measure consist of several component processes, our estimation strategy can be seen as reduced form, i.e., the gross effect of some factor on outcome, without separating components. This is a good starting point in order to assess if there exist any multigenerational effects. It is possible to decipher the components, but under stronger assumptions. For example Mare and Song (2014), also analyze the number of offspring with high status, but separate the processes of marriage, fertility, SES transmission under the implicit assumption that these processes are independent, and then simulate their cumulative effects. In another classic study, Preston and Campbell (1993) analyse the role of differential fertility for IQ trends, using a transition matrix that is constant across generations. While this is a good starting point, the processes may change dynamically, for example with population growth (Coleman 1993; Lam 1993). In line with our descriptive aim in this paper, we choose a more parsimonious albeit descriptive approach for the transitions, where we make no assumptions about dependency across processes or their stability over time, and instead rely on the availability of multigenerational data. Hence, while prior studies explicitly or implicitly employ strong theory a priority, our approach is explorative.

A consequence of our research design for regression analyses – using members of G1 as our unit of analysis – is that we can only include individual level characteristics of G1 in our models. This is because as members of G1 typically had a large number of descendants, we can only analyze factors such as fertility in G3 or birth years in G4 by using group level statistical measures such as means and quantiles. We can for example analyze the 50th percentile of birth years of G4, for a given member of G1. Another example of one such measure is our outcome in some of our regression analyses, the share of descendants in G4 with tertiary education. In some cases this implies that we in some analyses will include covariates which imply a select on the sample, one such example is analyses proportion tertiary educated in G4, where our sample consists of G1 with at least one descendant in G4.

A consequence of the limited region in our historical data is that we lack information on people that migrated outside the Skellefteå region in our historical dataset. Thus, demographic events outside the region are excluded from our data set. For this reason we condition our data set on presence to age 15 in both G1 and G2. However, it is still possible that we miss some members of G2 and G3 if these were born or migrated outside this region. Thus in particular for G2 and G3 our data is based on a selection of "stayers" in the Skellefteå region, and our analyses of descendants of G1 thus exclude some more mobile descendants. The impact of such migration can be evaluated from fertility statistics. Fertility numbers in G1 are similar to aggregated statistics, and it thus appears that migration has only a minor effect on our fertility numbers. The observed fertility in G2 and G3 is comparable to 85% and 70% of cohort total fertility estimated from aggregated statistics. This suggests that migration and linkage issues result in moderate underestimation of all actual descendants due to under-sampling. Mortality also necessitates that numbers of eventual number of children of descendants is lower than corresponding TFR numbers. Such effects are primarily concentrated in G3, and to a lesser degree G2.

Based on the birth years of G3, we estimate that over 99% of the completed family size (observed members of G4) of G3 will be born before 2007. For our analyses on determinants of number and educational achievements of descendants, we use information in administrative registers on educational attainment of great grandchildren (G4). These data are retrieved from the 1970 census, and yearly educational registers starting from 1985 to 2007 (see figure 2 on the process of educational expansion). We use the highest educational level recorded in any of these sources. We define tertiary education as at least 2 years of post-secondary education of any kind. A consequences of relying in the 1970 census, is that we only have information on possible tertiary education for people surviving until 1970. Due to the high life expectancies in G4 this only implies minor selection on the share of G4 with tertiary education. In order to make sure that all individuals have reached an age to which they can be expected to have finished at least two years of post-secondary education, we also only include members of G4 of at least age 27 (born before 1983). These criteria exclude around 7% of all G4 individuals. In our regression models we use linear effects to capture the effect of both fertility and the effect of birth years and intergenerational distances. We ran additional analyses were we found that this was a good approximation of the functional form of these covariates.

[Figure 2 about here]

Results

Univariate results

We begin by presenting some descriptive results for our four generation study population. This will be followed with regression analyses of the type described in our research design section. The first descriptive section will aim to give an overview of the demographic context, and the large degree of temporal and demographic variation in both fertility and timing of births in our population. In Figure 3 one can see the birth years of the different generations in our study spanning from 1860 to 1983. It is immediately clear that the range across generations is huge, and that there is a substantial overlap. For example, the 5th percentile in G4 and 95th percentile in G2 are very close. In G3 the difference between the 5th and 95th percentile is nearly 70 years.

[Figure 3 about here]

In figure 4, we examine the number of children in each generation. There is a big difference between the fertility of G1 and subsequent generations, as G1 primarily experienced their reproductive ages before the fertility transition, which was comparatively late in the Skellefteå area. Most members of G2 show post fertility transition patterns, and both G2 and G3 show fertility levels comparable to the rest of northern Sweden during and just after the fertility transition, though the number of children in G3 is somewhat lower than TFR numbers due to under-coverage and mortality.

[Figure 4 about here]

In figure S6 and S7 one can follow intergenerational distances in years for different generational pairs in our sample. The graphs show the median age interval between a parent, and all of their children and descendants. The graphs show the large variation in intergenerational age difference which produces the large differences in cohort timing visible in Figure 3. In figure 5 we show the number of descendants of G1 in G4 (their great grandchildren). Once again, the huge variation across members of G1 is striking. The 25th percentile has 2 great grandchildren, while the 75th percentile has 17. Almost 10 percent of men and women born in 1860-1879 have over 40 great grandchildren. In the other two panels in figure 4, the absolute and relative numbers of tertiary educated great grandchildren are shown. In our regression analyses we will further analyze what characteristics are related to absolute reproductive success, absolute reproductive success of high status individuals, and the relative share of high status individuals among all great grandchildren of an individual.

[Figure 5 about here]
[Figure 6 about here]

In figure 6 we show the strong positive association between fertility in the origin generation, and eventual number of great grandchildren. The results strongly suggest that large lineages are overwhelmingly concentrated in lineages originating in individuals who themselves have many children. These results contradict the evolutionary biologists that have speculated that low fertility might be associated with future reproductive success among distant descendants (cf. Borgerhoff Mulder 1998). In figure S8 we examine the degree to which fertility in G1 is associated with fertility levels in G2 and G3. Overall, we find that fertility among descendants appear largely independent of fertility in G1, though high fertility in G1 is associated with somewhat higher fertility in G2.

Multivariate results

Previous descriptive analyses have shown that variations in childbearing means that the long term descendants of an individual grow up in very different temporal contexts. Given the socioeconomic and demographic changes over the 19th and 20th century there are strong reasons to think that the context an individual grow up in has a large effect on the chances of both reproductive and socioeconomic success. We also want to examine the degree to which factors such as timing and quantum of childbearing across generations, as well as occupation in G1 are independent of each other. To further analyze this we conducted a number of OLS-regressions.

In table 1, we analyze the number of descendants in total as the outcome. Since our definition of G1 involves an interval (born between 1860 and 1879) and we have strong time trends, we use the birth year of G1 as a baseline control. Over and above this, we nonetheless see that timing is central as a larger distance between G1 and G4 is associated with smaller number of great grandchildren in model 1. Overall, later birth years have a moderate negative effect on eventual number of descendants. The effect is strongest in G1, as these cohorts were at the vanguard of the fertility transition. The effects are overall negative also in later generations as suggested by the slight negative effect of the G1-G4 interval.

[Tables 1, 2 and 3 about here]

In model 2, we unsurprisingly find that high childbearing in G1 but also in subsequent generations (G2 and G3) has a strong positive effect on number of eventual descendant. The explained variance in this model is some 68 percent suggesting that lineage size has a very strong intergenerational component in each generation (the G1 alone explains some half of this; not shown). The fertility effects are not driven by any timing effect; on the contrary, with controls for the timing which capture the negative fertility trends in model 3, we see that, the fertility effect tend to become stronger, not weaker. The effects are much larger than 1 which is due to the fact that an increase in median fertility in for example G3 typically is multiplied across a large number of individuals in G3. In additional regression analyses we found that the effect of fertility in all three generations was largely independent of each other, consistent with figure S8.

In model 4, we analyze the association between G1 SES and number of great grandchildren. The majority population of farmers with land tenure has clearly higher reproductive success than other occupational groups, with while white collar workers and skilled workers producing the smallest number. However, this is driven by timing and fertility, and with those controls added in model 5, the effects are halved, the difference between while white collar workers and skilled workers, and farmers, being some 2 great grandchildren. This SES effect is to a large degree mediated by subsequent generations' fertility, which we show in model 6. Finally in model 7, we control for another mediator, the proportion in G3 with tertiary education, but this has negligible effects. In general, we find that all of our covariates are of similar strength across our different models. This is suggestive of that all of the factors we examine; fertility, birth timing, and G1 occupation, are independently associated with our dependent variables.

In tables 2 and 3, we analyze great grandchildren with tertiary education in order to examine how socioeconomic success interacts with reproductive success. We analyze this both by examining socioeconomic success in an absolute demographic sense, examining total number of successful descendants, as well as the relative success of descendants examining the proportion with tertiary education. In absolute terms, our results in table 2 echo previous results. Larger family sizes, and farming SES produce the large number of tertiary educed offspring. Again, the explained variance in model 2 is exceptional at more than 50 percent, and this suggests that fertility behaviors trump most other effects. In general the effects of our independent variables change very little across our stepwise model specifications, suggesting that we measure largely independent variables.

Unlike previous results in table 1, later birth years have a positive effect on the absolute number with tertiary education, and the effects for the G1-G4 covariate is quite large. The fertility component is so large so that the net association between the most privileged class position in G1, the white collar category, has a negative effect. This is true, even after taking account of G1 birth year and fertility. However, when we turn to a relative comparison of descendant success, this change.

In table 3, the outcome is the relative proportion (bounded by 0 and 1) of the tertiary educated grandchildren. First, we find very strong effects of timing on the proportion with tertiary education. Each year later that the last generation is born increases the proportion with one percentage points. The interquartile range (Q3-Q1) across G1 persons is slightly below 10 years, and the 5th-95th percentile range is around 30 years (see figure S7), which translates to some 10 percentage point difference for the interquartile range. Given that the mean proportion with tertiary education in G4 is around .45 (see figure S4), this effect is substantial. This implies that while later births decrease number of descendants, they also increase the chance of those descendants entering tertiary education.

When analyzing fertility effects in model 2 and 3, we find evidence of a trade-off between quality and quality: larger family size in G1 and G2 are associated with a lower proportion of tertiary educated great grandchildren. There is a reversed, positive, effect of fertility in G3 in model 2 which however is explained by timing in model 3, and there is a general tendency that the family size effects become more negative when all the controls are added. The quality-quantity trade-off is also substantial in size: the interquartile range of G1's fertility is 7 – 2 = 5 (see figure 4), and thus associated with a 3.5 percentage point difference (-.007 × 5) in tertiary educated great grandchildren. For G2, the effect is of similar size (the interquartile range is 3, but the coefficient is larger, -.013).

Model 4 focuses on effects of SES effect, and here we can find a strong gradient. When we compare white collar workers to other unqualified workers in model 4, the difference is 11 percentage points (.048 +-.063), which translates to a relative different of 25 percent on the mean. Put differently, this is comparable to some 10 year difference in distance between G1 and G4. This gradient is somewhat reduced when fertility is taken into account in model 5 and 6. When we also control for the education of G3 as a mediator in model 7, we find that surprisingly little is explained by this factor, leaving some 7 percentage point difference between white collar workers to other unqualified workers. The education of G3, measured as the proportion with tertiary education also has a strong effect that is largely independent of G1 occupation (comparing Q1-Q3 in G3 educations, which is .33 in figure S3, yields a difference of six percentage points, 0.18 × .33). The explained variance for relative education is much lower than for the lineage size outcomes, and is primarily explained by intergenerational birth timing covariates.

Discussion

In this study, we have found multigenerational effects of both initial family size and timing and socioeconomic standing of a first generation, born in the 1860s and 1870s on number great grandchildren and their educational attainment. Larger family sizes are associated with more grandchildren, and this effect is huge. Larger family size in the first and following generation however also moderately predicts less educated grandchildren, which suggests an intergenerational quantity-quality trade-off. The fertility outcomes we observe in earlier generations are since long gone, since large family sizes have dwindled, but we can nonetheless trace their effects on lineage size into modern times. Our results also show that birth timing is strongly associated with future outcomes. Families with more recent born children and grandchildren, and thus longer birth spans, experience higher levels of education of their great grandchildren. These strong effects of timing are inevitable in analyses of periods of structural change, but we argue that this is not a nuisance but a powerful determinant of descendant outcomes, as well as an important source of inequality, since timing is not random but systematic and to some extent inherited.

Similar to many recent multigenerational studies, we also find that an occupationally privileged first generation get grandchildren with higher levels of education, suggesting lasting SES effects of prior generations. These results remain even after taking account of the fertility of the index generation, and when we control for the parental generation's education, and timing. Overall, our results are consistent with earlier studies by Goodman and colleagues, who found a strong association between fertility and number of eventual descendants, though we present earlier data with more variation in fertility and mortality rates. Importantly, the factors of family size, timing/generational spans, and SES by and large operate independently, both across factors and across generations. Hence, our study supports the argument made by Mare (2011) that studies of multigenerational transfers need to take both stratification and fertility into account, but not only because they may confound each other, but because there are a multitude of intergenerational transfer routes and they all build up a complex composite of sociodemographic outcomes. The finding that both the effects of fertility, timing and SES act independently on our outcomes, as well as the finding that the SES indicators in the different generations (G1 SES and G3 education) also act independently on the same outcomes, suggests that G1 SES and G3 education represent partially independent stratification systems. The G1 SES effects are rooted in class stratification before industrialism, whereas G3 education to large degree stems from educational expansion, which then benefited larger parts of the population than only the most advantaged (if this would have been the case, there would be a high correlation between the two, and large changes in their effect as the consequence). This in turn speaks to theories about how inequality responds to changes in opportunities over time (e.g., Raftery and Hout 1993).

Perhaps not surprising, the most important demographic factor to explain both total number of descendants, and total number of successful descendants is initial and subsequent levels of fertility. For any outcome where the quantity matters, high fertility will in often trump socio-economic effects by producing a very large number of offspring, and some will also attain advantaged positions as a mere function of those life chances available to each generation, without taking origin conditions into account (most of socio-economic outcomes are after all not structured by family background, and typical estimates of siblings correlations are below .5). Since even the underprivileged children have some positive probability of attaining high status, increasing the number of draws will increase the probability that at least some great grandchild gets a privileged position.

Our research also shows the importance of defining how we shall view intergenerational advantages: through an absolute of relative lens. Which we choose will influence on the conclusions we draw. The relative perspective has attracted the attention of most sociologists to date, but this perspective underplays demographic factors. The absolute perspective, on the other hand, will tend to be dominated by fertility processes, many of them completely uncorrelated with other observable factors, as these are fundamental for the production of family lineages. If we are interested in the ability for at least some lineage to reach high SES positions, almost any family is likely to do so after with sufficient initial size and after sufficient number of generations, not least since some families tend to die out, leaving other, zero-sum advantages for other to use.

We think that our results have implications for most research linking demographic and socioeconomic outcomes across multiple generations, and highlight an issue which might have important consequences for most multigenerational research. Any study of social stratification of more than 4 generations involving individuals that are alive today, will always have to relate to the sociodemographic transitions in the 19th and 20th century, and thoroughly understand how demography and stratification interacts in contexts of rapid change. Finding appropriate research designs that can deal the inevitably huge demographic variance, both temporal and related to reproduction outcomes, will be important in all future multigenerational studies. Both historians and social scientists interested in contemporary stratification will have to carefully examine the historical changes the last 150 years when examining socioeconomic stratification.

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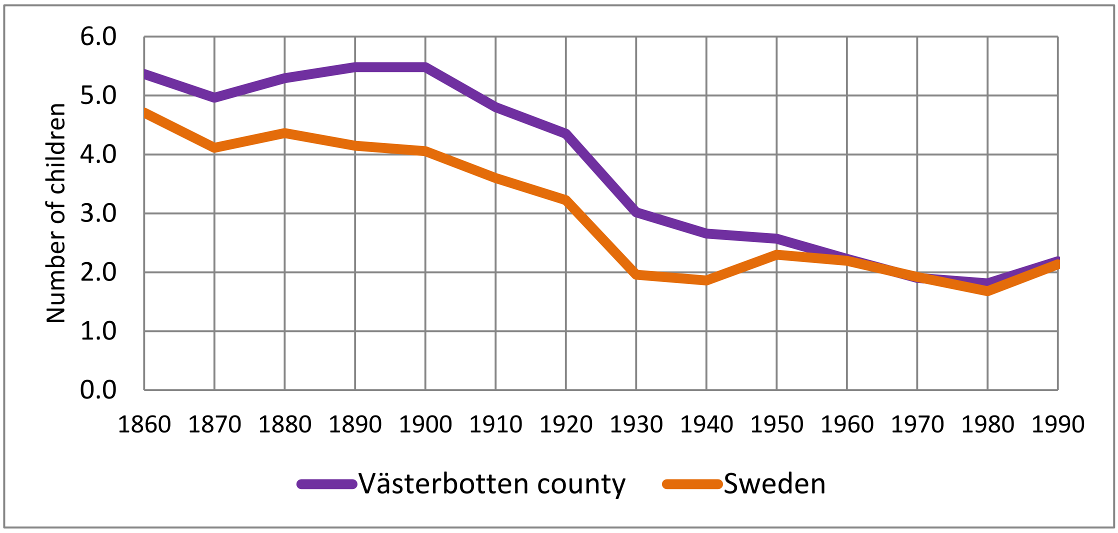

Figure 1: Total Fertility Rate in Sweden and Västerbotten Country (the county of Skellefteå) between 1860 and 1990

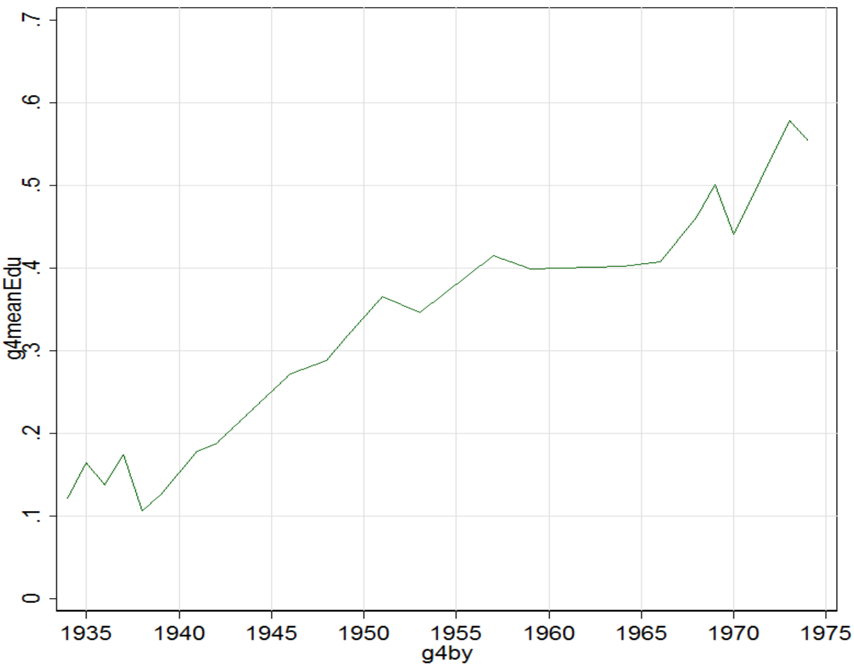

Figure 2: Share of great grandchildren with tertiary education of individuals born 1860-1879 in Skellefteå, by birth year of the great grandchild.

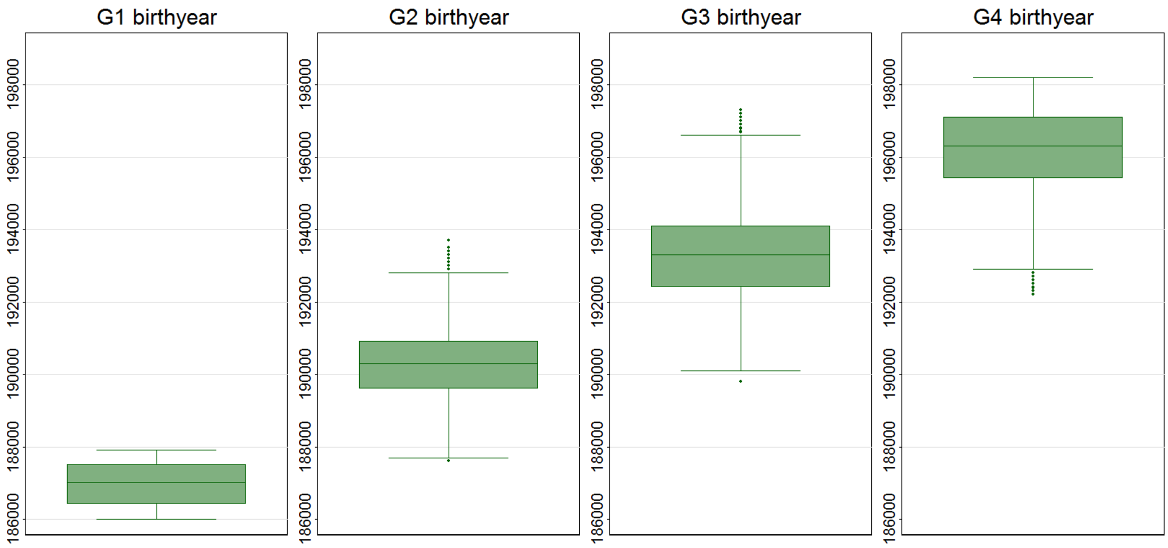

Figure 3: Box plot of birth year for G1, G2, G3 & G4.

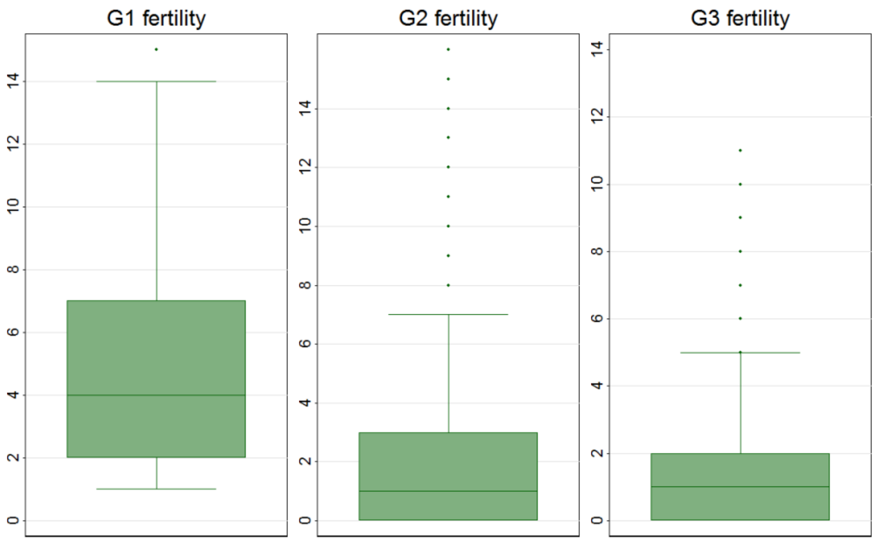

Figure 4: Number of children of G1, G2, & G3.

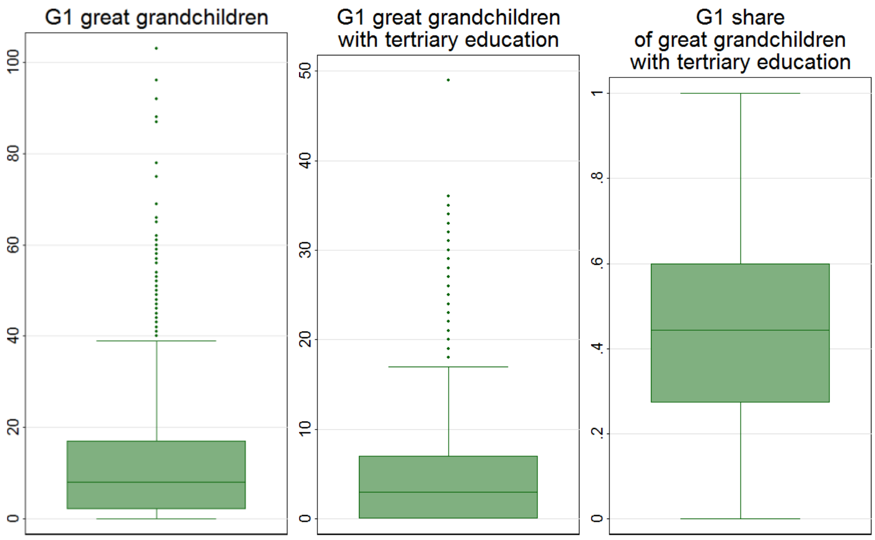

Figure 5: total number of great grandchildren in G4, number with tertiary education in G4, and share tertiary education among G4.

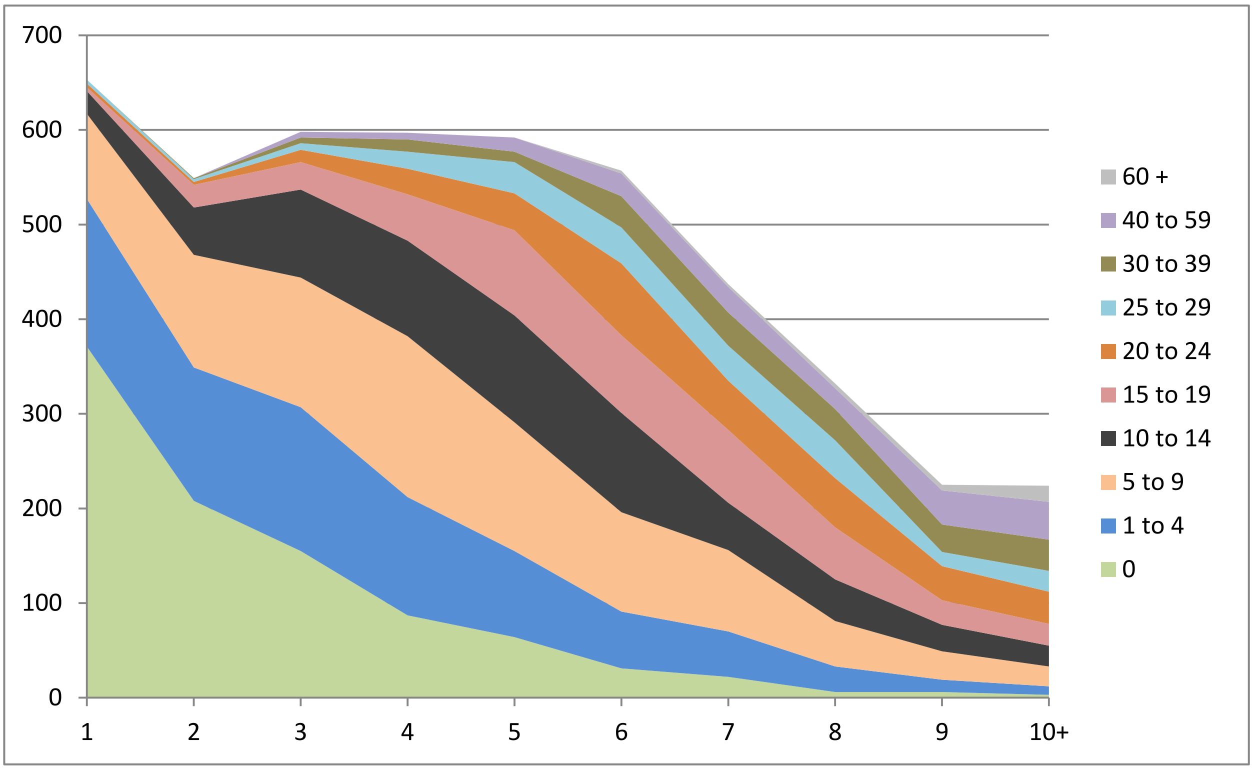

Figure 6: Number of members of G1 and fertility in G1, with total number of great grandchildren (G4)

Table 1. Regression of number of great grandchildren on socio-demographic characteristics of prior generations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
G1 birth year	-0.268***		-0.199***	-0.199***	-0.174***	-0.198***	-0.199***
	(-0.336 - -0.199)		(-0.240 - -0.158)	(-0.259 - -0.138)	(-0.234 - -0.114)	(-0.239 - -0.157)	(-0.241 - -0.158)
Birth interval G1-G4 (median)	-0.059**		-0.099***		-0.105***	-0.100***	-0.101***
	(-0.116 - -0.003)		(-0.132 - -0.066)		(-0.154 - -0.056)	(-0.133 - -0.066)	(-0.135 - -0.067)
G1 nr kids		3.091***	3.206***		2.439***	3.201***	3.203***
		(3.003 - 3.178)	(3.113 - 3.300)		(2.304 - 2.574)	(3.108 - 3.294)	(3.110 - 3.297)
G2 nr kids (median)		4.173***	4.188***			4.185***	4.189***
		(4.023 - 4.324)	(4.031 - 4.346)			(4.028 - 4.343)	(4.031 - 4.347)
G3 nr kids (median)		4.804***	5.278***			5.273***	5.251***
		(4.544 - 5.063)	(4.998 - 5.557)			(4.993 - 5.553)	(4.960 - 5.542)
G1 SES (ref = farmers)							
Upper/Lower white collar				-4.285***	-2.106*	-1.521*	-1.532*
				(-6.528 - -2.042)	(-4.427 - 0.216)	(-3.066 - 0.023)	(-3.077 - 0.013)
Skilled workers and craftsmen				-4.132***	-2.187***	-0.524	-0.522
				(-5.721 - -2.542)	(-3.825 - -0.550)	(-1.614 - 0.566)	(-1.613 - 0.568)
Other unqualified workers				-0.977**	-0.193	-0.228	-0.228
				(-1.804 - -0.150)	(-1.000 - 0.613)	(-0.765 - 0.308)	(-0.765 - 0.309)
Other/missing				-1.738**	-1.002	-0.140	-0.147
				(-3.153 - -0.323)	(-2.398 - 0.394)	(-1.069 - 0.790)	(-1.077 - 0.783)
G3 Proportion with TE (Mean)							0.312
							(-0.814 - 1.438)
Nr of individuals (G1)	3812[3]	4116[2]	3812[3]	4765[1]	3812[3]	3812[3]	3812[3]
R-squared	0.0152	0.677	0.674	0.0184	0.263	0.674	0.674

95 % CI in parentheses, *** p<0.01, ** p<0.05, * p<0.1 [1]Model specification implies conditioning on at least one member of G2 [2]Model specification implies conditioning on at least one member of G3 [3]Model specification implies conditioning on at least one member of G4

Table 2. Regression of number of great grandchildren with tertiary education on socio-demographic characteristics of prior generations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
G1 birth year	0.012		0.032***	-0.011	0.045***	0.028**	0.022**
	(-0.019 - 0.042)		(0.010 - 0.053)	(-0.038 - 0.016)	(0.017 - 0.072)	(0.006 - 0.050)	(0.000 - 0.044)
Birth interval G1-G4 (median)	0.100***		0.079***		0.078***	0.075***	0.069***
	(0.075 - 0.125)		(0.062 - 0.097)		(0.055 - 0.100)	(0.057 - 0.093)	(0.051 - 0.087)
G1 nr kids		1.213***	1.268***		0.976***	1.264***	1.273***
		(1.167 - 1.259)	(1.218 - 1.317)		(0.914 - 1.038)	(1.214 - 1.313)	(1.223 - 1.323)
G2 nr kids (median)		1.452***	1.547***			1.551***	1.566***
		(1.373 - 1.531)	(1.464 - 1.631)			(1.468 - 1.635)	(1.482 - 1.649)
G3 nr kids (median)		2.317***	2.262***			2.260***	2.175***
		(2.181 - 2.452)	(2.113 - 2.411)			(2.112 - 2.409)	(2.021 - 2.329)
G1 SES (ref = farmers)							
Upper/Lower white collar				-1.504***	-0.422	-0.189	-0.231
				(-2.495 - -0.512)	(-1.486 - 0.642)	(-1.008 - 0.629)	(-1.048 - 0.586)
Skilled workers and craftsmen				-1.737***	-0.912**	-0.262	-0.257
				(-2.440 - -1.035)	(-1.662 - -0.162)	(-0.840 - 0.316)	(-0.833 - 0.320)
Other unqualified workers				-1.081***	-0.696***	-0.709***	-0.708***
				(-1.447 - -0.716)	(-1.065 - -0.326)	(-0.994 - -0.425)	(-0.991 - -0.424)
Other/missing				-0.534*	0.030	0.348	0.319
				(-1.159 - 0.092)	(-0.610 - 0.670)	(-0.144 - 0.841)	(-0.173 - 0.811)
G3 Proportion with TE (Mean)							1.206***
							(0.611 - 1.802)
Nr of individuals (G1)	3812[3]	4116[2]	3812[3]	4765[1]	3812[3]	3812[3]	3812[3]
R-squared	0.0159	0.549	0.534	0.0113	0.219	0.538	0.540

95 % CI in parentheses, *** p<0.01, ** p<0.05, * p<0.1 [1]Model specification implies conditioning on at least one member of G2 [2]Model specification implies conditioning on at least one member of G3 [3]Model specification implies conditioning on at least one member of G4

Table 3. Regression of the proportion of great grandchildren with tertiary education on socio-demographic characteristics of prior generations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
G1 birth year	0.010***		0.010***	0.007***	0.010***	0.010***	0.009***
	(0.009 - 0.012)		(0.009 - 0.011)	(0.006 - 0.009)	(0.008 - 0.011)	(0.008 - 0.011)	(0.007 - 0.010)
Birth interval G1-G4 (median)	0.011***		0.011***		0.011***	0.011***	0.010***
	(0.010 - 0.012)		(0.010 - 0.012)		(0.010 - 0.012)	(0.010 - 0.012)	(0.009 - 0.011)
G1 nr kids		-0.008***	-0.007***		-0.005***	-0.007***	-0.006***
		(-0.011 - -0.005)	(-0.010 - -0.004)		(-0.008 - -0.002)	(-0.010 - -0.004)	(-0.009 - -0.003)
G2 nr kids (median)		-0.023***	-0.013***			-0.013***	-0.011***
		(-0.028 - -0.017)	(-0.019 - -0.008)			(-0.018 - -0.008)	(-0.016 - -0.006)
G3 nr kids (median)		0.016***	-0.006			-0.005	-0.018***
		(0.006 - 0.025)	(-0.015 - 0.004)			(-0.014 - 0.004)	(-0.027 - -0.009)
G1 SES (ref = farmers)							
Upper/Lower white collar				0.048*	0.046*	0.045*	0.038
				(-0.004 - 0.101)	(-0.004 - 0.096)	(-0.005 - 0.095)	(-0.011 - 0.088)
Skilled workers and craftsmen				0.035*	0.035*	0.031*	0.032*
				(-0.002 - 0.072)	(-0.001 - 0.070)	(-0.005 - 0.066)	(-0.003 - 0.066)
Other unqualified workers				-0.063***	-0.042***	-0.042***	-0.042***
				(-0.081 - -0.045)	(-0.060 - -0.025)	(-0.060 - -0.025)	(-0.059 - -0.025)
Other/missing				0.024	0.040***	0.038**	0.033**
				(-0.008 - 0.055)	(0.010 - 0.070)	(0.007 - 0.068)	(0.003 - 0.063)
G3 Proportion with TE (Mean)							0.180***
							(0.144 - 0.216)
Nr of individuals (G1)	3812[3]	3812[3]	3812[3]	3812[3]	3812[3]	3,812[3]	3,812[3]
R-squared	0.132	0.0214	0.141	0.0470	0.145	0.151	0.172

95 % CI in parentheses, *** p<0.01, ** p<0.05, * p<0.1 [3] Model specification implies conditioning on at least one member of G4

Supplemental online material

Figure S1: Map of the region. Area in orange is the parishes in the Skellefteå region included in our study.
Note: Map modifed from wikipedia/ CC BY

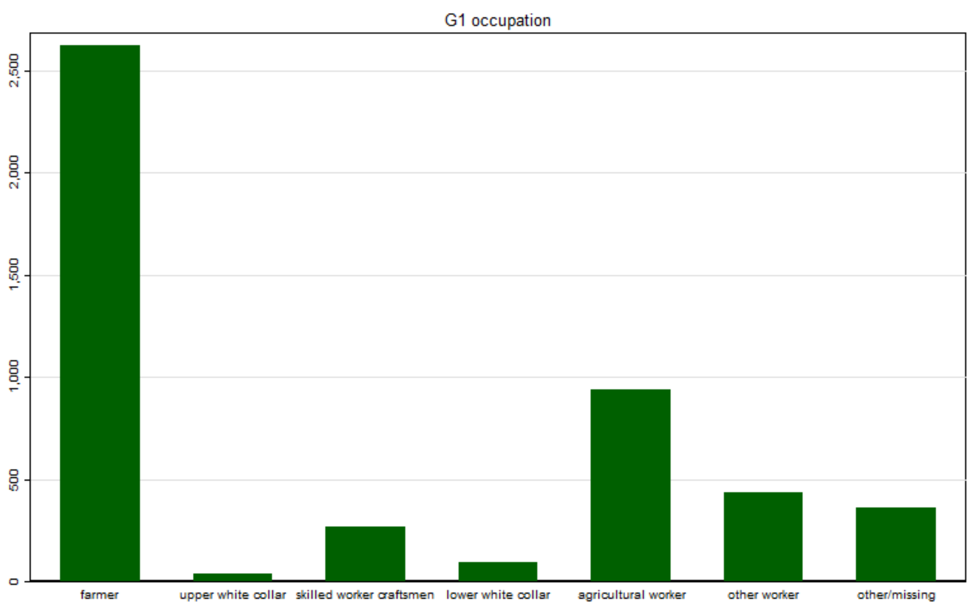

Figure S2: Occupations of individuals in G1

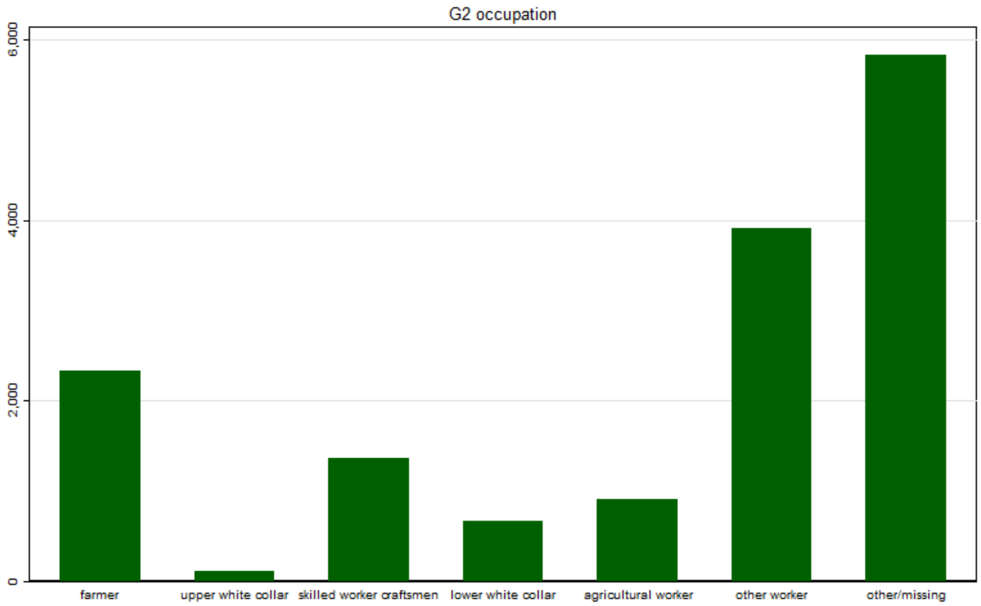

Figure S3: Occupations of individuals in G2

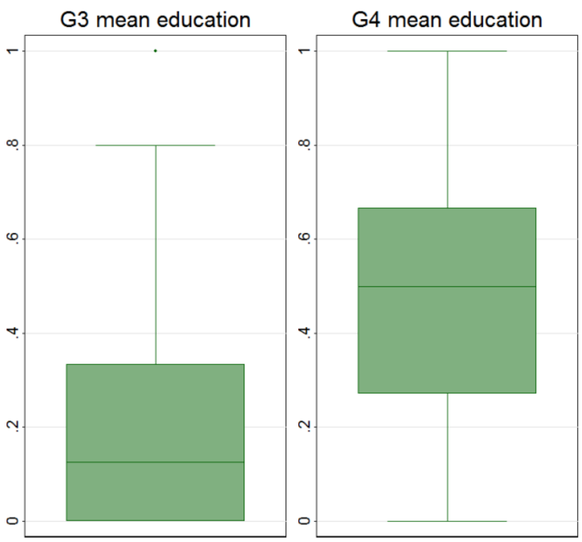

Figure S4: Education of individuals in G3 and G4.

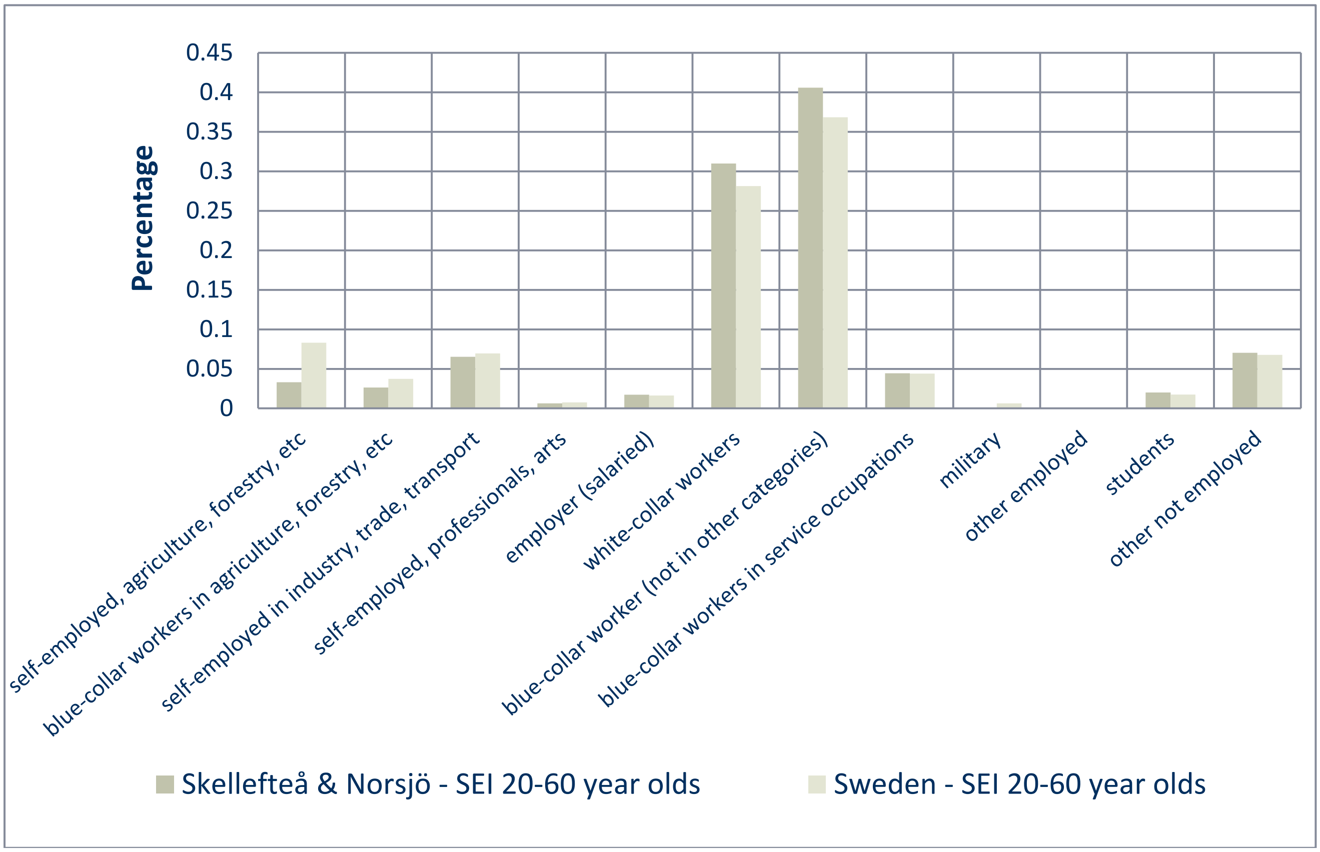

Figure S5: SES-composition in 1960 in Skellefteå Region and all of Sweden, based on 1960 census Statistics Sweden SES-scheme

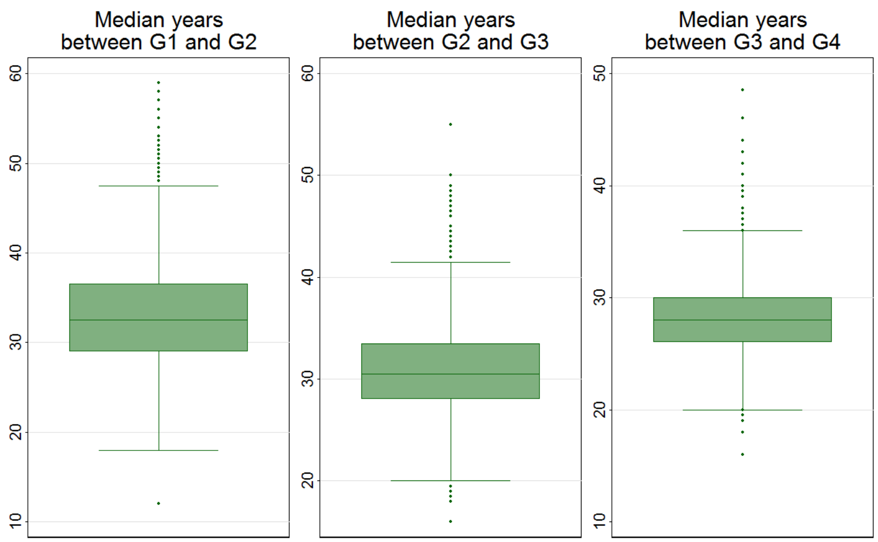

Figure S6: Median number of years between G1 and G2, G2 and G3, G3 and G4. Graphs show all individuals of oldest generation, and median distance to their children in the next generation.

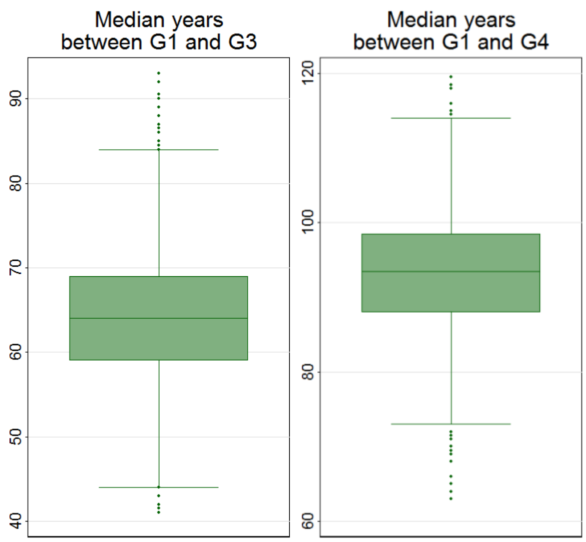

Figure S7: Median number of years between G1 & G3, and G1& G4. Graphs show all individuals of G1, and median distance to their descendants in G3 and G4.

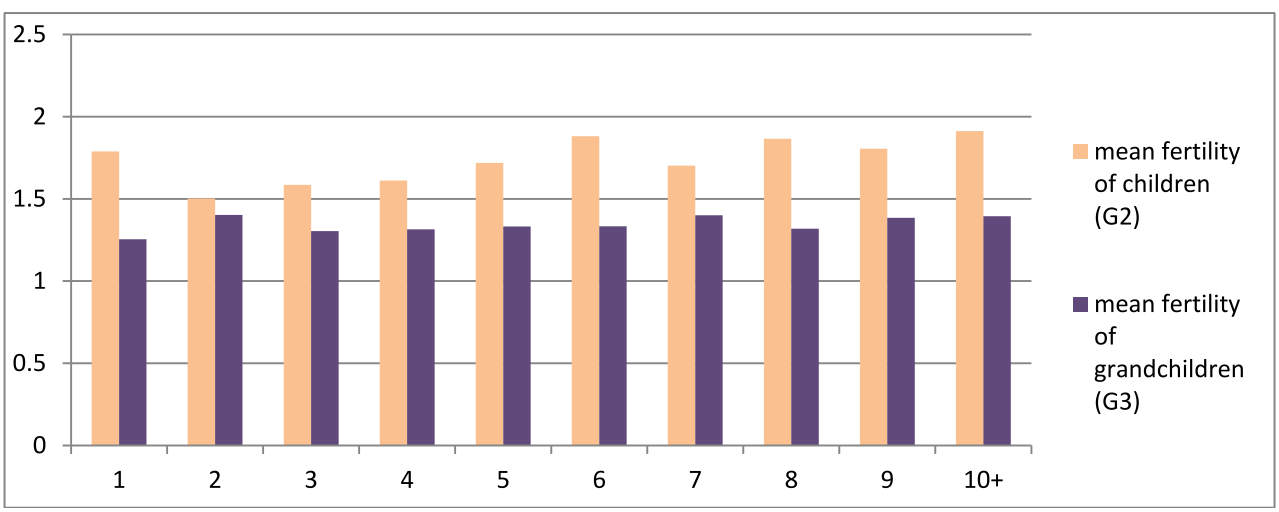

Figure S8: Mean fertility in G2 and G3 by fertility in G1.