Do grandfathers really matter for social mobility? Evidence from Swedish register data

JONAS HELGERTZ, MARTIN DRIBE

LUND PAPERS IN ECONOMIC DEMOGRAPHY 2019:1

Centre for Economic Demography
Lund University School of Economics and Management
P.O. Box 7083
SE-220 07 Lund, Sweden

www.ed.lu/publications/Lund-Papers-in-Economic-Demography/

CENTRE FOR ECONOMIC DEMOGRAPHY

The Centre for Economic Demography (CED), established in 2006 as a Linnaeus Centre of Excellence, is a multidisciplinary research centre at Lund University with members from the School of Economics and Management, the Faculty of Medicine and the Faculty of Social Sciences. The mission of CED is to promote research and training in population studies. Researchers at the Centre study demographic issues from different perspectives and in a variety of contexts across time and space. More information at www.ed.lu.

Copyright is held by the author(s). Lund Papers in Economic Demography are circulated for discussion and have not been peer-reviewed or reviewed by the Centre for Economic Demography. The views expressed are those of the author(s).

Do grandfathers really matter for social mobility? Evidence from Swedish register data

Jonas Helgertz
Minnesota Population Center, University of Minnesota
Centre for Economic Demography and Department of Economic History, Lund University
helgertz@umn.edu

Martin Dribe
Centre for Economic Demography and Department of Economic History, Lund University
Martin.Dribe@ekh.lu.se

Abstract

A growing empirical and theoretical literature has investigated to what extent socioeconomic inequalities are influenced by the outcomes and characteristics of ancestors prior to the parental generation. This paper contributes by examining multigenerational associations of earnings and occupational status in the entire Swedish population born 1968-1976, amounting to over 200,000 three-generation lineages of men and women. The population is followed until 2011, examining to which the strength of the grandfather-grandchild association interacts with theoretically motivated characteristics, including overlapping lifespans, residential proximity and competition for resources, net of the association between parents and children. To the extent that such interactions exist, it would be consistent with a causal multigenerational relationship. While a robust multigenerational association exists, our results fail to lend consistent support to any of the examined interaction, indicating that the relationship is unaffected by both the degree of overlapping lifespans and residential proximity, gauging the closeness of the multigenerational relationship, as well as by the extent to which the grandchild had to compete for the grandfather's resources with cousins and siblings. Our results therefore do not support the existence of a causal interpretation of the observed associations in socioeconomic outcomes of grandfathers and grandchildren.

Key words: Multigenerational attainment, grandfathers, Sweden, longitudinal data

Acknowledgements

Earlier versions of the manuscript were presented at seminars at the Minnesota Population Center, University of Minnesota and at the Institute for Social Research, University of Michigan, at the 2017 RC28 meeting in New York and at the annual meeting of the Population Association of America 2018. We acknowledge the Centre for Economic Demography at Lund University for access to data as well as financial support, as well as financial support from the research program The Landskrona Population Study (M15-0173:1), financed by Swedish Foundation for Humanities and Social Sciences. Support also came from the Minnesota Population Center, which receives core funding (P2C HD041023) from the Eunice Kennedy Shriver National Institute for Child Health and Human Development (NICHD).

Introduction

Despite overall improving standards of living, the gap between societies' richest and poorest has been widening for decades. According to the 2018 World Inequality Report, the national income share held by the richest 10% of the population ranged between 37 percent in Europe to over 60 percent in the Middle East. A distinguishing feature of such economic privilege is that it only in rare cases is the sole creation of the individual enjoying it. Instead, economic, occupational or educational success is characterized by a strong intergenerational component, where advantage is passed on across generations, through inherited ability as well as the transmission of a range of more tangible resources. While the transmission of advantage (or disadvantage) from parents to children has been thoroughly empirically demonstrated across geographical contexts and time, a growing literature in both economics and sociology has investigated to what extent socioeconomic inequalities also are influenced by the outcomes and characteristics of ancestors prior to the parental generation. Such multigenerational processes are potentially of great importance for our understanding of how socioeconomic inequality is reproduced in society (e.g. Mare 2011).

From a theoretical perspective, a direct influence from grandparents on the outcomes of their grandchildren emerges as an increasingly plausible mechanism in the attainment process of today's societies. Increasing longevity and years spent in good health has increased the chances of overlapping lifespans and thereby enabled grandparents to play an active role during the upbringing of their grandchildren. Apart from providing social support, grandparents can also assist their descendants by giving them an advantage through the provision of resources such as wealth or networks. Empirical research into this issue has been conducted on different geographical contexts and for different time periods. In a number of studies, clear associations between the outcomes of grandfathers and grandsons have been identified when also controlling for the outcomes of fathers (e.g. Dribe & Helgertz 2016; Lindahl et al. 2015; Zeng & Xie 2014

Long & Ferrie 2012; Chan and Boliver 2013; Hertel and Groh-Samberg 2014; Braun & Stuhler 2015). However, it is important to note that multigenerational associations of this kind cannot necessarily be taken as evidence that grandfathers' socioeconomic status affect the status of grandsons in a causal sense. While a causal effect clearly is a possibility, random measurement error in status attainment, or simple luck in the labor market in one of the generations, could produce similar associations between grandfathers and grandsons, net of the father-son association (Solon 2014; Stuhler 2014). Somewhat related, the existence of a latent factor that influences socioeconomic outcomes, such as earnings, occupation or education, has been suggested, and that this is reproduced across generations at a much higher rate than the outcomes we can measure (Clark 2014; Clark and Cummins 2015). This could also explain why an association in observed outcomes between grandfathers and grandsons, net of the association between fathers and sons, can be found even in cases of a two-generational (Markov) transmission of the latent factor (see Braun & Stuhler 2015).

Our aim is to comprehensively examine a selection of potential mechanisms that may underlie a grandfather-grandchild association in socioeconomic attainment. We examine the case of Sweden, where previous research has established direct grandfather-grandson associations in social class, education and earnings during different time periods (e.g. Lindahl et al. 2015; Dribe & Helgertz 2016; Modin et al. 2013; Hällsten 2014; Hällsten & Pfeffer 2017). We study the extent to which such multigenerational associations are influenced by overlapping life spans and residential proximity, and also whether the strength of the multigenerational association differs depending on the degree of competition for the socioeconomic resources at the grandparent's disposal. If associations are causal, and the result of a direct influence from the grandfathers on their grandchildren, we expect to find that overlapping life spans and residential proximity as well as increasing grandparental socioeconomic resources in combination with less competition for said resources would strengthen the multigenerational association.

We examine the earnings and occupational status attainment of the entire native born Swedish population born between 1968 and 1976, followed until 2011. The data allows for the analysis of the attainment of boys as well as girls, in addition to the multigenerational transmission of status both the paternal and the maternal side. Our results show that while there are statistically significant and meaningful net associations between the outcomes of grandfathers and grandchildren, they are hardly affected at all by overlapping life spans or the grandfather's residential proximity, indicative of the closeness of the multigenerational relationship. Furthermore, the relationship is unaffected by the extent to which the grandchild had to compete for the grandfather's resources with cousins and siblings. While not comprehensively examining all theoretically plausible causal pathways linking the attainment of grandfathers and their grandchildren, our results do not support the existence of a causal interpretation of the observed associations in socioeconomic outcomes of grandfathers and grandchildren.

Previous research

As a result of a growing body of research during the past decade into the role of grandfathers in the lives of their grandchildren (mainly grandsons), empirical evidence today exists from a range of different countries and periods. Results from analyses of empirical data have failed to provide consistent evidence either supporting or refuting the existence of a grandfather effect. Furthermore, as very few studies adopt a causal design in a strict sense, grandfather effects largely refer to associations of outcomes between grandfathers and grandsons, net of the association between fathers and sons. Previous studies have typically examined the influence of the grandfather on the attainment of their male descendant, examining mostly contemporary Western welfare states (see, however, Zeng & Xie 2014).

Studies on the United States have produced mixed results regarding whether a direct grandfather effect exists in terms of the occupational or educational attainment of their grandchildren. Using a sample survey dataset from 1947, reporting the attainment of males

belonging to three consecutive generations, Hodge (1966) concludes that the grandfather's occupation exercises no direct effect on an individual's own occupation, beyond its indirect influence through the father's attainment. Subsequently, the Wisconsin Longitudinal Study was used by Warren and Hauser (1997) and Jaeger (2012) where the former, examining the grandchild's occupational status, fail to find any influence of grandfather's education or earnings when controlling for the attainment of the intermediate generation. Jaeger (2012) similarly finds little evidence of a direct general grandfather effect, but instead that the grandfathers' socioeconomic characteristics matter for the educational success of descendants in low socioeconomic status families. These results are largely mirrored by Wrightman and Danziger (2014), who find that individuals with grandfathers with low incomes experienced a significantly lower probability of successfully completing high school. Looking instead at class attainment, Hertel and Groh-Samberg (2014) find multigenerational immobility in most classes for both the US and Germany, supportive of a grandfather effect. Lastly, an earlier study by Beck (1983), also examining class attainment using the National Longitudinal Surveys of Mature Men, finds that a two-generational model fails to fully account for the full influence of occupational background, thus attributing a tangible role to grandfathers.

Turning to the European context, studies cover several different countries. Examining class attainment, Chan and Boliver (2013, 2014[1]) find multigenerational effects for both the UK and Finland, similar to Hertel and Groh-Samberg (2014) for Germany. Interestingly, two separate studies on the Netherlands, looking at educational attainment fails to find any significant grandfather effect above and beyond the influence of the fathers (Bol & Kalmijn 2016, Wolbers & Ultee 2003).

[1] This is a reanalysis of the dataset analyzed by Erola and Moisio (2007), who fails to find a grandparent effect.

Hällsten (2014) and Hällsten and Pfeffer (2017) rely on contemporary data on individuals in Sweden belonging to the grandchild generation who were born between 1952-1990 and 1980-1996, respectively. In both cases, variation within cousin combinations are used, albeit in different ways, to cancel out shared characteristics at the grandparent level. Hällsten (2014) examines measures of cognition, education and labor market attainment, finding considerable multigenerational immobility, indicative of grandparents contributing to their descendants' outcomes above and beyond the parental generation. Hällsten and Pfeffer (2017) find that grandparental wealth affects their grandchildren's educational attainment both directly and via the intermediate generation's wealth and education. Indeed, by restricting the analysis to a two-generation perspective, the authors claim that about half of the inequality in educational achievement by educational wealth would be ignored. Modin et al. (2013) also examine the grandparental influence on individual educational performance, through grades in math and Swedish. While the findings suggest different mechanisms of multigenerational transmission depending on whether the descendant is a boy or a girl and whether the transmission occurs along the maternal or paternal line, the conclusions support the existence of a grandfather effect. In a previous study of men's occupational and earnings attainment for a regional sample in southern Sweden during the period 1815-2011, Dribe & Helgertz (2016) only find an association with grandfather status for the former. Lindahl et al. (2015) analyze a similarly small Swedish sample, with a distinctly more urban character, with educational and earnings attainment data across multiple generations. For both measurements the estimates of three-generational persistence obtained from the econometric analysis are both statistically and economically significant, suggesting a rather strong process of transmission.

Despite the amount of previous work done within the field, there is a lack of research with the explicit goal of investigating the mechanisms of influence, which could help explain the nature of such a relationship as well as observed differences between contexts. Examining data for

rural China in the early 21st century, Zheng and Xie (2014) find a substantial effect from the educational attainment of the grandparents on that of their grandchildren, a finding that, however, is contingent upon co-residence. In fact, no effect is found for grandparents who are either deceased or living elsewhere.

Bol and Kalmijn (2016) use the LISS survey for the Netherlands to investigate to what extent educational attainment is affected by the education, occupational status and cultural capital of grandparents. More importantly, they investigate whether the strength and nature of that relationship is affected by the degree to which the grandparents were involved in the life of their grandchildren. Using information on the individual's relationship with the grandparent's when the former was in primary school, the authors investigate the relevance of a composite measurement measuring the strength of the tie between the grandparent and the grandchild. Furthermore, the distance between the individual and their grandparent when the former was six years old, is used to proxy the opportunities for providing influence and support. The authors find no evidence suggesting that the influence of the grandparent's resources is moderated by the nature of their relationship to their grandchild. While the findings address an important gap in the current literature, it should be recognized that the sample analyzed is small, implying that the statistical power associated with the interaction effects of particular importance for the paper is rather limited.

Using the Danish Longitudinal Survey of Youth, tracking around 3,000 individuals born in the mid-1950s, Mollegaard and Jaeger (2015) analyze how various types of grandparental resources influence their grandchildren's educational performance. In distinguishing between cultural, economic and social capital, the authors argue that aforementioned variables capture the potential transmission of resources associated with different kinds of benefits for the grandchild. More specifically, whereas the grandparent's cultural capital is believed to more directly serve to promote their descendant's educational success, their economic capital may

serve to buffer adverse economic shocks. Since the outcome variable is represented by the grandchild's educational attainment, it should perhaps not come as a surprise that the strongest grandparental effect is found for cultural capital, being a composite measure including the grandparent's years of education.

In the wake of these studies, a parallel debate of a distinctly more methodological character has emerged, suggesting that estimates of the multigenerational link obtained from what is considered standard in the literature is associated with considerable problems. More specifically, Stuhler (2014) argues that grandfather-grandson associations in socioeconomic status, net of father status, does not necessarily imply a causal effect, but could stem from the correlation between grandparent and parent characteristics, and the child being affected by the latter. In the absence of exogenous variation in grandparental exposure, the recommendation is to control for relevant factors in the parental generation to the greatest extent possible. Indeed, Stuhler shows that, using Swedish register data, the grandparental effect substantially diminishes as such controls are added. The effect disappears when a small sample containing full information on socioeconomic attainment on all parents and grandparents is analyzed, associated with the standard caveat that the imprecise estimation of the point estimate is a result of sample size.

Theoretical framework

Originating from the theoretical work of Becker and Tomes (1979, 1986) on the persistence of status across two generations, as well as empirical findings suggesting that such processes likely extend to multiple generations, Solon (2014) formally extended the theoretical model to account for (possible) grandparental effects. Given the active role played by grandparents during the childhood and adolescence of individuals across contemporary contexts, the expectation that a causal link could exist between grandparents' and grandchildren's outcomes is intuitively appealing. Indeed, enjoying the company of grandparents is by no means uncommon in today's

Western societies, linked to increasing longevity in general and to more years spent in good physical and mental health. Swiss data from the year 2000 suggests that about 90 percent of twenty-year-olds had at least one living grandparent (Höpflinger et al. 2006). Research has also confirmed that increasingly overlapping lifespans between grandparents and their grandchildren appears to be synonymous with active participation in each other's lives. In Sweden, data from the Survey of Health Ageing and Retirement from 2004 suggests that almost 50 percent of grandfathers provided child care during the twelve-month period prior to the survey (Hank & Buber 2009).

Formalizing the pathways through which grandparents could directly influence the outcomes of their grandchildren, mechanisms outlined from a two-generational setting can be straightforwardly extended to a three-generational setting. Zeng and Xie (2014) postulate that a causal multigenerational link can be understood through the transmission of three types of resources; socio-emotional, economic and biological. In the analysis of this paper, we will focus on the first two, however, also outlining the fundamental mechanisms underlying the biological pathway. The first, socio-emotional, pathway postulates that grandparents may influence the long-term outcomes of their descendants through actively participating in their lives; for example by taking the grandchild to various activities and promoting (or discouraging) the pursuit of learning certain types of skills, thereby contributing to the acquisition of cultural as well as human capital. Instead, the economic pathway focuses on the transmission of more or less tangible resources, such as financial means, access to networks or otherwise relevant resources. Conversely, the lack of such resources may represent an obstacle to the attainment of elevated positions in the socioeconomic hierarchy. Given the nature of access to the Swedish educational system, which, unlike in the United States, is free of charge at all levels of progression and where admission is based on prior academic performance, the importance of access to networks and to financial resources to pay for tuition should be less important.

Consequently, the role of wealthy grandparents as a means to obtain an advanced degree should be rather marginal in Sweden. Instead, for the attainment of high-status occupations or high earnings, for Sweden we believe that a mechanism consistent with the economic pathway to more likely be grandparents' ability to facilitate access to employers and occupations.

While the socio-emotional and economic pathways outline the transmission of comparatively tangible resources, the biological pathway operates through the transmission of genes determining individual level characteristics such as ability, appearance, health or other inherited traits which can plausibly be expected to influence the individual's labor market outcome. Naturally, since the genetic influence from the grandparental generation is transmitted entirely through the intermediate parental generation, there would appear to be little reason to expect a strong grandparental influence that follows a biological pathway. For such an influence from either biological grandparent to exist, on average having passed on 25% of their genes to the grandchild, this presupposes that whatever characteristic that is underlying this relationship was not manifested in the parental generation. This is by no means an unusual phenomenon; traits manifested through a set of recessive genes may be observed in the child but not in either parent, but the extent to which such characteristics are instrumental in labor market success is questionable[2], however still a possibility.

There is a high degree of overlap between the socio-emotional and economic pathway. While only the socio-emotional pathway unequivocally exists in the presence of actual interaction between grandparent and grandchild, the transmission of both types of resources can be assumed to benefit from a close multigenerational relationship. Given the high female labor force participation and high divorce and separation rates characterizing a contemporary

[2] Among the physical features known to be linked to recessive genes are light hair, blue eyes, attached ear lobes, smooth chin and dimples. While individuals clearly have preferences which in certain situations may benefit a blonde haired and blue eyed man or woman, we are unaware of any evidence suggesting either of mentioned features systematically improving or harming an individual's labor market chances. We are also unaware of any research showing essential physical or mental health conditions or ability being determined by recessive traits.

Western welfare state such as Sweden, many parents rely on their own parents for child-care assistance, simultaneously promoting the creation of a bond between grandparents and their grandchildren. Grandparents' ability to provide such services is furthermore enhanced by secularly improving health and increasing longevity, implying that grandparents get to participate in a larger share of their grandchildren's childhood and adolescents while still in good health. Indeed, research has shown that children in many cases spend considerable amounts of time with their grandparents during their childhood (Bengtson 2001). Along with the creation of a multigenerational relationship, this should promote the transmission of both socio-emotional and economic resources should. Since socio-emotional resources can only be transmitted through actual interaction, while not conclusive evidence supporting a causal grandfather effect, a multigenerational association among grandparents whose life spans overlapped with their grandchildren should be greater than for those whose grandparents were already dead at the time they were born. Furthermore, the strength of the association should grow with the amount of overlap.

Even in the presence of overlapping lifespans, not all grandparents, however, have the same opportunity to participate in the lives of their grandchildren, also affecting the average transmission of resources. Arguably, one of the most evident restrictions to direct physical participation is linked to residential proximity, implying that – all else equal – grandparents who live closer to their descendants should experience more face-to-face interaction compared to grandparents who live farther away (Gray & Brogdon 2017)[3]. Indeed, research has shown that residential proximity is positively associated with the overall frequency of joint activities

[3] Naturally, living in close vicinity is not the only way in which a grandparent can sustain a meaningful relationship with their grandchild. Today, in particular, with practically all households in Sweden having access to high speed Internet as well as laptops and/or tablets (Davidsson & Thoresson 2017), regular face-to-face interaction is as an efficient way to promote a close and personal relationship. The cohorts examined in this paper, however, were brought up prior to this technological revolution, having to rely on landline phones (where Sweden was one of the countries in the world with the highest share of phones per capita (Tahvanainen 1994)) and physical letters.

(Roberto & Skoglund 1996) and interaction (Kivett 1985, Gershenson Hodgson 1992). This leads to the expectation is that if holding the amount of years of overlapping lifespans constant, the grandparental association should be stronger among those having lived in close proximity to their grandchildren.

Both the socio-emotional and the economic pathways outline the transmission of a type of resources that by definition are finite. More specifically, a grandparent's resources – in terms of time or assets – are not endless, and to the extent that the desire is to allocate them somewhat equitably, this implies that the amount of resources allocated to any one grandchild is negatively linked to the number of grandchildren (Hagestad 2006). This follows directly from the quantity/quality-hypothesis (Becker & Lewis 1974), a framework that typically is applied to parents choosing between how many children existing household resources will be shared. As such, a weaker transmission of status from grandfather to grandchild in the presence of greater competition for said resources will be consistent with this tradeoff.

Data and methods

We use data from the Swedish Interdisciplinary Panel, hosted at the Centre for Economic Demography, Lund University, covering all individuals living in Sweden between 1968 and 2011 who belong to the birth cohorts 1930-1980. In addition to the main study population, the multigenerational register has been used to add parents and siblings born outside this sampling window. The selected study sample consists of individuals (generation three, G3) born between 1968 and 1976 and who has been successfully linked to both biological parents (generation two, G2) and their complete set of biological maternal and paternal grandfathers (generation one, G1). In addition, the sample is restricted to individuals where the members of all three generations were born in Sweden. The number of individuals who we are able to successfully link across all generations and for whom information on all covariates is available amounts to about 201,000 males and 189,000 females.

This study focuses on the multigenerational transmission of socioeconomic status, with the outcome variables measured through earned income and occupation. For occupational attainment, observations are transformed into Camsis; a continuous stratification measurement, ranging from 1-99. It measures the average relative position of individuals in a given occupation, based on patterns of interaction of individuals in contemporary Western society (Prandy 1999). Data on occupation is available from the quinquennial full-count censuses from 1960-1990[4] and annually from 2001 onwards. For income, this is available annually, from 1968. Ideally, attainment would be measured at identical ages in all three generations which, unfortunately, is not possible due to G1 and G3 roughly being born 60 years apart and the period of data availability only covering 51 and 43 years for occupational and income attainment, respectively. Instead, for G3, we measure occupational attainment as the highest observed Camsis score from age 35 and onwards (mean age 37.9), with sensitivity analyses using observations on occupation from age 30 and onwards[5]. For G2 and G1, we use a similar procedure, but for observations in the age range 40-60 and 40-65, respectively[6], again with sensitivity analyses restricting the age range to younger ages.

In creating the outcome variable for the analysis on the multigenerational transmission of earnings, we also rely on multiple earnings observations for each individual and within predetermined age ranges. Using repeated observations on earnings is particularly meaningful, since individual earnings fluctuate from year to year to a considerably higher extent than occupational status. For each yearly observation on income, we assign an individual their percentile rank between 1-100, conditional on their sex, year of birth and year of observation. In the next step, we calculate the individual's mean earnings rank in the relevant age range,

[4] No census was conducted in 1965.
[5] Results are qualitatively and quantitatively similar, available at request
[6] Mean age in G2: fathers 47.5, mothers 47.3. Mean age for the maternal grandfather (MG1) is 57.1, and for the paternal grandfather (PG1), it is 57.9.

intended to approximate lifetime earnings. Note that while we examine the influence of both the G2 male and female (i.e. the mother and the father) on the attainment of the G3 individual, we only investigate the influence of the *grandfather's* attainment, however on both the paternal and the maternal side. Furthermore, in order to account for each generation member being observed at different points in the life course, estimated models control for the mean age of the G1/G2/G3 individual. Hence, if a given G3 individual is observed with a non-missing observation on occupation or earnings between the ages 35-45, the age variable used in the analysis would be 40.

The study sample consists of both men and women belonging to G3, throughout analyzed separately. Table 1 displays descriptive statistics for the sample, indicating a considerable improvement in mean occupational status between the grandparental and the parental generation. More specifically, whereas G3 and G2 are observed with a mean Camsis between 56.4 (G3 men) and 61.9 (G3 women), the attainment of the grandparental generation is substantially lower, around 49. This is likely to be linked to considerable educational expansion in Sweden, benefiting the parental generation and beyond. Turning to income, by construction with a mean of 50 within each unique combination of sex, observation year and birth year, substantially less variation across the generations can be observed. Indeed, all generations are observed with a mean earnings rank between 47.7 and 51.4, ranging from 1 to 100. Both outcome variables are analyzed as they were originally constructed, i.e. as continuous measurements ranging from 1-100 (earnings) and from 1-99 (Camsis), as well through a categorical specification in order to investigate nonlinearities in the multigenerational association of attainment.

Table 1 here

In order to conduct the tests outlined in the theoretical section, we examine how the association between grandfather and grandchildren attainment differs across relevant characteristics.

Firstly, we use information on the time of death and the individual's municipality of residence to capture the duration and intensity of interaction between the individual and their grandfathers. As displayed in Table 1, the data indicate that 7 and 8 percent of the sample experienced no interaction with their maternal and paternal grandfathers, respectively, as their death occurred prior to the birth of their grandchildren. Among individuals whose grandfathers died after their birth, we distinguish between the degree of interaction in two different ways. Firstly, we capture the degree of overlap between the lives of grandfathers and their grandsons by distinguishing between grandfathers dying before the individual starts school (age 0-6), during primary school (age 7-15), during high school and early adulthood (age 16-25), and thereafter. Overall, the variables show that a substantial share of G3 individuals experience the potential support of their grandfathers well into their adolescence and early adulthood.

Overlapping life spans do not, however, fully capture the conditions under which grandparental influence is maximized, as the desire and ability to transfer a range of different resources benefit from actual interaction. Such interaction is on average considerably more likely if the grandfather is geographically proximate. Therefore, the variables capturing the duration of the overlapping lifespans have been extended to take into account whether the major part of that time was spent geographically proximate or distant. This is done by gauging the centroid distance (as the crow flies) between the municipality of the individual and the grandfather for each individual-year observation. Throughout, the maternal and paternal grandfather display very similar patterns, with an average number of years spent in close vicinity (same municipality) to their grandchild during their first 25 years amounting to about eight years. Taking into account the number of years spent within 100 kilometers (medium distance) and more than 100 kilometers (far distance), the data indicates that the typical grandfather remains alive for the first 17-18 years of their grandchild's life.

In each respective category of lifespan overlap, the variable distinguishes whether the largest share of the time was spent in close vicinity (same municipality), within 100 kilometers (medium distance) or more than 100 kilometers (far distance). Consequently, fully exploiting the longitudinal nature of the data, for an individual whose grandfather dies when he or she is five and where the grandfather spent three of these years in a municipality located 60 kilometers away and two years in the same municipality, the physical distance is considered to be medium. In all lifespan overlap categories, the grandfather most commonly lives in the same municipality, suggesting optimal opportunities for interaction. In fact, only about one out of five grandfathers, on both the maternal and paternal side, live more than 100 kilometers away.

Regardless of the character of the resources being transmitted from grandfather to grandchild, their finite nature implies that the amount being transmitted to any one grandchild on average will be negatively linked to the number of individuals between whom the resources are shared. This is tested through exploiting information on the average number of cousins (and siblings) to which the generation three individual is exposed during their upbringing, on the maternal and paternal side, respectively. Consequently, an individual with one older sibling and two older cousins on the paternal side will be sharing the paternal grandfather's resources with three paternal "cousins". Table 1 illustrates that 1-3 cousins on either side represents the most common situation, with about 20 percent of the sample either having no cousins (3.7 percent) or seven or more (13.1/14.5 percent) cousins.

The baseline model specification follows equation (1), below, where the attainment of individual *i* is estimated as the function of the attainment of their paternal (PG1) and maternal (MG1) grandfather. *X* represents a vector of control variables, including the attainment of the intermediate G2 generation (both mother and father), as well as a vector of demographic controls, including the birth parity of the G3 individual, the number of maternal and paternal cousins, as well as the age at observation for each individual whose attainment the model

controls for. In addition, the model controls for whether the individual resides in a metropolitan area, as designated by the Swedish authorities. Throughout, models are estimated separately by sex.

$$(1)\ G3\ attainment_{ijk} = \alpha + PG1\ attainment_j\rho + MG1\ attainment_k\delta + X_{ijk}\beta + \varepsilon_{ijk}$$

While specification (1) is useful to establish a baseline multigenerational association in attainment, in the paper we argue that the nature of a multigenerational association that is consistent with a causal relationship is likely to depend on, for example, measures of intergenerational overlap and residential proximity. Therefore, our main model specifications follow a similar logic as (2), below, where the association between the grandfather's attainment is allowed to differ depending on characteristics of the multigenerational relationship. Instead of modeling it through interacting the grandfather's attainment with the moderating characteristic in question, resulting in both base and interaction effects and thus for the multigenerational association to differ both in terms of slope and intercept, we opt for a specification where the association only differs in terms of slope. The conclusions of the paper are not, however, contingent on this choice, and we favor it as the statistical test of the extent to which grandparental associations differ by, for example, whether they were alive at the time of their grandchild's birth becomes a matter of testing whether the regression slopes are statistically significantly different. In the model outlined below, the multigenerational association in attainment on the paternal side is allowed to differ depending on whether the grandfather was alive at the time of the G3 individual's birth. Consequently, statistically testing whether the association differs depending on the presence of overlapping lifespans boils down to testing whether $\rho_1 \neq \rho_2$, naturally also depending on whether the internal ordering of the size of the coefficients are consistent with the expectations.

$$(2)\ G3\ attainment_{ijk}$$
$$= \alpha + PG1\ attainment, PG1\ dead\ at\ G3\ birth_j \rho_1$$
$$+ PG1\ attainment, PG1\ alive\ at\ G3\ birth_j \rho_2$$
$$+ MG1\ attainment, MG1\ dead\ at\ G3\ birth_j \delta_1$$
$$+ MG1\ attainment, MG1\ alive\ at\ G3\ birth_j \delta_2 + X_{ijk}\beta + \varepsilon_{ijk}$$

Results

Baseline estimates

Models 1a-1i in panels A through D represent the baseline intergenerational and multigenerational associations of Camsis and lifetime earnings attainment, and is presented in Table 2. Models 1a-1c only account for the association between the attainment of the G2 generation and the G3 generation, producing quite a gendered pattern. In particular for G3 men, the association with the attainment of the father is considerably stronger than with that of the mother, as indicated by model C. For the sex-adjusted earnings rank, in Panel C, a one unit increase in the attainment of the father is predicted to increase the lifetime earnings rank of the son by 0.23, to be compared to only 0.09 for a one unit increase in the earnings rank of the mother. For occupational status, in Panel A, the difference between the influence of the mother and the father is considerably less attenuated, however consistent with the father exercising a larger influence when both the mother's and the father's attainment is taken into account. Turning to women, in Panels B and D, mothers appear to be a more important influence on their daughters' occupational status attainment than the father, according to Model 1c transferring 0.15 units of a one Camsis unit higher attainment to their child, compared to 0.11 units for the father. Turning lastly to earnings rank attainment, in Panel D, the influence of mother and

father's attainment is roughly similar, representing an interesting contrast to the situation observed for men, where the influence of the father vastly outweighed that of the mother.

Table 2 here

Models 1d-1i introduce the association between the grandfather and the grandchild, consistently producing statistically significant point estimates. Overall, and in particular when also taking the intermediate parental generation into account, the association is stronger for Camsis occupational status attainment. For both G3 men and women, the baseline association between the grandfather association on the paternal (Model 1d) and on the maternal (Model 1f) side are roughly of the same magnitude, however, with larger associations for men. Indeed, before taking the influence of the parental generation into account, a one unit increase in the paternal grandfather's Camsis attainment is associated with a 0.14 unit increase in the G3 man's attainment, to be compared to a 0.08 unit increase for G3 women. Models 1e and 1g add the attainment of the father and mother, respectively, resulting in the grandfather association to roughly halve in size. Corresponding models for lifetime earnings rank attainment suggest associations that are considerably smaller in magnitude, in particular when the attainment of the father or mother is taken into account, suggesting a weaker transmission of attainment in terms of earnings.

Turning lastly to Model 1i, where grandfathers' and parents' attainment is simultaneously taken into account, we can again confirm larger grandfather associations for Camsis attainment than for earnings rank, in addition to all point estimates being statistically significant. Beginning with Panels A and B, for Camsis, the results for both men and women indicate that the net association between the grandfather and the grandchild is larger on the maternal side, with the difference compared to the paternal grandfather being statistically significant for men. Again, the intergenerational association displays a distinct gendered pattern, with the mother's Camsis attainment standing out as being particularly influential for women. A reversed gender

transmission pattern is observable in Panel C, for men's earnings attainment, with the association between the father's sex-adjusted earnings rank and the attainment of the son being almost three times larger than for the mother. More specifically, whereas a one unit increase in the earnings rank of the father translates to a 0.22 unit increase in the attainment of the son, the corresponding figure for the mother is only 0.08. The results for women, in Panel D, suggests a more or less similarly strong association between both parents and the child. Turning, lastly, to the multigenerational association, they are considerably smaller in magnitude compared to the Camsis estimates, suggesting that a one unit increase in the earnings rank attainment is translates to an increase in the attainment of the grandchild of between 0.01-0.02 units.

Overlapping lifespans

The theoretical section outlined that the transmission of resources according to the economic and – in particular - the socio-emotional pathway benefits from the formation of an emotional bond between the grandfather and the grandchild. Correspondingly, we hypothesized that overlapping lifespans constitute a prerequisite for such a bond to form, why the strength of the multigenerational association in status should be positively related to the amount of overlap.

Models 2a-2d, in Table 3, show results from identical specifications, for both outcomes and both sexes, which distinguishes between the association in attainment of the grandfather and the grandchild depending on whether the grandfather was alive when the grandchild was born. Model 2a, for Camsis attainment among men, display results that are inconsistent with the hypothesis that the multigenerational association is stronger among individuals whose grandfather was still alive at their time of birth. The results suggest that the association on the paternal grandfather's side is entirely unrelated to overlapping lifespans, with point estimates that are identical, the association on the maternal side if anything indicate that the transmission is *stronger* when the grandfather was already deceased at the time of the G3 individual's birth. Not only is this difference in the association depending on the grandfather's life status, however,

negligible in size, it is furthermore impossible to statistically distinguish between the point estimates, leading us to reject this first test of the hypothesis that the multigenerational association in Camsis is affected by overlapping lifespans.

Table 3 here

Models 2c and 2d proceed to examine the multigenerational association in earnings rank attainment in an analogous fashion, confirming that the overall multigenerational transmission of earnings is weaker than for occupational status. Indeed, when the G1 individual died prior to the birth of their grandchild, the multigenerational association on both the paternal and the maternal side is statistically insignificant, suggesting a null effect. In contrast, in the presence of overlapping lifespans, all multigenerational associations are positive and statistically significant, suggesting up to two percent of a grandparental earnings advantage being transmitted to the grandchild. However, while the associations are significantly different from zero, we are unable conclude that the association is statistically significantly larger than associations estimated for the absence of overlapping lifespans at any conventional level of statistical significance, Hence, thus far there is no consistent evidence to support the hypothesis that the multigenerational association benefits from the grandfather and grandchild having the opportunity to establish a relationship.

Models 3a-d allow the influence of the grandfather's attainment to differ depending on the amount of overlapping lifespans, based on the assumption that the ability of the grandfather to influence the outcome of their grandchild is positively associated with the amount of overlap. We therefore investigate whether the association differs depending on whether the grandfather died when the G3 individual was in the age range 0-6, 7-1, 16-25 or thereafter. For both outcomes and for men as well as women, the point estimates fail to indicate that the transmission grows stronger with increasing multigenerational overlap. Looking at earnings, there is no association when the grandfather was dead at the time of birth of G3. While most estimates of

status transmission for overlapping life span are statistically significant, there is no consistent pattern where transmission grows stronger when the length of overlap increases.

Geographical proximity

While overlapping lifespans are informative as it helps to obtain a baseline understanding regarding the character of the multigenerational relationship, another important dimension relating to the prerequisites for a bond to form between grandfather and grandchild is linked to the opportunities for face-to-face interaction. Table 4 presents models that explicitly accounts for this dimension as well, through geographic proximity. Models 4a-4d represent a more rudimentary specification, only distinguishing between whether a grandfather who was alive at the time of the G3 individual's birth resided in the same municipality or in another municipality at that point in time. The results do not indicate a stronger association for those whose grandfather lived in the same municipality at their time of their birth. Indeed, the pattern is typically the opposite, with the exception of earnings rank attainment for men where the association on the paternal side is statistically significantly larger if they resided in the same municipality at the time of the grandson's birth.

Table 4 here

Model 5 represents a more comprehensive specification, investigating whether the strength of the multigenerational association in attainment depends on not only the amount of intergenerational overlap, but also whether the bulk of this time was spent in close proximity (same municipality) at a medium distance (<=100 km) or at a far distance (>100 km). At any given degree of geographical proximity, the associations differ only very marginally depending on the amount of overlapping lifespans. As an example, at the highest degree of geographical proximity (residing in the same municipality), the multigenerational association on the paternal side is 0.03 regardless of whether the grandfather died before the G3 individual turns seven year

of age or after they turn 25. Turning to the other dimension, whether – holding the degree of overlapping lifespan constant – residing in closer proximity strengthens the multigenerational association, the results for occupational attainment (Model 5a and 5b) fails to provide any evidence suggesting that this would be the case. Contrary to the hypothesis, for Camsis occupational attainment, the results consistently show that the transmission grows stronger with *increasing* geographical distance, and the difference between the point estimate for the most proximate category is frequently statistically significantly different from the most distant category. Turning to the results for men's earnings (Model 5c), men whose grandfathers resided within 100 kilometers systematically display a stronger association of earnings than those residing at a far distance, which is in line with our expectations. For women (Model 5d), the pattern is more erratic and inconsistent.

Resource competition

Models 6a-6d in Table 5 address whether the strength of the association depends on the number of cousins and siblings, as a measure of the competition for grandparental time and resources, typically representing assets that are of a finite nature and therefore benefiting those with comparatively less competition for said resources. Model 6a, for men's Camsis occupational status attainment, suggests an inverted U-shaped relationship, where the multigenerational association on both the paternal and the maternal side is weakest when the individual either has no or many (7 or more) cousins. While the decline in the strength of the association when competition increases is consistent with the hypothesis, the weak association for individuals without any competition is counterintuitive. On both the maternal and paternal sides, the strongest grandfather association is observed in the presence of 1-3 cousins, and the estimate is statistically significantly greater than the association for individuals with seven or more cousins. Turning to the remaining models, the results consistently display a similar pattern for women as well as when considering the multigenerational association in earnings. Thus, while there are

some indications suggesting that large competition for existing resources weakens the multigenerational association of attainment, most of the differences are not statistically significant. Additional models (not shown, available at request) have been estimated, allowing the association in multigenerational attainment by degree of competition to differ depending on where in the status distribution the grandfather is. More specifically, if grandfathers with very few descendants are disproportionately drawn from the bottom (or top) of the status distribution, the weak multigenerational association may reflect a lack of resources more than anything else. The results, however show a more or less similar inverted U-shaped relationship regardless of which quartile of the status distribution the grandfather belongs to, confirming the lack of support for the hypothesis that the strength of the multigenerational association is negatively linked to the degree of competition for the grandfather's resources.

Table 5 here

Conclusions

While a large scientific literature has examined multigenerational associations in socioeconomic attainment, the lack of studies explicitly investigating mechanisms that are consistent with a theoretically motivated causal relationship implies that it is difficult to assess whether frequently obtained associations reflect anything above and beyond a statistical association. The importance of obtaining a better understanding of the nature of this link is, however, substantial, as it has important implications for the persistence of inequality in today's societies. In the absence of exogenous variation in exposure to grandparents and/or the resources they possess, one way to approach an understanding of whether observed associations reflect causality is to examine theoretically plausible pathways of multigenerational influence. Using uniquely detailed, full population, administrative register data for modern-day Sweden,

this paper contributes by examining to what extent the grandparental association in earnings and occupational attainment is influenced by what are believed to be fundamental aspects of a causal multigenerational relationship. In addition, this study contributes by examining the attainment of both boys and girls, as well as the grandfather-grandchild association along both the paternal and maternal side.

We find clear and robust associations between the attainment of grandfathers and grandchildren for both men and women, net of the influence of parents. With measures of earnings and occupational status that are scaled as identically as possible, the results consistently indicate a stronger multigenerational association according to the latter, with – within each outcome – no noticeable difference between the association along the paternal and maternal side. In terms of size, the results indicate that up to six percent of a grandfather's advantage is passed on to their grandchild, compared to no more than two percent in terms of earnings rank, net of the transmission of attainment from the mother and father. As expected, throughout, the multigenerational associations are dwarfed by the intergeneration associations.

Turning to explicitly addressing the mechanisms of grandfather influence examined in the paper, our theoretical points of departure were twofold. Firstly, we expected the transmission of socioemotional and economic resources to benefit from a close relationship between the grandfather and the grandchild. More specifically, we expected that a grandfather's willingness and motivation to transfer resources would be greater when they enjoy a close bond with their grandchild. Secondly, as the means by which a grandfather can influence the outcome of their grandchild by definition are finite, all else equal, the transfer of resources will be negatively related to the amount of individuals competing for the same resources.

The nature of the multigenerational relationship was tested through information on the amount of overlapping lifespans and the degree of geographical proximity between grandfather and grandchild. While we are unable to directly observe neither the intensity of interaction nor the

quality of the relationship, we believe that both dimensions on average allows us to distinguish between fundamental aspects of the relationship between grandfather and grandchild. Evidently, a fundamental prerequisite for *any* multigenerational relationship is that the lives of the grandfather and the grandchild overlap to some extent. Following this, we also postulated that increasing amount of overlapping lifespans further promotes the multigenerational relationship, strengthening the multigenerational transmission of resources. The results, however, comprehensively rejected this hypothesis, finding no difference in the strength of the multigenerational transmission of occupational attainment between grandfathers who were already deceased at the time of their grandchild's birth and grandfathers who died subsequent to the grandchild's birth. For earnings, while the results indicate that there is a difference in the association depending on whether there was any overlapping lifespans, there are no indications that increased amounts of overlap strengthens the association. Holding the amount of overlapping lifespans constant, we also hypothesized that time spent in close geographical proximity would promote the multigenerational relationship, as it enhances the opportunities for physical interaction. Again, the results consistently rejected this being the case, providing no systematic indications that grandfathers who reside in close proximity were more successful in transmitting an advantage to their grandchild compared to grandfathers who resided at a distance making frequent face-to-face interaction challenging.

A similar lack of results that are consistent with a multigenerational association that reflects a theoretically plausible scenario reflecting a causal link is found when investigating whether the strength of the multigenerational association differs by the amount of competition for the grandfather's resources. Given the finite nature of both socioemotional and economic resources, we expected the multigenerational transmission to be negatively related to the number of (paternal or maternal) cousins and siblings that an individual had to share said resources with. For both occupational and earnings rank attainment, the results indicate a more or less similarly

strong multigenerational association regardless of whether they got to enjoy the resources of the grandfather without any competition or with seven or more other siblings and cousins.

In conclusion, none of the examined mechanisms appear particularly relevant in explaining the multigenerational associations observed. This lends support to claims that such associations are not reflecting causal effects from grandfathers to grandchildren, but instead are mainly by-products of measurement errors in estimating the true social status of each generation.

Beck, S.H. (1983): The Role of Other Family Members in Intergenerational Occupational Mobility. *The Sociological Quarterly*, 24(2): 273-285.

Becker, G., & Lewis, H.G., (1974): Interaction between Quantity and Quality of Children. In Schultz, T.W (ed): *Economics of the Family: Marriage, Children, and Human Capital*. University of Chicago Press.

Becker, G., & Tomes, N., (1979): An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility. *The Journal of Political Economy*, 87(6): 1153-1189.

Becker, G., & Tomes, N., (1986): Human Capital and the Rise and Fall of Families. *Journal of Labor Economics*, 4(3): S1-39.

Bengtson, V.L. (2001): Beyond the nuclear family: The increasing importance of multigenerational bonds. *Journal of Marriage and Family*, 63(1).

Bol, T. & Kalmijn, M. (2016): Grandparents' resources and grandchildren's schooling: Does grandparental involvement moderate the grandparent effect? *Social Science Research*, 55: 155-170.

Braun, S.T. & Stuhler, J. (2015). The Transmission of Inequality Across Multiple Generations: Testing Recent Theories with Evidence from Germany. Unpublished manuscript.

Chan, T.W. & Boliver, V. (2013): The Grandparents Effect in Social Mobility: Evidence from British Birth Cohort Studies. *American Sociological Review* 78, no. 4: 662–78.

Chan, T.W. & Boliver, V. (2014): Social Mobility Over Three Generations in Finland: A Critique. *European Sociological Review* 30(1): 13-17.

Clark, G. (2014): *The Son also Rises: Surnames and the History of Social Mobility*. Princeton: Princeton University Press.

Clark, G & Cummins, N. (2015). Intergenerational Wealth Mobility in England, 1858–2012: Surnames and Social Mobility. *The Economic Journal* 125, no. 582: 61–85.

Dribe, M. & Helgertz, J. (2016): The Lasting Impact of Grandfathers: Class, Occupational Status, and Earnings over Three Generations in Sweden 1815-2011. *The Journal of Economic History*, 76(4): 969-1000.

Gershenson Hodgson, L. (1992): Adult grandchildren and their grandparents: The enduring bond. *International Journal of Aging and Human Development*, 34(3), 209-225.

Gray, P.B., & Brogdon, E. (2017): Do Step- and Biological Grandparents Show Differences in Investment and Emotional Closeness With Their Grandchildren? *Evolutionary Psychology*, 1-9.

Hagestad, G.O. (2006): Transfers between grandparents and grandchildren: The importance of taking a three-generation perspective. Zeitschrift fur Familienforschung, 18(3): 315-332.

Hank, K. & Buber, I. (2009): Grandparents Caring for Their Grandchildren. *Journal of Family Issues*, 30(1): 53-73.

Hertel, F.R. & Groh-Samberg, O. (2014) Class Mobility Across Three Generations in the U.S. and Germany." *Research in Social Stratification and Mobility* 35, no. 1 : 35–52.

Hodge, R.W. (1966): Occupational Mobility as a Probability Process. *Demography*, 3(1): 19-34.

Hällsten, M. (2014): Inequality Across Three and Four Generations in Egalitarian Sweden: 1st and 2nd Cousin Correlations in Socio-Economic Outcomes." *Research in Social Stratification and Mobility* 35, no. 1: 10–33.

Hällsten, M., & Pfeffer, F., (2017): Grand Advantage: Family Wealth and Grandchildren's Educational Achievement in Sweden. *American Sociological Review*, 82(2): 328-360.

Jaeger, M.M. (2012): The Extended Family and Children's Educational Success." *American Sociological Review*, 77(6): 903–22.

Jamison, C. S., Cornell, L. L., Jamison, P. L., & Nakazato, H. (2002). Are all grandmothers equal? A review and a preliminary test of the "grandmother hypothesis" in Tokugawa Japan. *American Journal of Physical Anthropology* 119:67-76.

Kivett, V.R. (1985): Grandfathers and Grandchildren: Patterns of Association, Helping, and Psychological Closeness. *Family Relations*, 34(4): 565-571.

Laspita, S., Breugst, N., Heblich, S., & Patzelt, H. (2012): Intergenerational transmission of entrepreneurial intentions. *Journal of Business Venturing*, 27: 414-435.

Lindahl, M., Palme, M., Sandgren Massih, S., & Sjögren, A. (2015): Long-Term Intergenerational Persistence of Human Capital: An Empirical Analysis of Four Generations. *Journal of Human Resources* 50, no. 1: 1–33.

Long, J. & Ferrie, J. (2012): Grandfathers matter(ed). "Occupational Mobility Across Three Generations in the U.S. and Britain, 1850–1910." Unpublished manuscript.

Mare, R.D. (2011). A Multigenerational View of Inequality. *Demography*, 48(1):1-23.

Modin, B., Erikson, R., & Vågerö, D. (2013): Intergenerational Continuity in School Performance: Do Grandparents Matter? *European Sociological Review* 29, no. 4: 858–70.

Mollegaard, S. & Jaeger, M.M., (2015): The effect of grandparents' economic, cultural, and social capital on grandchildren's educational success. *Research in Social Stratification and Mobility*, 42: 11-19.

Prandy, K. 1999. The social interaction approach to the measurement and analysis of social stratification. *International Journal of Sociology and Social Policy*, 19(9/10/11): 204-236.

Roberto, K.A., & Skoglund, R.R (1996): Interactions with grandparents and great-grandparents: A comparison of activities, influences, and relationships. *International Journal of Aging and Human Development*, 43(2), 107-117.

Skuse, D.H. (2006). Sexual dimorphism in cognition and behavior: the role of X-linked genes. European *Journal of Endocrinology*. 155: S99-S106.

Solon, G. (2014): Theoretical models of inequality transmission across multiple generations. *Research in Social Stratification and Mobility*, 35:13-18

Stuhler, J. (2014). "Mobility Across Multiple Generations: The Iterated Regression Fallacy." *Unpublished manuscript.*

Voland, E. & Beise, J. (2002). Opposite effects of maternal and paternal grandmothers on infant survival in historical Krummhörn. *Behavioral Ecology and Sociobiology* 52:435-443.

Zeng, Zhen and Yu Xie. "The Effects of Grandparents on Children's Schooling: Evidence from Rural China." *Demography* 51, no. 2 (2014): 599–617.

Warren, J.R.., & Hauser, R., (1997): Social Stratification across Three Generations: New Evidence from the WisconsinLongitudinal Study. *American Sociological Review*, 62(4): 561-572.

Wolbers, & Ultee (2003): Driegeneraties- en Tweeoudersvragen over het Opleidingsniveau van Mannen en Vrouwen in Nederland. *Mens Maatsch*. 88, 276-294.

Wrightman, P., & Danziger, S. (2014): Multi-generational income disadvantage and the educational attainment of young adults. *Research in Social Stratification and Mobility*, 35: 53-69

Table 1: Sample means

	Full sample	Men	Women
Camsis			
G3	59.1	56.4	61.9
G2 mother	61.2	61.2	61.2
G2 father	57.8	57.9	57.8
G1 maternal	48.7	48.7	48.7
G1 paternal	48.7	48.7	48.6
Earnings rank (sex-specific)			
G3	50.8	51.2	50.4
G2 mother	49.8	49.8	49.8
G2 father	51.4	51.4	51.4
G1 maternal	47.7	47.8	47.7
G1 paternal	48.2	48.3	48.2
Maternal G1 life span overlap and residential proximity			
Dead at G3 birth	7.8	7.8	7.8
Alive at G3 birth	92.2	92.2	92.2
Alive at G3 birth, dies between age 0-6	9.4	9.4	9.4
Alive at G3 birth, dies between age 7-15	21.1	21.1	21.1
Alive at G3 birth, dies between age 16-25	29.4	29.4	29.3
Alive at G3 birth, dies past the age 25	32.4	32.3	32.4
Number of years during G3 upbringing at near distance (0 km)	7.98	8.02	7.94
Number of years during G3 upbringing at medium distance (1-100 km)	5.57	5.57	5.58
Number of years during G3 upbringing at far distance (>100 km)	4.19	4.15	4.22
Paternal G1 life span overlap and residential proximity			
Dead at G3 birth	8.2	8.0	8.3
Alive at G3 birth	91.9	92.0	91.7
Alive at G3 birth, dies between age 0-6	9.9	9.9	10.0
Alive at G3 birth, dies between age 7-15	21.7	21.7	21.8
Alive at G3 birth, dies between age 16-25	28.2	28.2	28.2
Alive at G3 birth, dies past the age 25	32.0	32.2	31.8
Number of years during G3 upbringing at near distance (0 km)	8.2	8.2	8.1
Number of years during G3 upbringing at med distance (1-100 km)	4.8	4.8	4.8
Number of years during G3 upbringing at far distance (>100 km)	3.8	3.8	3.8
Mean age			
G3	34.4	34.4	34.4
G2 mother	48.8	48.8	48.8
G2 father	49.2	49.2	49.2
G1 maternal	57.9	57.9	57.9
G1 paternal	58.6	58.6	58.6
G3 birth parity			
1	51.4	51.5	51.4
2	37.3	37.2	37.3
3+	11.3	11.3	11.3
Average number of maternal cousins and siblings before age 20			
0	3.7	3.7	3.7
1-3	60.3	60.5	60.1
4-6	22.9	22.8	23.1

7-	13.1	13.1	13.1
Average number of paternal cousins and siblings before age 20			
0	3.7	3.6	3.7
1-3	57.7	57.6	57.7
4-6	24.2	24.3	24.1
7-	14.5	14.5	14.5
G3 residing in metro area			
Yes	59.7	59.8	59.6
No	40.3	40.2	40.4

Notes: Variable means are based on the sample examined in the CAMSIS analysis (N, all: 389,413, N, men: 200,674, N, women: 188,739), with the exception of G1/G2/G3 earning means, based on the earnings sample (N, all: 269,712, N, men: 138,969, N, women: 130,743)

Table 2: OLS regression results. Baseline intergenerational and multigenerational associations.

PANEL A: CAMSIS, MEN	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e	Model 1f	Model 1g	Model 1h	Model 1i
Father's attainment	0.271***		0.224***		0.252***				0.202***
Mother's attainment		0.286***	0.198***				0.257***		0.177***
Paternal grandfather's attainment				0.136***	0.065***			0.111***	0.044***
Maternal grandfather's attainment						0.138***	0.096***	0.112***	0.059***
Observations	200,674	200,674	200,674	200,674	200,674	200,674	200,674	200,674	200,674
Adjusted R squared	0.112	0.085	0.136	0.048	0.118	0.052	0.096	0.069	0.143

PANEL B: CAMSIS, WOMEN	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e	Model 1f	Model 1g	Model 1h	Model 1i
Father's attainment	0.149***		0.113***		0.135***				0.098***
Mother's attainment		0.199***	0.153***				0.182***		0.140***
Paternal grandfather's attainment				0.083***	0.045***			0.067***	0.031***
Maternal grandfather's attainment						0.082***	0.054***	0.069***	0.034***
Observations	188,739	188,739	188,739	188,739	188,739	188,739	188,739	188,739	188,739
Adjusted R squared	0.066	0.067	0.091	0.033	0.072	0.036	0.075	0.483	0.098

PANEL C: EARNINGS RANK, MEN	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e	Model 1f	Model 1g	Model 1h	Model 1i
Father's attainment	0.247***		0.227***		0.239***				0.218***
Mother's attainment		0.127***	0.083***				0.116***		0.078***
Paternal grandfather's attainment				0.075***	0.018***			0.062***	0.009***
Maternal grandfather's attainment						0.072***	0.050***	0.059***	0.012***
Observations	138,969	138,969	138,969	138,969	138,969	138,969	138,969	138,969	138,969
Adjusted R squared	0.061	0.024	0.066	0.014	0.062	0.014	0.028	0.021	0.068

PANEL D: EARNINGS RANK, WOMEN	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e	Model 1f	Model 1g	Model 1h	Model 1i
Father's attainment	0.189***		0.154***		0.177***				0.144***
Mother's attainment		0.176***	0.147***				0.167***		0.141***

Paternal grandfather's attainment				0.072***	0.029***			0.060***	0.015***
Maternal grandfather's attainment						0.065***	0.033***	0.052***	0.011***
Observations	130,743	130,743	130,743	130,743	130,743	130,743	130,743	130,743	130,743
Adjusted R squared	0.044	0.043	0.064	0.017	0.046	0.017	0.046	0.024	0.065

Note: Models control for age at observation of G3 and G2/G1 individual included in the model, G3 birth parity, mean number of maternal or paternal cousins during upbringing, and G3 metropolitan residence

** $p < .05$, *** $p < .01$

Table 3: OLS regression results. Multigenerational associations, by overlapping lifespans.

	Model 2a	Model 2b	Model 2c	Model 2d	Model 3a	Model 3b	Model 3c	Model 3d
	Camsis		Earnings rank		Camsis		Earnings rank	
	Men	Women	Men	Women	Men	Women	Men	Women
Father's attainment	0.202***	0.098***	0.218***	0.144***	0.202***	0.098***	0.218***	0.144***
Mother's attainment	0.177***	0.140***	0.078***	0.142***	0.177***	0.140***	0.078***	0.142***
Paternal grandfather's attainment if dead at time of G3 birth	0.043***	0.028***	0.017	0.002	0.043***	0.027***	0.016	0.002
Paternal grandfather's attainment if alive at time of G3 birth	0.044***	0.031***	0.009***	0.015***				
Paternal grandfather's attainment if alive at time of G3 birth, dies between age 0-6					0.045***	0.031***	0.008	0.012**
Paternal grandfather's attainment if alive at time of G3 birth, dies between age 7-15					0.044***	0.029***	0.004	0.016***
Paternal grandfather's attainment if alive at time of G3 birth, dies between age 16-25					0.043***	0.031***	0.009***	0.013***
Paternal grandfather's attainment if alive at time of G3 birth, dies past age 25					0.044***	0.032***	0.010***	0.016***
Maternal grandfather's attainment if dead at time of G3 birth	0.062***	0.030***	0.006	0.009	0.062***	0.029***	0.005	0.008
Maternal grandfather's attainment if alive at time of G3 birth	0.059***	0.034***	0.020***	0.011***				
Maternal grandfather's attainment if alive at time of G3 birth, dies between age 0-6					0.058***	0.027***	0.018***	0.013**
Maternal grandfather's attainment if alive at time of G3 birth, dies between age 7-15					0.056***	0.032***	0.019***	0.010***
Maternal grandfather's attainment if alive at time of G3 birth, dies between age 16-25					0.059***	0.034***	0.014***	0.009***
Maternal grandfather's attainment if alive at time of G3 birth, dies past age 25					0.060***	0.036***	0.023***	0.013***
Observations	200,674	188,739	138,969	130,743	200,674	188,739	138,969	130,743
Adjusted R squared	0.143	0.098	0.068	0.065	0.143	0.098	0.068	0.065

Note: Models control for age at observation of G3 and G2/G1 individual included in the model, G3 birth parity, mean number of maternal or paternal cousins during upbringing, and G3 metropolitan residence

** p < .05, *** p < .01

Table 4: OLS regression results. Multigenerational associations, by overlapping lifespans and residential proximity.

	Model 4a	Model 4b	Model 4c	Model 4d	Model 5a	Model 5b	Model 5c	Model 5d
	Camsis		Earnings rank		Camsis		Earnings rank	
	Men	Women	Men	Women	Men	Women	Men	Women
Father's attainment	0.195***	0.095***	0.220***	0.143***	0.193***	0.094***	0.222***	0.143***
Mother's attainment	0.173***	0.139***	0.080***	0.141***	0.171***	0.138***	0.081***	0.141***
Paternal grandfather's attainment if dead at time of G3 birth	0.041***	0.027***	0.017	0.002	0.040***	0.026***	0.017	0.002
Paternal grandfather's attainment if alive and residing in other municipality at time of G3 birth	0.051***	0.034***	0.000	0.017***				
Paternal grandfather's attainment if alive and residing in same municipality at time of G3 birth	0.031***	0.025***	0.018***	0.012***				
Paternal grandfather's attainment if alive at G3 birth, dies between the age 0-6 & near (0 km)					0.030***	0.025***	0.020**	0.010
Paternal grandfather's attainment if alive at G3 birth, dies between the age 0-6 & med (1-100 km)					0.047***	0.029***	0.020**	0.025**
Paternal grandfather's attainment if alive at G3 birth, dies between the age 0-6 & far (>100 km)					0.058***	0.040***	-0.028**	0.000
Paternal grandfather's attainment if alive at G3 birth, dies between the age 7-15 & near (0 km)					0.029***	0.024***	0.017***	0.010**
Paternal grandfather's attainment if alive at G3 birth, dies between the age 7-15 & med (1-100 km)					0.043***	0.027***	0.008	0.029***
Paternal grandfather's attainment if alive at G3 birth, dies between the age 7-15 & far (>100 km)					0.058***	0.036***	-0.026***	0.013**
Paternal grandfather's attainment if alive at G3 birth, dies between the age 16-25 & near (0 km)					0.027***	0.026***	0.023***	0.013***
Paternal grandfather's attainment if alive at G3 birth, dies between the age 16-25 & med (1-100 km)					0.048***	0.029***	0.005	0.006
Paternal grandfather's attainment if alive at G3 birth, dies between the age 16-25 & far (>100 km)					0.054***	0.037***	-0.011**	0.020***
Paternal grandfather's attainment if alive at G3 birth, dies after age 25 & near (0 km)					0.032***	0.028***	0.019****	0.011***
Paternal grandfather's attainment if alive at G3 birth, dies after age 25 & med (1-100 km)					0.045***	0.031***	0.013***	0.023***

Paternal grandfather's attainment if alive at G3 birth, dies after age 25 & far (>100 km)					0.055***	0.037***	-0.008	0.014***
Maternal grandfather's attainment if dead at time of G3 birth	0.060***	0.029***	0.007	0.009	0.059***	0.028***	0.007	0.008
Maternal grandfather's attainment if alive and residing in other municipality at time of G3 birth	0.064***	0.036***	0.018***	0.013***				
Maternal grandfather's attainment if alive and residing in same municipality at time of G3 birth	0.047***	0.029***	0.023***	0.009***				
Maternal grandfather's attainment if alive at G3 birth, dies between the age 0-6 & near (0 km)					0.046***	0.020***	0.030***	0.005
Maternal grandfather's attainment if alive at G3 birth, dies between the age 0-6 & med (1-100 km)					0.052***	0.029***	0.025**	0.012
Maternal grandfather's attainment if alive at G3 birth, dies between the age 0-6 & far (>100 km)					0.071***	0.033***	-0.006	0.028**
Maternal grandfather's attainment if alive at G3 birth, dies between the age 7-15 & near (0 km)					0.041***	0.026***	0.019***	0.003
Maternal grandfather's attainment if alive at G3 birth, dies between the age 7-15 & med (1-100 km)					0.054***	0.029***	0.033***	0.018***
Maternal grandfather's attainment if alive at G3 birth, dies between the age 7-15 & far (>100 km)					0.072***	0.042***	0.005	0.012*
Maternal grandfather's attainment if alive at G3 birth, dies between the age 16-25 & near (0 km)					0.045***	0.030***	0.018***	0.008**
Maternal grandfather's attainment if alive at G3 birth, dies between the age 16-25 & med (1-100 km)					0.057***	0.031***	0.023***	0.011**
Maternal grandfather's attainment if alive at G3 birth, dies between the age 16-25 & far (>100 km)					0.072***	0.040***	0.001	0.007
Maternal grandfather's attainment if alive at G3 birth, dies after age 25 & near (0 km)					0.049***	0.032***	0.023***	0.012***
Maternal grandfather's attainment if alive at G3 birth, dies after age 25 & med (1-100 km)					0.057***	0.034***	0.033***	0.015***
Maternal grandfather's attainment if alive at G3 birth, dies after age 25 & far (>100 km)					0.071***	0.040***	0.017***	0.011**
Observations	200,674	188,739	138,969	130,743	200,674	188,739	138,969	130,743
Adjusted R squared	0.146	0.098	0.069	0.066	0.143	0.099	0.069	0.066

Note: Models control for age at observation of G3 and G2/G1 individual included in the model, G3 birth parity, mean number of maternal or paternal cousins during upbringing, and G3 metropolitan residence

** p < .05, *** p < .01

Table 5: OLS regression results. Multigenerational associations, by competition for grandfather resources.

	Model 6a	Model 6b	Model 6c	Model 6d
	Camsis		Earnings rank	
	Men	Women	Men	Women
Father's attainment	0.203***	0.098***	0.219***	0.145***
Mother's attainment	0.178***	0.141***	0.078***	0.141***
Paternal grandfather's attainment, 0 paternal cousins	0.036***	0.026***	-0.017***	0.008***
Paternal grandfather's attainment, 1-3 paternal cousins	0.048***	0.033***	0.012***	0.021***
Paternal grandfather's attainment, 4-6 paternal cousins	0.042***	0.030***	0.009***	0.010***
Paternal grandfather's attainment, 7 or more paternal cousins	0.032***	0.024***	0.001***	-0.002***
Maternal grandfather's attainment, 0 maternal cousins	0.059***	0.035***	0.007***	0.011***
Maternal grandfather's attainment, 1-3 maternal cousins	0.063***	0.037***	0.025***	0.018***
Maternal grandfather's attainment, 4-6 maternal cousins	0.056***	0.031***	0.018***	0.007***
Maternal grandfather's attainment, 7 or more maternal cousins	0.046***	0.024***	0.003***	-0.018***
Observations	200,674	188,739	138,969	130,743
Adjusted R squared	0.143	0.097	0.068	0.065

Note: Models control for age at observation of G3 and G2/G1 individual included in the model, G3 birth parity and G3 metropolitan residence.

** p < .05, *** p < .01