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Grand advantage: family wealth and grandchildren's educational achievement in Sweden

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Grand advantage: family wealth and grandchildren's educational achievement in Sweden[1]

by

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Abstract

We study the role of family wealth for children's educational achievement using novel and unique Swedish register data. In particular, we focus on the relationship between grandparents' wealth and their grandchildren's educational achievement. Doing so allows us to reliably establish the independent role of wealth in contributing to long-term inequalities in opportunity. We use regression models with rich controls to account for observed socioeconomic characteristics of families, cousin fixed effects to net out potentially unobserved grandparental effects, and marginal structural models to account for endogenous selection. We find substantial associations between grandparents' wealth and their grandchildren's grade point averages (GPA) in the 9th grade that are only partly mediated by the socioeconomic characteristics and wealth of parents. Our findings indicate that family wealth inequality – even in a comparatively egalitarian context like Sweden – has profound consequences for the distribution of opportunity across multiple generations. We posit that our estimates of the long-term consequences of wealth inequality may be conservative for nations other than Sweden, like the U.S., where family wealth – in addition to its insurance and normative functions – allows the direct purchase of educational quality and access.

Keywords: Wealth, education, intergenerational transmissions, social mobility
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Table of contents

1 Introduction 3

2 Theoretical background 5
2.1 Wealth and dimensions of socioeconomic standing 5
2.2 What is unique about wealth? 6
2.3 Family wealth and children's education 6
2.4 The importance of grandparental wealth 8
2.5 Wealth mechanisms 9
2.6 The Swedish context 12

3 Data and methods 15
3.1 Data and sample 15
3.2 Variables 15
3.3 Analytic strategy 21
3.4 Methods and models 23

4 Results 25
4.1 Family net worth and children's educational achievement 25
4.2 Marginal structural models of multigenerational wealth effects 33
4.3 Net worth and children's educational achievement summarized 34
4.4 The role of wealth components 36
4.5 Academic upper-secondary attainment 38

5 Discussion 40

References 44

Appendix A. Additional methodological considerations for the cousin fixed effects strategy 52

Appendix B. Marginal structural models 56

1 Introduction

For decades, inequality research has focused on occupations, education, or income as the main signifiers of socioeconomic wellbeing. In comparison, economic wealth as a dimension of social stratification has only recently begun to attract more empirical attention (e.g., Oliver and Shapiro 1995; Conley 1999; Keister 2000; Piketty 2011). This research suggests that family wealth is central to intergenerational transmission processes. It also documents considerable intergenerational rigidity, in particular at the top of the wealth distribution (Björklund, Roine and Waldenström 2012; Hällsten 2014; Pfeffer and Killewald 2016b), where the very wealthy are most successful in maintaining their social advantage. Concerns about wealth stratification are also at the center of recent and widely discussed predictions about the rise of a class of individuals living solely off the returns to their economic capital (i.e., rentiers) rather than their labor (Piketty 2011).

While some studies argue that the persistence of wealth is limited to two generations (e.g., Adermon, Lindahl and Waldenström 2015 for Sweden), others have found effects of grandparents' wealth that extend to their grandchildren's wealth position (Pfeffer and Killewald 2016a). For intergenerational mobility more broadly, a current strand of the literature suggests that inequality should be studied as transmitted across multiple rather than just two generations (Mare 2011; Jaeger 2012; Hällsten 2014; Lindahl et al. 2015).

In this analysis, we determine to what extent family wealth structures educational outcomes over multiple generations in Sweden. Our primary analytic focus is on the relationship between grandparents' wealth and their grandchildren's educational outcomes – namely their grade point average (GPA) in 9th grade and their transition into the highest track of upper-secondary schooling, intended for university-bound students. We directly address the rapidly growing interest in the transmission of inequality across multiple generations and the hypothesis that – compared to socioeconomic characteristics – family wealth may wield particularly strong multigenerational influences (Mare 2011; Pfeffer 2014). Together, our analyses substantially expand knowledge on the long-term processes of status maintenance, moving beyond prior work that has focused on other components of socioeconomic inequality or has analyzed transmission processes solely from parents to children.

This study uses administrative data drawn from tax registers that capture detailed wealth components for the entire Swedish population between 1999 and 2007. For this project, we have linked these data to other administrative data sources, including school registers that provide information on the educational achievement and attainment of students. This new source of linked data provides a range of measures that – in their combination – are typically unavailable for social science research. We have a rich set of socioeconomic measures for parents *and* grandparents that includes both permanent (lifetime) income and detailed wealth information. These data allow for a rigorous test of the independent role of net worth and separate asset components (financial assets, home wealth, real assets, and debts). They also permit analyses of whether the associations between grandparents' wealth and grandchildren's educational outcomes are mediated by characteristics of the middle generation, including fathers' cognitive ability, and non-cognitive skills and by selection into more socioeconomically segregated schools.

The focus on wealth that is two generations removed also affords some unique methodological opportunities. Besides capturing otherwise "unobserved wealth" still in the hands of the generation prior to parents, it helps reduce several particularly thorny concerns about endogeneity – namely unobserved confounding and reverse causation, which we will elaborate on below. Our analyses account for unobserved factors of families by comparing cousins, which we consider a separate methodological contribution.

Finally, apart from its unique available data, Sweden also presents a particularly interesting national case to assess the intergenerational influences of family wealth. Sweden is known as one of the most egalitarian countries of the industrialized world, with comparatively low levels of income and class inequality, both within and across generations, and a very comprehensive education system. However, as we will show, Sweden's wealth distribution and the intergenerational impacts are far from equitable. Finding a substantial and extended role of family wealth in an otherwise egalitarian context makes a strong case for the increased attention to family wealth in examinations of inequality in opportunity in other, less egalitarian countries.

2 Theoretical background

2.1 Wealth and dimensions of socioeconomic standing

At the turn of the millennium, several scholars made the case for increased consideration of wealth as a central dimension of social stratification (Keister and Moller 2000; Spilerman 2000). In his proposition of new principles for class analysis, Sorensen (2000, p. 1540) also suggested that physical wealth is a central social background condition that should be considered in all analyses of social class and mobility. While research on the intergenerational role of wealth has emerged since – and will be reviewed below – our main models of intergenerational mobility often exclude wealth (Killewald, Pfeffer and Schachner 2017, forthcoming). In large strands of social mobility research, the focus is on the correlation in one outcome across generations, most often occupational position or income (Solon 1999; Torche 2015). In contrast, traditional status attainment research in sociology (Blau and Duncan 1967; Sewell, Haller and Portes 1969) assessed multiple parental background factors (generally education and occupation) in analyses of children's socioeconomic attainment in terms of not only their final occupation but also key intermediary steps such as educational attainment and first occupation. Early on, this approach was criticized to miss unobserved factors in individuals' backgrounds. Even in 1972, Bowles noted that wealth was missing from these models and that its exclusion would likely lead to a biased view of the overall importance of social inequality in status attainment (Bowles 1972). Similarly, Henretta and Campbell (1978) suggested that the stratification literature had ignored measures of wealth even though most sociologists saw wealth as an important source of power. Interestingly, anticipating this line of reasoning, Blau and Duncan (1967) had already presented a defense of their own approach: "[I]nclusion of other family background variables may lead to some reinterpretation of how the effect of such variables is transmitted, or of what is their relative importance, but it will not alter greatly our over-all estimate of the importance of variables of this kind (p. 191)". Half a decade later, it is still an open question whether analyzing wealth as a dimension of socioeconomic background contributes unique and significant explanatory power to our understanding of the intergenerational status attainment process.

2.2 What is unique about wealth?

Wealth differs from other components of family background components used to study attainment inequality – such as parental education, income, and occupation – in that it has a higher degree of permanence: wealth tends to capture advantages generated many generations back and thus most strongly incorporates the history of prior inequality and social exclusion (Oliver and Shapiro 1995). Wealth is different from other background factors, particularly income, in several ways. Wealth is not directly tied to work in a given period and therefore not directly determined by episodes of unemployment or illnesses (even though one may consume wealth to overcome such hardships) or by preferences for leisure (Spilerman 2000). Wealth is also often taxed more favorably than income, and can, to some extent, be consumed without being lost, for instance in the case of housing wealth (Spilerman 2000, p. 500). Most important, wealth is also more highly concentrated at the top compared to income, and top wealth holders and top earners are not always the same individuals. In fact, the very top of the wealth distribution is often not inhabited by the highest income earners since the truly wealthy do not need to work (Keister 2014). Wealth may thus be a much more relevant measure to identify economic elites. On the other end of the scale, wealth – unlike most forms of income – can be negative in the form of net debt. Finally, in Weberian terms, wealth captures not only the class or market dimension of inequality but also the status dimension that entails social prestige and admiration, that is, Weber's concept of 'Stand'. Overall, wealth may therefore not only be a different, but also a more encompassing, indicator of inequality.

2.3 Family wealth and children's education

The intergenerational literature on wealth has largely focused on transfers of wealth itself and how individuals tend to use these transfers (as reviewed in Spilerman 2000). The effects of wealth on other outcomes, such as children's education, have been studied less frequently. One of the earliest contributions by Rumberger (1983) found that parental wealth was associated with children's education net of other measures of socio-economic background. Conley (2001) provided evidence on substantial and independent associations between parental wealth and children's college attendance. Several other studies on the U.S. document a substantial association between parental wealth and children's educational achievement (Orr 2003; Shanks 2007; Yeung and

Conley 2008) or attainment (Axinn, Duncan and Thornton 1997; Conley 2001; Morgan and Kim 2006; Belley and Lochner 2007; Pfeffer 2011). Strong wealth effects on educational attainment have also been shown in late-industrializing countries, such as Brazil, Chile, India, and Mexico (Filmer and Pritchett 2001; Torche and Spilerman 2006; Torche and Spilerman 2009; Torche and Costa-Ribeiro 2012). Since developing economies often have labor markets with high economic volatility, weak or non-existent social safety nets, and limited access to credit, even low levels of wealth may constitute a crucial economic resource for families to invest in children instead of relying on them to work for financial support. In comparison, one might assume more limited wealth effects on education in developed countries, given higher overall incomes and the availability of public welfare programs and public education. Nonetheless, wealth has also been shown to matter for educational attainment in post-industrial countries with extensive welfare systems and state-funded education (Pfeffer and Hällsten 2012).

A recent contribution that appears to provide a critique of any potential causal role of parental wealth for children's education comes from Cesarini et al. (2015). They use lottery wins as a source of exogenous variation in wealth in Sweden and find that parental lottery wins have no effects on children's educational outcomes.[4] They suggest that "the correlations observed in developed countries between […] parental *income* [our italics] and children's outcomes do not reflect a causal effect of wealth (p. 4)." We interpret their findings as strong evidence that Swedish families do *not* face economic constraints for educational participation, which may be unsurprising since education is tuition-free at all levels in Sweden. However, while lottery-won wealth is clearly exogenous (conditional on lottery participation), lottery wins may not establish the same social conditions that come along with wealth accumulated and passed down over generations, such as the reinforcement of social norms related to wealth (discussed in more detail below). Qualitative research shows that inherited wealth – presumably unlike lottery wealth – carries a broader meaning than just its monetary value, namely, it is perceived as a status transfer in the form of a long-term loan with clear limitations on how it should be spent (Schaeffer 2014). But, of course, neither inherited nor accumulated wealth lend themselves to a social experiment.

[4] Similarly, Bleakley and Ferrie (2013) show that lottery wealth gained through the 1832 Georgia Cherokee Land Lottery had no impact on children's education. However, in the predominant farming economy of the mid 19th century, winning a parcel of land might instead be expected to increase parents' demand for children's farm labor and bind resources to the agricultural business to the detriment of educational investments.

Some have posited that family wealth, as well as other socioeconomic characteristics tied to children's outcomes, are just genetic effects in disguise. Black et al. (2015) have recently negated this view: Comparing intergenerational wealth correlations across adopted and biological children in Sweden, they found substantial correlations for adopted children for whom a biological link is missing. In fact, the wealth correlation was even stronger for adopted children than for biological children. That is, growing up in a wealthy environment has long-term effects that dwarf genetic factors.

2.4 The importance of grandparental wealth

There are several reasons to focus especially on grandparents when conceptualizing family wealth. Because wealth reflects historical inequality and advantage accumulated over many generations, examining only the parental family will be too limited and downwardly bias our assessment of the importance of wealth. Furthermore, for a large share of the sample studied here, grandparents were still alive during their teenage years, meaning that wealth transfers to parents have not yet occurred in full. This highlights the challenge in measuring wealth that may not yet have been passed down from the prior to the current parent generation. An exclusive focus on parental wealth thus underestimates the family's wealth potential (Pfeffer and Killewald 2016a).

A small number of studies have also begun to consider the role of multigenerational wealth effects on children's educational outcomes. Møllegaard and Jaeger (2015) found that grandparents' cultural capital (measured as their education and cultural participation) was associated with grandchildren's schooling, but that grandparents' economic and social capital was not. However, in their available measures of economic capital, Møllegaard and Jaeger could only draw on a limited indicator of wealth (owning a summerhouse).[5] Adermon, Lindahl and Waldenström (2015) find that education can account for a fifth of the intergenerational (parent-child) wealth persistence in Sweden, and a third of the multigenerational (grandparent-child) wealth persistence (see their Table 7). Similarly, Pfeffer and Killewald (2016a) found that education accounts for a quarter of the parent-child wealth correlation in the U.S., but nearly half of the grandparent-child wealth correlation. Both contributions suggest that education is an important factor behind the multigenerational effects of wealth, complementing direct

[5] While Møllegaard and Jaeger consider their wealth measure an indicator of economic capital in juxtaposition to cultural capital, we will argue below – when we discuss the potential normative function of wealth – that such distinction may not be as clear-cut.

transfers. In line with these findings, we expect wealthy origins to have a profound impact on inter- and multigenerational mobility processes, in particular through their impact on children's education.

2.5 Wealth mechanisms

Family wealth can exert intergenerational influences in many ways. Below, we briefly present three possible mechanisms that may explain the effects of family wealth on offspring's educational outcomes. Our empirical analyses are not designed to sharply distinguish among these pathways or determine their relative importance. Instead, we make a case for the general significance of these mechanisms and the fact that their particular importance depends on institutional and macro-social contexts. The next section then details the particular Swedish context and hypothesizes the likely relevance of the mechanisms resulting from it.

2.5.1 The purchasing mechanism

The most intuitive function of wealth in intergenerational processes is that it allows the purchase of various goods and services, including those that support learning and educational success. The primary purchasing function is the investment by which students can attend schools with tuition fees. In a country like the U.S., this may be the purchase of a home in a neighborhood with high-quality public schools (Owens 2016), the purchase of private secondary education, or the reduction of credit constraints to access costly higher education (Lovenheim 2011; Pfeffer 2011). Home ownership – a major part of the typical household's wealth portfolio and often aided by intergenerational wealth transfers (Spilerman 2004) – can also be crucial in providing a safe and stable learning environment for children (Conley 1999; Solari and Mare 2012) and serve to reduce behavioral problems in children (cf Spilerman and Wolff 2012, p. 208).

The scope of the purchasing function is likely to vary by national context and depend, in particular, on the extent to which education and out-of-school academic support is paid for privately, the strength of gradients in schooling quality in neighborhoods of different affluence, and the direct costs of higher education.

2.5.2 The insurance mechanism

One mechanism for the intergenerational effect of wealth may not only be the *use* of wealth – as implied by the purchasing function – but also the *potential* for its use. As Spilerman points out (2000, p. 500), wealth does not need not be consumed to be an effective resource. It has a latent function that provides insurance for various types of failures, for instance, by substituting for income losses and in his way smoothing career disruptions, thereby reducing the impact of uncertainty (Pfeffer 2010; Pfeffer and Hällsten 2012). With wealth-provided insurance, the potential cost of risk-taking behavior is lower.[6] Wealth's insurance against risk may allow educational decisions to be guided more by children's strengths and interests than by external constraints, thereby fostering their unique abilities and skills. Also, wealth may allow children greater opportunity to identify their unique abilities, for instance by enrolling in higher educational programs without the immediate constraints placed by the economic calculation of expected human capital investment returns.

As argued by Pfeffer and Hällsten (2012), the scope of wealth's insurance function is likely dependent on the extent of the public insurance system. For instance, a public system of generous unemployment insurance may make the need for additional wealth-based insurance against career disruptions unnecessary. However, even the most advanced welfare states cannot give complete insurance against life course risks, and especially not against the risks involved in continuing one's education beyond the minimum required school attendance. That is, wealth should always provide at least supplementary insurance even in the most developed welfare state contexts.

2.5.3 The normative mechanism

The third mechanism that may account for the intergenerational influence of wealth is its role in fostering pro-education norms. A baseline assumption is that since wealth is associated with power and privilege, families strive to secure this advantage for their descendants (Thurow 1976, ch. 6). Our argument is that since, in modern society, the intergenerational stability of elite social positions is not *prima facie* guaranteed, families with wealth may emphasize higher education as a way to increase their descendants' ability to preserve family wealth either by their own socioeconomic success or by their

[6] While an argument about moral hazard could be made, according to which the insurance provided by very high wealth leads children to discount future outcomes and therefore underinvest in their education, we expect that this effect is surpassed in importance by the positive influence of insurance.

skillful management of dynastic wealth. The idea that education is one instrument by which advantaged groups reproduce their advantage has a long history in sociological thought (Collins 1971; Parkin 1979), but analyses of the reproduction of economic *wealth* through education are few, and have focused on the very top of the distribution, for example, on elite schooling (Levine 1980; Bourdieu 1998; Khan 2011).

Here we argue that the normative channel through which family wealth and education are connected also extends beyond elite positions – that the presence of family wealth at levels far below those required for elite closure may foster the sense of higher education as a conventional goal. That is, by sustaining socialization into the idea that further education is possible, even moderate family wealth may create a sense of educational entitlement (Conley 1999; Conley 2001).[7] We also add that families of more moderate wealth levels may foster pro-education norms out of instrumental motivations, similar to the way in which the wealthiest families may invest in the asset management capacities of their eventual heirs: Moderate wealth can dissipate quickly in the next generation if it is consumed during periods of unemployment (see Spilerman 2000). Educational success facilitates access to more stable employment and income flows, as well as to marital partners with similarly stable employment and income prospects. Thus, fostering normative orientations towards education is a rational strategy for the intergenerational preservation of even moderate wealth.

While the effects of pro-education norms materialize in the form of a desired educational destination (degree), those educational destinations are already predetermined by previous educational achievement (test scores, GPAs) that make them realistic goals (Morgan 2005). That is, pro-education norms feed into higher ambitions for educational *attainment* and, by doing so, create higher educational *achievement*.

Finally, we believe that the scope for the normative mechanism also depends on broad, macro-economic contexts, namely the degree of fluidity of the economic and social structure in terms of overall levels of intergenerational status reproduction (social mobility), the volatility of the economic system, and the stability of institutions that defend property rights. In a society that is fluid in these senses, the need for status

[7] The suggested relevance of a normative mechanism below the wealth level of economic elites carries some similarity to work that claims a broader relevance of wealth based on its cultural content: For instance, Orr (2003) has argued that moderate wealth exposes individuals to forms of cultural capital, such as the *beaux arts*, that are accessed by non-elites and that may be beneficial for educational outcomes (DiMaggio 1982; Jaeger and Breen 2016). Similarly, though in a different substantive context, Schneider (2011) has argued that wealth serves as a cultural signifier for marriageability, again far below the echelons of a wealthy elite.

reproduction via education should be the highest. The same holds for a society that is widely *perceived* as fluid by its members and the resulting *perceived* need of status reproduction via education. Since the forces mentioned do not only – and likely not even primarily – impact elites but also the rest of the distribution, we consider the normative power of wealth for status-maintenance through education to be an explanation with population-wide relevance in fluid societies.

2.6 The Swedish context

We study Sweden, a small country with advanced welfare state capitalism and a long tradition of redistribution and egalitarian policies. Its income distribution is one of the most equal in the industrialized world (Gottschalk and Smeeding 2000) because the Swedish welfare state provides comparatively extensive benefits to disadvantaged groups in society and because unionism and collective bargaining are influential in setting worker wages and benefits (Alexopoulos and Cohen 2003). Whether Swedish wealth inequality is also comparatively low has been debated. Findings from the mid-80s tended to suggest a comparatively low level of wealth inequality in Sweden, for instance compared to the U.S. (gini coefficient of .59 vs. .79, respectively; Davies and Shorrocks 2000), though in absolute terms wealth inequality still far exceeds income inequality in Sweden. More recent international comparisons of wealth inequality have shown Sweden to be marked by the highest levels of wealth inequality in the industrialized world (Jäntti, Sierminska and Smeeding 2008, p. 263). In part, this finding can be explained by the fact that wealth data typically fail to capture public pension entitlements (Domeij and Klein 2002), which – thanks to Sweden's strong public pension system – are distributed much more equally than wealth held in private pension accounts. We therefore side with the conservative conclusion that levels of wealth inequality in Sweden are at least *not* exceptionally low compared to other developed countries. But we do note that the incentives for wealth accumulation in Sweden are relatively low given the public provision of not only pension benefits but also education (see below). With reduced necessity to save for old age and for one's children's education, private wealth portfolios may be even more reflective of permanent long-term inequality than in other nations and less reflective of parental preferences (for savings for old age and direct investment in children's education), making our analysis a particularly strong test of wealth effects.

Sweden levied a wealth tax of up to 4 percent of total wealth holdings per annum, relatively high in international comparison, before it was abolished in 2007 (Rietz and Henrekson 2015). Despite this tax, an unequal wealth distribution prevailed. It should also be noted that social democratic reforms in Sweden from the 1930s and onwards have typically not been aimed at challenging the capitalist class but rather occurred through collaboration, although this collaborative spirit has also been romanticized in retrospective accounts (Lundberg 1985).

Schooling in Sweden is not only free at all levels, elementary through university level, but also nearly completely standardized. The complex and divided educational pathways found in other systems have been abolished. There is a national standardized curriculum. Schooling is mandatory throughout the non-tracked "elementary school" until grade nine or, usually, age 16. The three-year upper-secondary school is tracked, primarily between academic and vocational fields. The vocational tracks are general in character without the strong connection to the labor market typical for apprenticeship systems, like that of Germany. Admission to upper-secondary school is based on relative rank in terms of 9th grade GPA and a fixed number of school vacancies, and the same principle applies for tertiary education. That is, the idea that determinants of students' early efforts to achieve largely predetermine later educational choices (Morgan 2005) fits the Swedish cases well, since prestigious, academic tracks are mostly inaccessible to students with poor grades. All academic tracks, on the other hand, grant basic eligibility for tertiary education. Standardized education also used to mean that students were assigned to schools exclusively by proximity, creating a tight bond between neighborhood and school segregation. Since the 1990s, this bond has loosened. In 1992, the free schooling reform introduced the possibility of school choice and so-called "free schools" that are publicly funded but privately run, much like charter schools in the U.S. (Björklund et al. 2005). Admission to these is based on queues, which means that engaged (and privileged) parents that choose schools well before school starting age have an advantage in utilizing school choice. This reform came into effect gradually but school choice is now widespread. By 2012 (when the last of our analyzed cohorts graduated from elementary school), around 15 percent of students at the elementary level and 25 percent at the upper-secondary level went to free schools. As a consequence of school choice, but also increased neighborhood segregation,

sorting on achievement across schools has steadily increased, yet the influence of family background on achievement at the elementary level has remained stable over time (Holmlund et al. 2014).

Although we are not able to neatly separate the effects of the three hypothesized mechanisms underlying the importance of family wealth for education, we can now make some predictions about their relative contributions in the case of Sweden. First, since education is free at all levels, the purchasing function of wealth is likely to be of limited scope, especially in comparison to its likely impact in other countries, such as the U.S., where the monetary constraints to educational access are much higher. Similarly, the importance of wealth for obtaining for-purchase out-of-school academic support is comparatively limited in Sweden, especially in comparison to countries like the U.S. with a strong "shadow education" sector (Baker et al. 2001; Buchmann, Condron and Roscigno 2010). The public funding of education is complemented by Sweden's regulated rental markets and overall high housing quality, limiting the potential influence of home ownership wealth on children's education. Although affluent neighborhoods are sites of high-quality schools and highly motivated peers also in Sweden, the standardized education system and comparatively low level of economic segregation lead us to expect even the purchasing function of homeownership to be relatively weak and – to the extent it exists – mediated by school characteristics.

Second, although Sweden generally offers rather extensive public insurance schemes, private insurance against remaining risks will still be present and, in the Swedish case, likely be more important that the purchasing mechanism. The decision to enroll in university – and with it all development and preparation in earlier grades – still incurs the risk of potential non-completion and lost opportunity costs, which neither the Swedish system – nor any other system – insures against (see Pfeffer and Hällsten 2012 for more detail).

Third, the normative mechanism may be particularly significant in accounting for the intergenerational influence of family wealth on children's education in Sweden. Overall, Sweden is a rather fluid society. As a small open market economy, it is very dependent on trade and has a long tradition of economic restructuring to adapt to changing market influences (Alexopoulos and Cohen 2003). All of these factors have broad implications for the function of wealth beyond economic elites: A more fluid society like that of

Sweden puts a higher premium on education to maintain advantaged positions and avoid social degrading across the distribution.

3 Data and methods

3.1 Data and sample

The data for our analyses are drawn from Swedish administrative registers. The Swedish multigenerational register contains population-wide links between children and their parents and grandparents based on birth and adoption records. We merged data from this register on individuals in cohorts born between 1980 and 1996 to information on their parents' and grandparents' education, occupation, employment, and income via school registers, tax registers, occupation registers, and censuses, and to their parents' and grandparents' wealth via the Swedish Wealth Register that existed from 1999 through 2007. We also merged on information on fathers' cognitive and non-cognitive skills from mandatory military enlistment records.

Our data are for the entire Swedish population with two exceptions. First, not every individual had traceable grandparents, largely because of immigration (i.e., their grandparents were not Swedish residents), and a few cases had exceptionally long generational spacing such that the death of grandparents occurred before we could observe them in the registers. In our data, we could identify the grandparents of 84 percent of the members of our birth cohorts. But when we restricted the sample to Swedish-born children with Swedish-born mothers, this figure rose to 99.9 percent. Of these identified grandparents, 92 percent were alive up to 2007, allowing us to observe their wealth. Thus, our data cover families with non-immigrant origins and normal generational spans. The second exception is that not all fathers in the sample completed Sweden's mandatory military enlistment, leading to a loss of another 20 percent of the analytic sample. However, sensitivity analyses (available upon request) reveal that our results are very stable across subsamples with and without enlistment matches for fathers, suggesting bias to be negligible.

3.2 Variables

3.2.1 Outcome variables

The educational outcomes we use are the GPA from 9th grade, which is the final year of mandatory education, and graduation from an academic program in upper secondary

school, which prepares students for college, measured as a dummy variable (yes/no). Both measures are collected from school registers. We transform GPAs to ranks within each graduation year using the cumulative distribution function. This variable thus represents each child's relative position in the distribution of educational performance, bounded by 0 and 1.[8]

3.2.2 Family wealth

Our key independent variables are various measures of family wealth, collected from the Swedish Wealth Register (1999 to 2007), which contains detailed information on various types of financial and real assets and debts. Register information on wealth is primarily based on tax records, but complemented with reports from financial organizations such as banks, and estate registers. In 2008, the Swedish wealth tax was abolished (the gift tax and inheritance tax had been abolished already in 2005); as a result, 2007 is the last year for which these wealth data are available. We measure wealth for parents and grandparents on both the matrilineal and patrilineal side, assessments not generally available in previous multigenerational research.

We construct two sets of wealth measures. First, we compute net worth as total wealth minus total debts. Second, we decompose wealth into financial wealth, net home wealth, and net real wealth. *Financial wealth* consists of cash, stocks, bonds and other financial instruments that rarely serve as collateral – that is, debt is rarely held against them – which is reflected in a rather low correlation between financial wealth and debt (see Table A 2). We divide wealth not held in financial assets into *net home wealth*, i.e. the net value of owner-occupied housing, and *net real wealth*, i.e. real estate property, such as summer houses, and other highly priced assets like cars and jewelry. We observe the value of owner-occupied housing and other real estate properties in tax registers which, fortunately, also include the market value of homes rather than only the taxed value of these assets (the latter would severely underestimate home wealth). In contrast, other highly priced assets – such as cars or valuable collections – are self-

[8] In the mid-1990s, the Swedish education system changed from a "relative" to a "goal-oriented" grading system. This has caused grade inflation, i.e., average grades increased over time although skills and abilities were constant or may even have decreased (Holmlund et al. 2014). Since we use GPA ranks within each year, this trend is not an issue in our analyses. However, according to Holmlund et al., grade inflation also tends to be somewhat stronger in free schools and in areas with more school competition, although these differences are small. Our controls for school characteristics, including a free-school dummy and average parental wealth level, capture this heterogeneity. In addition, we have run sensitivity analyses with school fixed effects that capture all effects of the school and its surrounding environment as well as grade ranks within municipalities, i.e., where schools compete for students. Results remained unchanged (not shown).

reported to the tax authority (since there is no administrative register for such items). As a consequence, any potential reporting bias likely in survey-based wealth measures will also apply to our measure of *net real wealth*, affecting this measure more than the other wealth components. We measure both housing and real wealth net of debt. Though we cannot directly observe the type of debt and the asset against which it may be held, we know that the vast majority of debt held by Swedish households is in the form of mortgages or home equity-based lending. Unsurprisingly, then, debt is more highly associated with home values than any other asset component (especially for parents but also for grandparents; see Table A 2). We therefore subtract debts from gross home values to obtain net home wealth. When debt is in excess of the value of the owner-occupied home, we set net home wealth to zero and subtract the remaining debt from gross real wealth, yielding net real wealth. As a result, net real wealth can be negative, while financial and home wealth is zero or larger.

Although wealth holdings may be marked by less volatility than annual income streams (see Solon 1989), wealth is exposed to other sources of volatility, such as stock market or housing market volatility. We seek to reduce attenuation bias in our estimates by averaging across all available years in the wealth registers (1999–2007). The correlation between these averaged wealth measures and their respective one-year versions lie between .85 and .95, suggesting that the attenuation bias in one-year measures would have led to an underestimation of the association between wealth and our outcomes. Since wealth is recorded at the individual rather than the family level, we compute wealth measures for parents by taking totals over mothers and fathers and for grandparents by taking totals over grandmothers and grandfathers across both lineages (i.e., a total of maternal and paternal grandparental wealth). Table A 1 shows the distribution of our wealth measures in raw currency.

We have conducted specification searches to test various functional forms of family wealth. Our preferred specification, reported here, uses ranks of each underlying continuous covariate (the cumulative distribution function bounded by 0 and 1).

3.2.3 Other socio-economic characteristics

A competing explanation for associations between family wealth and educational achievement is that they reflect other dimensions of family socioeconomic standing and characteristics. We therefore include extensive and high-quality controls for both

parents' and grandparents' education, occupation, and income, as well as parents' employment and father's cognitive ability and non-cognitive skills.

Swedish administrative data on education are comprehensive and date back to the 1970s. We know from previous studies using those data that measures of educational attainment should not be reduced to either educational level or educational field (Hällsten 2013). The Swedish educational nomenclature (SUN2000) is very specific and allows combining both educational levels and fields (coded to the European standard ISCED-97, see Statistics Sweden 2005) to observe specific degrees (e.g., a BA in economics). To capture the complexity of both educational level and field while maintaining parsimony, we follow prior research (Björklund and Sundström 2006) in using an aggregate variable of "educational value," regressing children's GPA on fixed effects for unique combinations of parental educational level and field codes. The resulting predicted GPA provides a unidimensional measure of parents' educational characteristics that are relevant to children's GPA. The same assignment process is then used for grandparents' education.

To capture parents' and grandparents' occupations, we use both three-digit International Standard Classification of Occupations (ISCO-88) from occupation registers and five-digit codes from the Nordic Standard Occupational Classification (NYK85) from censuses. We compute an aggregate "occupational value" following a process like that used to assign "educational value" (regressing child GPA on parents' occupational codes as fixed effects and using the resulting predicted GPA as a unidimensional measure that reflects parents' occupational characteristics relevant to child GPA). We observe disposable individual income and average it between 1968, the first year of population income data, and 2012, restricting the data to ages 18 to 65. In other words, we draw on an unusually exhaustive measure of permanent lifetime income. In addition, we use tax registers to capture parents' non-employment (approximated through exceptionally low annual market earnings), averaged between 1980 and their children's 19th birthday. Non-employment of parents is coded as earnings below 10,000 Swedish Krona (SEK) per month (which is a bit stricter than the method used by Erikson et al. 2007 in their study of labor market entry for youths).

The aggregation rule for each socioeconomic characteristic is as follows: For educational and occupational measures, we take the mean value over parents and both

lineages of grandparents. For disposable individual income, we take the sum over parental and both grandparental pairs (like we did for wealth).

For fathers, we also draw on mandatory military enlistment registers to link information on cognitive ability (assessed by a formal test, see Carlstedt and Mårdberg 1993) as well as non-cognitive skills (assessed by a psychologist, see Mood, Jonsson and Bihagen 2013).Both measures have discrete values ranging from 1 to 9 and are Stanine-scaled to a mean of 5 and a standard deviation of 2. These measures of cognitive ability and non-cognitive skill have been shown to be powerful predictors of educational performance and labor market outcomes (Lindqvist and Vestman 2011).

Table 1. Descriptive statistics

	Mean	(SD)	Min.	Max.	Count
Outcomes					
GPA (z-score), 9th grade	0.0557	(0.9334)	-4.1348	2	1,013,587
Graduate of academic upper secondary	0.3144	(0.4643)	0	1	732,048
Grandparental SES					
GPs' net worth*	2247.227	(4909.7472)	-135,000	753,607	1,013,587
GPs' financial wealth*	935.3209	(3258.1086)	0	733,272	1,013,587
GPs' home wealth	1142.098	(1183.6018)	0	69,765	1,013,587
GPs' real (not home) wealth	481.5926	(2857.6609)	-1,120	650,917	1,013,587
GPs' debt	377.5578	(1434.7686)	-6.7329	395,897	1,013,587
GPs' net home wealth*	832.7138	(985.5635)	0	56,202	1,013,587
GPs' net real wealth*	413.419	(2296.0297)	-267,000	354,744	1,013,587
GPs' study debt	2.1883	(16.7628)	0	1,125	1,013,587
GPs' education value	-0.835	(0.5687)	-3.8606	3	1,013,587
GPs' occupation value	-0.8774	(0.6937)	-3.9558	2	1,013,587
GPs' permanent ln income	5.4075	(0.2768)	0.7773	8	1,013,587
Parental SES					
Ps' net worth*	944.641	(4812.8104)	-66,400	3,040,863	1,013,587
Ps' financial wealth*	270.3889	(3806.0479)	0	2,799,025	1,013,587
Ps' home wealth	1084.899	(1067.2286)	0	59,618	1,013,587
Ps' real (not home) wealth	347.329	(1922.1525)	-696.931	316,135	1,013,587
Ps' debt	745.4923	(1090.6744)	-0.034	161,504	1,013,587
Ps' net home wealth*	457.7852	(719.9662)	0	54,559	1,013,587
Ps' net real wealth*	228.9499	(1580.7786)	-149,000	247,610	1,013,587
Ps' study debt	43.2059	(85.2727)	0	1,641	1,013,587
Ps' education value, z-scores	-0.3596	(0.8653)	-5.027	3	1,013,587
Ps' occupation value, z-scores	-0.3694	(0.8430)	-3.9558	2	1,013,587
Ps' non-employment	0.3061	(0.1925)	0	1	1,013,587
Ps' permanent ln income	5.6576	(0.2560)	1.4363	11	1,013,587

	Mean	(SD)	Min.	Max.	Count
Other controls					
Father's cognitive ability	0.0039	(0.9948)	-2.1864	2	1,013,587
Father's non-cognitive skills	0.0396	(0.9511)	-2.7133	2	1,013,587
C's school: share first generation	0.0598	(0.0609)	0	1	1,013,587
C's school: Ps' education value	0.0397	(0.0759)	-0.2142	1	1,013,587
C's school's average wealth	4.0542	(0.7828)	0	8	1,013,587
Free school (0/1)	0.0675	(0.2509)	0	1	1,013,587
Demographics					
Female	0.4886	(0.4999)	0	1	1,013,587
Mat GP divorced/es[a]	0.1992	(0.3994)	0	1	1,013,587
Pat GP divorced/es[a]	0.1693	(0.3750)	0	1	1,013,587
Ps divorced/es[a]	0.3773	(0.4847)	0	1	1,013,587
Birth year, mother	1961.717	(5.3849)	1935	1982	1,013,587
Birth year, father	1959.681	(5.2931)	1950	1981	1,013,587
Birth year, maternal grandmother	1935.078	(8.4553)	1892	1963	1,011,367
Birth year, maternal grandfather	1931.775	(9.1404)	1885	1963	996,556
Birth year, paternal grandmother	1932.672	(8.4548)	1890	1962	1,010,585
Birth year, paternal grandfather	1929.361	(9.1572)	1885	1961	995,845
Father dead/dies[b]	0.0295	(0.1692)	0	1	1,013,587
Mother dead/dies[b]	0.0155	(0.1235)	0	1	1,013,587
Paternal grandfather dead/dies[b]	0.4727	(0.4993)	0	1	1,013,587
Paternal grandmother dead/dies[b]	0.2539	(0.4352)	0	1	1,013,587
Maternal grandfather dead/dies[b]	0.2088	(0.4064)	0	1	1,013,587
Maternal grandmother dead/dies[b]	0.4088	(0.4916)	0	1	1,013,587
Birth cohorts, GPA 9th grade			1980	1996	1,013,587
Birth cohorts, Graduate of academic US			1980	1992	727,592

Note: C = children, P = parents, GP = grandparents. Wealth Values are in thousand SEK in 2003 prices (1 USD ≈ 7.3 SEK; December 2003). * These wealth measures are the focus of the paper. Net worth is all wealth minus debt. Financial wealth refers to cash, stocks, bonds, etc.; net home wealth refers to owner-occupied housing minus debts (home equity); net real wealth refers to other property, including real estate or other valuable assets minus any remaining debt (see text for more details). [a] The divorce indicators measures whether P/GP are divorced during the period when wealth is measured (1999–2007). [b] The death indicators measures if the person was dead or died during the first 1/3 of the period when we measure wealth (1999–2007). The sample is conditional on at least one parent, one maternal grandparent and one paternal being alive in some year when we measure wealth (1999–2007).

To capture the effects of children's elementary school contexts, we construct school-level aggregates of proportion of foreign-born students, average educational values of parents, and wealth concentration in the school (measured as an additive index of financial, home, and real wealth among matrilineal grandparents and parents; Cronbach's $\alpha = .93$), as well as a dummy for attending a free school, which often is more socially selective. Table 1 provides a list and descriptive statistics for all variables used in the analyses. We transform all continuous variables into ranks using the

cumulative distribution function (which is bounded by 0 and 1). As a consequence, our models resemble the percentile rank regressions used by Chetty et al. (2014) in their study of income mobility in the U.S.

3.2.4 Other controls

We include birth year dummies for *all* generations (the earliest observed year within parent and grandparent pairs) in the baseline specification to avoid confounding life-cycle differences in wealth with age effects, a biasing factor extensively discussed in the wealth literature in economics. In practice, these controls matter very little over and above children's birth year.[9] Reasons may include that within the birth cohorts studied here (1980-1996), the variance in age of parents and grandparents is limited and may therefore be expected to produce limited bias. We also measure divorce among parents or grandparents during the period of observation using separate dummies for each spousal pair. We also include dummies capturing whether any ancestor died before 2003, since grandparental death may capture whether wealth was transferred to parents. This control also had only marginal impacts on our results.

Intergenerational wealth effects may be confounded by geographic variation in wealth and schooling outcomes, and home wealth – a major source of wealth – shows vast variation across local areas in Sweden. However, conducting sensitivity analyses that include municipality dummies for all generations had virtually no impact on the results (not shown).

3.3 Analytic strategy

Family wealth is measured as parents' and grandparents' wealth. Our analytic focus, however, is on grandparents' wealth. Besides the substantive importance of a multigenerational perspective discussed above, the focus on grandparents' wealth carries several advantages in terms of reducing concerns about unobserved bias. Potential claims about unobserved heterogeneity driving intergenerational wealth associations often refer to differential savings behaviors and future orientations that impact both parents' wealth accumulation and their children's educational success. While we have argued that the Swedish context should tend to minimize the importance of these factors, these claims nonetheless compete with the social mechanisms we have

[9] Furthermore, we have run sensitivity analyses with wealth measures adjusted for birth cohort-specific mean wealth in 1999-2007, as well as within birth cohort wealth ranks, but the results are essentially the same.

hypothesized to explain the effects of family wealth on children's educational outcomes (purchasing, insurance, norms). Our focus on grandparental wealth allows us to control for unobserved factors of the extended family, namely by comparing cousins in what we call the *cousin fixed effects* (FE) approach. This design compares cousins from the same patrilineal stem that are exposed to different levels of matrilineal wealth. While we focus on the effect of matrilineal grandparents' wealth, our grandparental wealth measure sums the wealth of both lineages. Thanks to this approach, we capture the full effect of maternal grandparental wealth, and a part of the paternal grandparental wealth effect. In Appendix A, we explain in more detail why this approach continues to capture most of paternal grandparental wealth information.[10]

The cousin fixed effects approach is novel partly because it is not available in the study of two-generational influences. Estimating the effect of maternal wealth while conditioning on paternal fixed effects (or vice versa), that is, a sibling fixed effect approach, would require some within-family variation in maternal (paternal) wealth. That variation would typically arise from sibling births being spaced apart significantly and the family experiencing a sudden wealth increase or decrease that impacts only the younger sibling. In other words, the effect would be identified based on a quite select sample.

In addition to some specific methodological concerns faced by our cousin fixed effects strategy addressed in Appendix A, we note a broader methodological concern about grandparental wealth effects and three-generational effects in general: Unmeasured parent characteristics as well as measurement error in observed parental characteristics tend to attenuate parent effects and increase grandparent effects, upwardly biasing the latter. In response to this concern, we have taken considerable care in measuring a wide range of parental control variables with as little measurement error as possible using unusually long time spans – for instance full life-time incomes. Measuring income across the entire life course should also better capture savings behaviors since the two have been shown to be closely associated (Dynan, Skinner and Zeldes 2004). With an accurate estimate of the total accumulated income flows that can

[10] One could instead also focus on patrilineal wealth and use the matrilineal line to define the fixed effect. We focus on matrilineal wealth since intergenerational social relations and investments tend to be stronger along the matrilineal lineage (Chan and Elder 2000; Euler 2011). In replicating our analyses with matrilineal fixed effects (not shown), we find evidence for these predictions: paternal grandparental wealth effects are about one fifth weaker than the maternal grandparental wealth effects shown here. We do not explore these lineage differences in more detail but encourage future research to expand on explanations of gender differences in the multigenerational transmission of advantage.

be converted into a stock – that is, with controls for the true permanent incomes for grandparents and parents – we can net out a great deal of saving behaviors.

Finally, we also argue that our focus on grandparents reduces some remaining concerns about endogeneity in the effects of family wealth on children's educational outcomes. In particular, some researchers may be concerned about reverse causality according to which children's educational outcomes impact families' wealth accumulation. For example, information on the educational performance of children early in their schooling careers may trigger parents to accumulate more assets (e.g., if children's high performance motivates parents to save for their college career) or to draw down on their existing assets (e.g., if children's low performance is driven by behavioral problems that limit parents' possibilities of market work). These alternative narratives of reversed causation – whether they are convincing to begin with or not – apply to *parental* wealth. Grandparental wealth, in contrast, is less likely to confront the same concerns to the same degree: Grandparents' wealth has largely been accumulated when the signals of their grandchildren's early educational performance emerge, making the temporal ordering of our variables somewhat clearer than for the two-generational case.

In sum, while we expect educational outcomes to be more weakly associated with grandparental wealth than with parental wealth, based on our arguments and the empirical identification strategy described, we consider the association between education and grandparental wealth to be less subject to endogeneity bias and thus potentially more reflective of the three hypothesized wealth mechanisms.

3.4 Methods and models

We begin by estimating linear models (OLS and FE). For our analysis of graduation from academic upper secondary schools, our models are linear probability models (LPM) where the coefficients are interpreted as a change in probability (as Mood 2010 shows, logistic regression coefficients are not comparable across models due to scaling issues). In practice, LPM coefficients are often very similar to Average Marginal Effects (AME) from logistic regressions (i.e., the marginal effect evaluated over all covariate combinations that exist in the sample). We have computed AMEs to corroborate our results and the AME and LPM are close to identical in all our models (results available upon request). Our models use robust standard errors clustered on patrilineal

grandparents. We test for differences in the wealth effect across models to assess the statistical significance of confounding or mediation.[11]

In addition to the OLS and FE models, we also apply Marginal Structural Models (MSM). Most studies of intergenerational mobility are still guided by the two-stage Markovian paradigm in which intergenerational transmission occurs in independent sequences between two generations (i.e., from grandparents to parents and from parents to children, but not from grandparents directly to grandchildren; Mare 2011). A test of the alternative, non-Markovian scenario with direct multigenerational transmission consists of estimating whether an additional prior generation contributes unique explained variance *net of* two-generational transmission processes. The corresponding test of a direct grandparental contribution controlling for parental characteristics can, however, also downplay the influence of older generations, since some explanatory power that originated in prior generations may be mistakenly ascribed to parents. For example, when studying the effect of neighborhood segregation as experienced by parents and as experienced by their children on these children's educational achievement, Sharkey and Elwert (2011) show that standard regression estimates that control for variables – such as children's neighborhood characteristics – that lie on the causal pathway between parental neighborhood poverty and the outcome lead to underestimation of the total effect of parental neighborhood poverty. Their solution is to rely on MSM (Robins, Hernán and Brumback 2000) using inverse probability-of-treatment weights (IPTW). We follow this strategy to assess the total contribution of grandparents' wealth to children's GPA while simultaneously addressing collider and over-control bias. In essence, we create data where confounders are orthogonal to wealth in each of the parental and grandparental generations using a re-weighting strategy. For a discussion of the technical aspects of MSM-IPTW, see the Online Appendix B.

[11] We base the test on $t = (b_1-b_0)/(se_1^2 + se_0^2)^{1/2}$ omitting the covariance term $-2Cov(b_1,b_0)$ (which is computationally difficult to recapture). We consider this a conservative t-test (the covariance term should be positive since we use the same data and close to identical model specifications; it would thus enter with a negative sign and increase the t-statistic).

4 Results

4.1 Family net worth and children's educational achievement

As a first description of the association between family wealth and educational achievement, Figure 1 reports a non-parametric plot of children's 9th grade GPA across different dimensions of socioeconomic background (SES), measured as ranks, for parents and grandparents separately. All SES measures, including wealth, correlate strongly with GPA. On average, children from the bottom quintile of the SES distribution (rank <.2) typically place in the third decile (between the 30th and 40th percentile) of the GPA distribution, whereas children from the top quintile (rank ≥.8) typically place in the sixth decile. Gradients by grandparental SES are flatter, influenced by faster regression to the mean at the bottom: On average, the educational achievement of children from the bottom quintile of the grandparental SES distribution lies in the fourth decile of the GPA distribution. So, in line with our expectations, SES gradients are stronger for parents but still quite pronounced for grandparents – this in a country that has exerted exceptional efforts to reduce educational inequality for decades.

With the exception of the very bottom of the distribution, the wealth gradients in achievement found here closely resemble the gradients found for other dimensions of SES, both for parents and grandparents. In particular, it is worth noting that the association between ranks of GPA and ranks of parental SES is largely linear, including for wealth. One difference emerges for households in the bottom of the wealth distribution that – unlike the income distribution – is made up of cases of negative and zero values. Children from these households fare somewhat better in terms of their educational achievement compared to children from the bottom of the distribution of other SES characteristics, reflecting the ambivalent nature of net debt. That is, in some case, net debt may indicate families' ability to take out loans, or "productive debt," and thus does not exclusively capture economic disadvantage.

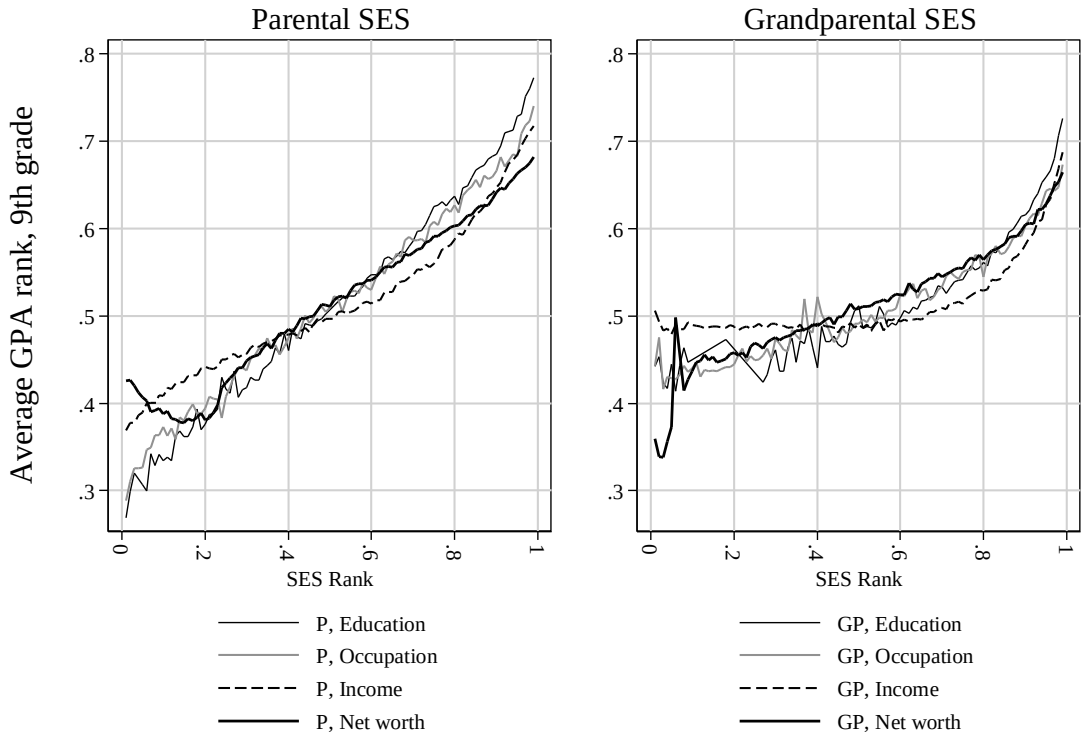

Figure 1. GPA (9th grade) and dimensions of parental and grandparental SES

Notes: GPA and SES are ranks. The figure displays average values within each SES percentile bins. P = parents, GP = grandparents.

That phenomenon, however, does not extend to the association between GPA and grandparental wealth, where the lowest net worth levels are associated with exceptionally low achievement. This may indicate that net debt in former generations overwhelmingly reflects economic disadvantage rather than productive debt. Otherwise, the GPA gradient by grandparental wealth again follows the shape of gradients by other SES characteristics, with the more pronounced curvature of the lines indicating that educational advantage accrues faster with rising SES. However, the conclusion that educational advantage is concentrated solely at the very top of the grandparental wealth distribution – that is, that multigenerational reproduction is exclusively elite reproduction – is unwarranted. If anything, the association between educational achievement and grandparental wealth follows a *less* exponential pattern than for other SES components, especially income, in which educational advantage is largely concentrated only within the top quarter of the distribution.

Figure 2. GPA (9th grade) and wealth components

Note: GPA and wealth are ranked. The figure displays average values within each wealth percentile bins. P = parents, GP = grandparents. Financial wealth refers to cash, stocks, bonds, etc.; net home wealth refers to owner-occupied housing minus debts (home equity); net real wealth refers to other property, including real estate or other valuable assets minus any remaining debt (see text for more details). Intervals with straight lines indicate humps in the underlying distribution, e.g. at zero for net real wealth.

Figure 2 decomposes net worth into three components: financial wealth, net home wealth, and net real wealth. The gradients in GPA are similarly patterned for parental and grandparental wealth components, though they are again flatter for the latter. The strongest wealth gradient in GPA emerges for financial wealth, especially in the grandparental generation. The home wealth gradient in GPA is similar to that of financial wealth – though, naturally, it does not capture achievement gaps among children of non-owners – and becomes steeper in the top quintile of the distribution, indicating increasing returns to high housing wealth. We observe a somewhat weaker gradient in GPA for net real wealth, i.e. real estate, farm lands, and other valuable real assets.

Table 2 reports associations between GPA and grandparental wealth as estimated in a series of OLS regression models. In model 1, with only basic controls for demographic

differences, we find that the rank-rank slope between GPA and grandparental wealth is .23. Thus, for a one-percentile rise in grandparents' wealth rank, children's educational achievement rank increases by close to a quarter of a percentile. This association is diminished somewhat by adding further controls for grandparental divorce (model 2) and other grandparental socioeconomic characteristics, chiefly grandparental education (model 3), and less so for grandparental occupation (model 4) and permanent income (model 5). All the decreases in the coefficients are statistically significant. Notably, in a model that includes all grandparental socio-economic characteristics (model 5), wealth stands out with the strongest independent association with GPA.

In model 6, we additionally control for paternal cousin fixed effects in an effort, as described above, to take into account further unobserved grandparental characteristics. With this control in place, the association between grandparents' wealth rank and grandchildren's GPA rank decreases significantly, from .15 to .12, or by around 20 percent. The association, however, remains still substantial: For each percentile rank increase in grandparental net worth, children's GPA rises by .12 percentiles. Strikingly, the wealth coefficient still remains the largest among all SES dimensions.

Table 2. Regression of GPA rank on grandparents' wealth and control variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GPs' net worth rank	0.2342***	0.2255***†	0.1736***†	0.1595***†	0.1510***†	0.1191***†	0.1022***	0.1183***
GPs' education value, rank			0.1641***	0.1202***	0.1046***	0.0702***	-0.0349***	-0.0363***
GPs' occupation value, rank				0.0824***	0.0775***	0.0504***	0.0506***	0.0414***
GPs' ln perm. income, rank					0.0487***	0.0414***	0.0122	0.0352***
GPs' net worth rank squared							0.0161	
GPs' education value, rank squared							0.1214***	0.1228***
GPs' occupation value, rank squared							-0.0108	
GPs' ln perm. income, rank squared							0.0224	
Gender, immigration, birth years, deaths	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GP divorced/es		Yes	Yes	Yes	Yes	Yes	Yes	Yes
GP fixed effect						Yes	Yes	Yes
# Individuals	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584
# Cousin FE						448,931	448,931	448,931
Adjusted R2	0.1432	0.1462	0.1697	0.174	0.1753	0.086	0.0864	0.0863

Note: Statistical significance levels at * p<.05, ** p<.01, and *** p<.001 based on two-tailed tests, standard errors adjusted for clustering within patrilineal grandparents. † Coefficient statistically different from previous model with p <.05 (test only conducted for GP net worth). C = children, P = parents, GP = grandparents. Ranks are continuous and vary between 0 and 1

.

In model 7, we pay closer attention to the non-linearities observed in the descriptions of raw associations provided earlier. We capture non-linearities for grandparents' wealth and other SES characteristics in a quadratic specification. [12] The results confirm our earlier conclusion that the educational advantage arising from grandparental wealth should not be thought of as purely or even chiefly dynastic reproduction at the very top of the distribution. In fact, in these conditional models, the concentration of educational advantage at the top is much stronger only for grandparental *education*; the quadratic terms for the other SES variables are not significant. The grandparental wealth association thus follows a linear pattern. The non-linear association for grandparental education consists of a very low, even negative, conditional association in the bottom half of the distribution but a particularly strong one at the top. In fact, the conditional association is even stronger at the top of the educational distribution (grandparental education effect of .2079 [=-.0349+ 2 × .1214][13]) than at the top of the wealth distribution (grandparental wealth effect of .1344 [=.1022 + 2 × .0161]). In model 8, we thus drop the quadratic terms for all variables except grandparental education. Our preferred linear wealth effect is estimated to be .12.

In the next set of analyses, reported in Table 3, we add mediators from the parental generation. Here, our specification search suggested a square term for parental non-employment as the only detected non-linearity in the parental associations. For reference, model 1 repeats the estimates from our final model based on grandparental information only (see Table 2, model 8). In model 2, we control for parental wealth, which significantly reduces the grandparental wealth association, from .12 to .08, which is about half the size of the direct parental wealth association (.17).

[12] We have also tested higher order polynomials and dummy categories; available upon request.

[13] The rank specification allows a direct interpretation of the non-linear specification. At the lowest rank, the association is captured by the main effect (first order term), in the middle of the distribution the association equals the sum of the main and squared term (first order + second order term), and at the top of the distribution, the association is the sum of the first order term plus twice the second order term: The regression $Y = a + b_1X + b_2X^2 + \ldots + e$ has the partial derivative of $\partial Y/\partial X = b_1 + 2b_2X$. Therefore, $\partial Y/\partial X = b_1$ for X=0, $\partial Y/\partial X = b_1 + b_2$ for X = 0.5, and $\partial Y/\partial X = b_1 + 2b_2$ for X = 1.

Table 3. Regression of GPA rank on grandparents' wealth, control variables and mediators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GPs' net worth, rank	0.1183***	0.0776***†	0.0740***	0.0469***†	0.0437***	0.0437***	0.0451***	0.0457***
Ps' net worth, rank		0.1665***	0.1371***†	0.1143***†	0.0986***†	0.0985***	0.0953***	0.0966***
Ps' education value, rank				0.2894***	0.2273***	0.2272***	0.2078***	0.2084***
Ps' occupation value, rank					0.0944***	0.0942***	0.0860***	0.0865***
Ps' non-employment, rank					-0.004	-0.0039	-0.0087	-0.0079
Ps' non-employment, rank squared					-0.0679***	-0.0676***	-0.0662***	-0.0665***
Ps' income, rank						0.001	-0.0089*	-0.0080*
Fathers' cog. ability, rank							0.0770***	0.0771***
Fathers' non-cog. skills, rank							0.0324***	0.0326***
School: share first generation, rank								-0.0019
School: Ps' education value, rank								-0.0018
School: average wealth, rank								-0.0116***
School: free school 0/1								-0.0066***
Gender, immigration, birth years, deaths	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cousin fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GP SES[a]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GP divorced/es	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
P divorced/es			Yes	Yes	Yes	Yes	Yes	Yes
# Individuals	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584
# Cousin FE	448,931	448,931	448,931	448,931	448,931	448,931	448,931	448,931
Adjusted R2	0.0863	0.0944	0.1018	0.1241	0.1282	0.1282	0.1303	0.1304

Note: Statistical significance levels at * p<.05, ** p<.01, and *** p<.001 based on two-tailed tests, standard errors adjusted for clustering within patrilineal grandparents. † Coefficient statistically different from previous model with p <.05 (test only conducted for P and GP net worth). C = children, P = parents, GP = grandparents. Ranks are continuous and vary between 0 and 1. [a] GP SES contains square terms for education.

Another major and significant drop of the direct grandparental association – to .05 – occurs when controlling for parental education (model 4), but both parental wealth and grandparental wealth associations are remarkably stable to the introduction of controls for parental divorce (model 3), other socioeconomic characteristics of parents (models 5 and 6), and even fathers' cognitive ability and non-cognitive skills (model 7), and the quality of schools attended by children (model 8). Overall, then, grandparental wealth contributes to the variance in educational achievement substantively and separately from other grandparental characteristics with a rank-rank slope of .12 through a direct channel (.05) and two main indirect channels via parental wealth (.04) and parental education (.03).[14]

Finally, focusing on the independent associations with parental wealth reveals that it, too, is remarkably stable to the introduction of other parental controls. The rank-rank slope coefficient of around .10 (models 7-10) suggests that children of the wealthiest parents have a 10 percentile rank advantage in terms of their GPA compared to children from the least wealthy parents, after controlling for the wealth and SES position of the grandparental generation. This association is substantial; its size is only second to that of parental education and notably larger than the associations with parental occupation and fathers' cognitive ability. Interestingly, net of education, none of the parental wealth associations was explained by fathers' cognitive ability, fathers' non-cognitive skills, or the quality of schools attended by children.

In sum, we have documented sizeable joint and independent associations of grand-parental and parental wealth with their (grand-)children's educational achievements. These associations are partly mediated by the educational attainment of the parent generation, further suggesting an exposed role of education in the multigenerational significance of family wealth. In particular, the finding that grandparental wealth plays a greater role than other dimensions of grandparents' socioeconomic status is very much in line with the theoretical motivation, discussed above, that multigenerational associations may be particularly marked for wealth (Mare 2011, Pfeffer 2014).

[14] Since grandparental influence could also emerge through the extended family besides parents, namely through grandparents' other children – who are the aunts and uncles of the children studied here – we also consider the potential influence of aunts' and uncles' wealth and other socio-economic characteristics. In supplementary analyses (displayed in Table S 2 in the Online Appendix), we observe that aunts'/uncles' wealth and other socio-economic characteristics do not contribute to the explanation of grandparent wealth associations, except when conditional on parents' SES, and do not explain parental wealth associations.

4.2 Marginal structural models of multigenerational wealth effects

To assess the overall effect of family wealth and the relative importance of both grandparental and parental wealth, we now turn to Marginal Structural Models (MSM). Table 4 reports baseline OLS estimates for regressions based on specifications using wealth deciles, rescaled to match the scale used above for wealth ranks. The main difference between these two sets of results lies in the detail of the wealth variable (deciles vs. full rank) and the presence of a cousin fixed effect (excluded vs. included). We report the unconditional effects of grandparental and parental wealth in models 1 and 2, respectively, and their joint effects in model 3. The results closely reproduce the patterns found in prior models: The unconditional grandparental effect is very similar to the one shown in Table 2, the parental effect is only slightly larger, and when we consider their effects jointly both are reduced, with parental wealth showing a stronger effect. Introducing controls for all other socioeconomic indicators in both the grandparental and parental generation (model 4) also produces estimates of wealth effects that closely resemble those reported earlier, with a parental wealth effect of around .10 and a grandparental wealth effect of .034, somewhat smaller than the estimate of .045 reported in Table 3.

In model 5 of Table 4, we finally re-estimate the grandparental wealth effect using marginal structural models with inverse probability treatment weights (MSM-IPTW). The results indicate that the effects of grandparental wealth are very similar in size to those of parental wealth. With an effect size of .10, the grandparental effect estimated through MSM is, in fact, quite close to the baseline grandparental wealth effect without any controls in the parental generation (.12; see Table 2, model 8). However, given that the fixed effect reduces the grandparental wealth effect by some 20 percent in Table 3, we may assume a similar degree of upward bias here, which would bring the true effect to .08. This finding suggests that a traditional mediation analysis, as used in the prior section, adequately divides the total effect of grandparents into a direct and indirect effect (via parental wealth and education) and, importantly, that these regression estimates do not suffer to a substantively meaningful extent from collider variable bias. The MSM approach instead assigns both these paths to their origin in grandparental wealth. The total effect of family wealth in two prior generations is the sum of the grandparental wealth coefficient and the parental wealth coefficient. The estimate of close to .20 implies, for instance, a 2 percentile point change in educational achievement

for a decile shift in both grandparental *and* parental wealth. This effect is about the size of the unconditional wealth gaps described in the beginning of this paper.

Overall, the MSM-based results strengthen our conclusion that both grandparental and parental wealth are important and strong contributors to (grand-)children's educational achievement. Wealth inequality has long-standing effects on subsequent generations.

Table 4. Marginal structural models of multigenerational wealth effects on GPA

			Unconditional	Regression adjustment	MSM w/ IPT weighting
	(1)	(2)	(3)	(4)	(5)
GP net worth[a]	0.221***		0.133***	0.034***	0.099***
	(194.001)		(109.333)	(30.111)	(60.092)
P net worth[a]		0.248***	0.190***	0.094***	0.101***
		(224.385)	(158.797)	(84.623)	(63.541)
N	1,010,585	1,010,585	1,010,585	1,010,585	1,010,585

Note: Statistical significance levels at * p<.05, ** p<.01, and *** p<.001 based on two-tailed tests and standard errors adjusted for clustering within patrilineal grandparents; t-values in parenthesis. [a] The underlying metric is in deciles (to make use of MSM), but the measure is rescaled to min = 0, max =1. The coefficient scale is thus consistent with the cumulative rank in Tables 2 and 3.

4.3 Net worth and children's educational achievement summarized

Here, we briefly summarize and provide an intuitive presentation of our main empirical findings on the relationship between family wealth and academic achievement. Figure 3 compares the predicted level of educational achievement between children whose parents' and grandparents' net worth is towards the bottom (10^{th} percentile) versus the top (90^{th} percentile) of the distribution. The figure displays results from three modeling approaches: baseline regressions models (OLS), regression models with full controls and cousin fixed effects (FE), and marginal structural models (MSM). Multiplying the gaps shown in the figure by 1.25 yields the regression coefficients displayed in the tables (coefficients refer to differences of 100 percentiles, P90-P10 to differences of 80 percentiles, hence 100/80 = 1.25).

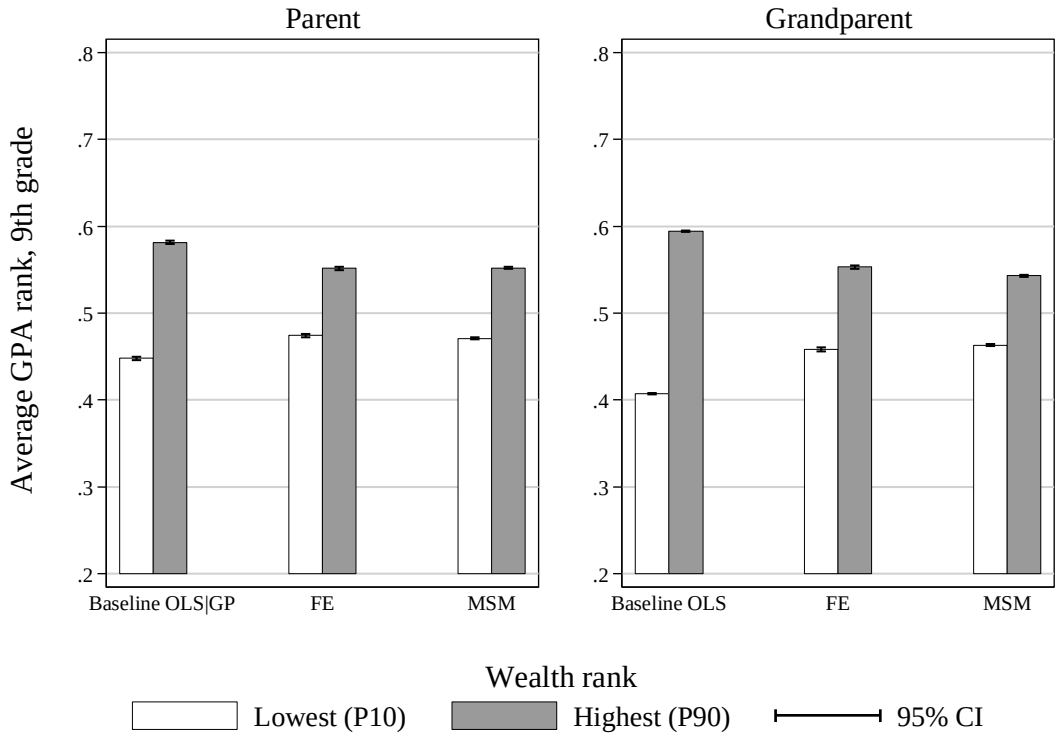

Figure 3. Predicted GPA (9th grade) for the 10th and 90th percentile of the parental and grandparental net worth distributions

Note: We display the average predicted GPA at the given percentiles in the parent generation (left side) and the grandparental generation (right side), based on regression models reported above. "Baseline OLS" estimates for parental wealth are based on an OLS model that controls for grandparental wealth (Table 3, model 2), on a cousin fixed effect model ("FE", Table 3, model 8) and on a Marginal Structural Model ("MSM", Table 4, model 5). Estimates for grandparental wealth are based on an OLS model (Table 2, model 1), on a cousin fixed model (Table 2, Model 8), and on a Marginal Structural Model (Table 4, model 5).

The right side of Figure 3 illustrates that – without any controls for confounding factors – individuals whose grandparents were at the 90th percentile of the wealth distribution (P90) on average perform at about the 60th percentile in terms of GPA, and those whose grandparents were at the 10th percentile of the wealth distribution (P10) perform at about the 40th percentile (the approximate 20 percentage point difference in these predicted values is in essence the regression coefficient as displayed in the regression tables; see Table 2, model 1). Taking into account that the origins of children with wealthy grandparents also differ from those with less wealthy grandparents in other observable and unobservable ways (FE model) reduces the gap in their educational achievement: Grandchildren from the top and bottom of the wealth distribution are predicted to perform at the 55th GPA percentile and the 45th GPA percentile, respectively. This 10 percentile point gaps also remains when we take into account

confounders on the causal pathway from grandparents to grandchildren (i.e., in the parental generation) using MSM.

The left side of Figure 3 displays predicted GPA values by parental wealth position. Conditional on grandparental wealth, children of parents in the 90th percentile of the wealth distribution achieve a GPA at the 58th percentile on average, while children of parents in the 10th percentile of the distribution fall on average at the 44th percentile of the GPA distribution. Controls for confounders in both the fixed effect model and the MSM design reduce that gap to the 55th versus the 47th percentile, a remarkably similar gap to that found based on grandparental wealth.

4.4 The role of wealth components

Additionally, we assess whether and to what degree the associations between educational achievement and family net worth described above are driven by the specific wealth components of financial wealth, net home wealth, and net real wealth. Table 5 reports baseline models based on both net worth and wealth components. Our specification search suggested that associations with separate wealth component are also linear.

In model 1, based on grandparental wealth without further controls for grandparental and parental SES, we clearly observe that net financial wealth drives most of the net worth association with grandchildren's GPA. The .12 association with grandparental net worth breaks down to a .10 association with grandparental financial wealth, and .04 and .03 association for net home wealth and other net real wealth, respectively.

When we control for parental wealth and SES as mediators in models 2 and 3, these differences across grandparental wealth components attenuate but the grandparental financial wealth coefficient is still much larger than that of other grandparental wealth components. In the parental generation the dominant role of financial wealth is even more marked: With full controls for other socio-economic characteristics, the parental financial wealth coefficient is .11 – even larger than the parental net worth coefficient (.095) – followed by the parental net home wealth coefficient of .03. Overall, then, we conclude that financial wealth – or wealth in largely liquid form rather than in housing or other real estate – is the most consequential component of family wealth in predicting the educational achievement of children.

Table 5. Regression of GPA rank on wealth components

	(1)		(2)		(3)	
	Baseline			w/ GP controls		w/ P mediators
All GPs' net worth, rank	0.1183***		0.0776***		0.0457***	
All GPs' financial wealth, rank		0.1017***		0.0395***		0.0264***
All GPs' net home wealth, rank		0.0343***		0.0209***		0.0099**
All GPs' net real wealth <0, rank		0.0166		0.0258**		0.0156
All GPs' net real wealth >0, rank		0.0184***		0.0107**		0.0072*
Ps' net worth, rank			0.1665***		0.0966***	
Ps' financial wealth, rank				0.1760***		0.1092***
Ps' net home wealth, rank				0.0796***		0.0355***
Ps' net real wealth, <0, rank				0.0254***		0.0048
Ps' net real wealth, >0, rank				0.0053		0.0066
Gender, immigration, birth years, deaths	Yes	Yes	Yes	Yes	Yes	Yes
GP SES	Yes	Yes	Yes	Yes	Yes	Yes
GP divorced/es	Yes	Yes	Yes	Yes	Yes	Yes
Ps' SES					Yes	Yes
P Divorced/es					Yes	Yes
Fathers' cognitive and non-cognitive					Yes	Yes
School characteristics					Yes	Yes
# Individuals	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584	1,010,584
# Cousin FE	448,931	448,931	448,931	448,931	448,931	448,931
Adjusted R2	0.0863	0.0871	0.0944	0.1028	0.1304	0.1325

Note: Statistical significance levels at * p<.05, ** p<.01, and *** p<.001 based on two-tailed tests, standard errors adjusted for clustering within patrilineal grandparents. C = children, P = parents, GP = grandparents. Financial wealth refers to cash, stocks and bonds etc.; Net home wealth refers to home ownership minus debt; Net real wealth refers to other property, i.e., farm land, summerhouses etc., and to some extent assets such as cars, boats, jewelry, etc., minus debt.

4.5 Academic upper-secondary attainment

Finally, we also analyze how family wealth is associated with graduation from the most prestigious academic track on the secondary level. In Table 6, model 1, the coefficient for grandparents net worth rank is .27, meaning that we observe a 27 percentage point difference in graduation rates between children from the very top and the bottom end of the grandparental wealth distribution. Given that the average graduation rate from this track is about 31 percent (see Table 1), this gap is very large. With controls for grandparents SES in model 2, the coefficient falls to .10, which still is substantial. However, when we control for 9th grade GPA (model 3), which we have focused on so far, we observe that this measure of educational achievement accounts for a large part – about four fifths (1-.0230/.1140) – of the association between family wealth and educational attainment. The GPA coefficient estimate is .75, meaning that a shift by one percentile rank in the GPA distribution translates into .75 of a percentage point change in graduation rates.

The same conclusion can be drawn from models with the full set and sequence of further parental controls (models 4-7). As before, controls for parental wealth alone (model 4), explain a substantial part of the grandparental wealth association, and so does controlling for parental SES (model 5). The parental wealth association net of other parental socioeconomic characteristics indicates a 10 percentage point difference in graduation rates between children whose grandparents are the wealthiest and the poorest.

Also as before, controlling for father's cognitive ability and school selectivity (model 6) has a small impact on these wealth associations. However, by again introducing controls for GPA, the parental wealth effect, too, is almost fully mediated. Hence, we conclude that grandparental wealth is associated with track choice in upper-secondary school but primarily via its association with children's educational achievement as manifested in 9th grade GPA, lending support to our decision to focus on the analysis of educational achievement.

Table 6. Linear probability model of graduation from academic upper-secondary track (0/1) on family wealth and control variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
All GPs' net worth, rank	0.2735***	0.1140***	0.0230***	0.0653***	0.0297***	0.0310***	-0.0042
Ps' net worth, rank				0.1950***	0.1078***	0.1008***	0.0280***
GPA rank			0.7487***				0.7306***
Gender, immigration, birth years, deaths	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GP SES		Yes	Yes	Yes	Yes	Yes	Yes
GP divorced/es		Yes	Yes	Yes	Yes	Yes	Yes
Ps' SES					Yes	Yes	Yes
P Divorced/es					Yes	Yes	Yes
Fathers' cognitive and non-cognitive						Yes	Yes
School characteristics						Yes	Yes
# Individuals	725,076	725,076	725,076	725,076	725,076	725,076	725,076
# Cousin FE		353,448	353,448	353,448	353,448	353,448	353,448
Adjusted R2	0.0728	0.0338	0.1828	0.0368	0.0493	0.0502	0.1855

Note: Statistical significance levels at * p<.05, ** p<.01, and *** p<.001 based on two-tailed tests, standard errors adjusted for clustering within patrilineal grandparents. C = children, P = parents, GP = grandparents. This analysis is limited to cohorts born 1980–1992. The estimates are OLS regression coefficients (from a linear probability model) and have been corroborated with average marginal effects from a logit regression.

5 Discussion

Our analyses address concerns about the long-term consequences of wealth inequality for the distribution of opportunity in following generations – concerns that are all the more relevant given the extreme and rising level of wealth inequality throughout most of the industrialized world. We find that wealth in prior generations is important for educational achievement even in the rather egalitarian context of Sweden. Family wealth thus establishes inequality in the cognitive dimensions of schooling as captured in grade point averages, which suggest a rather fundamental inequality generating mechanism that should be expected to in turn have consequences for later life outcomes.

Our analyses reveal family wealth effects to be quite large in comparison to the effects of other socioeconomic characteristics, and, in particular, that the influence of grandparental wealth and parental wealth is about equal in size. Moving from the bottom to the top of the wealth distribution in either the parental or the grandparental distribution implies a gain of 10 percentile points in children's 9^{th} grade GPA score – or 20 percentile points if we consider both generations together. In other words, if we had restricted our focus to a two-generational perspective, as in much prior stratification research, we would have missed half of the inequality in educational achievement by family wealth. Furthermore, we found that the influence of grandparental wealth can be partitioned into a direct, three-generational effect on grandchildren's educational achievement and a sequence of two-generational associations via parental wealth and parental education – all of which are of similar size. To reach this conclusion, we have relied on marginal structural models (MSM) that take into account confounders on the causal pathway from grandparental wealth to children's educational achievement. The MSM approach also enabled us to gain a better understanding of the total role of wealth spread within family lineages, which is not adequately captured if we focus exclusively on only the "direct" multigenerational effect of grandparental wealth. We have, however, also taken great care in estimating such direct effect – based on a new methodological approach that we call cousin fixed effects – and found it to persist even with ample controls for observed and unobserved parental characteristics.

Further insights are yielded by our analyses. First, the association between family wealth and education is appreciably linear. Although the full population register data used for this study include true wealth elites, our analyses demonstrated that the

advantages from family wealth accrue throughout the distribution and not just at the very top. If interpreted through the prism of the normative function of wealth, this finding corresponds to our supposition that such function spreads across the wealth distribution rather than being of exclusive significance for processes of elite closure.

Second, establishing a direct effect of grandparental wealth on children's education – that is, that grandparental wealth matters directly and beyond the sequence of two-generational transmissions processes from grandparents to parents and parents to children – is important, especially as the great majority of today's children grow up while their grandparents are still alive. Analyzing the wealth of grandparents measured at the end of their careers may also have the additional benefit of fully capturing grandparents' lifetime success since education and occupation are largely fixed in the first half of individuals' careers. Lifetime income encompasses the full working life but only captures one specific labor market outcome. In contrast, wealth at career end may provide an informative summary of the degree of advantage accumulated by grandparents. Our results suggest that this total accumulated advantage – beyond grandparents' educational, occupational, and income attainment – can be passed on to their grandchildren in the form of educational achievement. This may be one of the reasons why grandparental wealth shows such strong associations compared to the other dimensions of grandparental SES.

Third, we have shown that family wealth effects are tied to a range of different asset components but most strongly to financial wealth. In Sweden, home wealth – an asset held more widely in other contexts, especially in the U.S. – does not produce educational benefits to the same extent as financial wealth.

Fourth, family wealth effects in Sweden on educational achievement translate into wealth gaps in educational transitions – and with that, the effects likely impact children beyond their educational outcomes, carrying over into their labor market careers.

Overall, our results emphasize that family wealth independently adds to our understanding of the intergenerational determinants of educational outcomes – especially when considered in a multigenerational perspective. Much previous research has been restricted to the analysis of select socioeconomic characteristics of parents, chiefly their occupation, income, and own education. Our analyses indicate that wealth of prior generations should also count as an integral part of socioeconomic background.

Our empirical analyses focused on the identification of family wealth effects but did not set out to test the social mechanisms underlying them or to empirically separate their relative importance. While we hope that future research will make further progress in this direction, we end by discussing the ways in which our results may still lend some credibility to different explanations of family wealth effects in Sweden and, importantly, what expectations about the size of multigenerational wealth effects may be drawn for other nations, in particular, the U.S..

We proposed three theoretical mechanisms that may account for the observed inter-generational role of family wealth – purchasing, insurance, and normative mechanisms – and noted that their relative importance likely depends on the specific institutional and macrosocial contexts of a given country. We argued that Sweden provides a context that severely limits the purchasing function of wealth. Sweden's strong public education system and its tuition-free universities may effectively eliminate direct economic barriers to accessing high-quality schools and higher education. In line with that argument, we found that controls for school quality had minimal influence on our estimates. Similarly, we consider recent research that fails to find a significant intergenerational payoff to lottery wins in Sweden (Cesarini et al. 2015) as supportive of the idea that purchasing function of wealth in Sweden is limited at best. In contrast, we consider the normative and insurance mechanisms as the more likely candidates to explain our finding of strong associations between family wealth and educational outcomes in Sweden. First, the potential influence of a normative channel is in line with our finding that the association between wealth and the transition into academic upper-secondary education is practically fully mediated by educational achievement. Normative values on the importance of educational success – as fostered by wealth – exert their effect on early motivation and achievement, largely predetermining later educational attainment (see also Morgan 2005). Furthermore, our finding of quite linear wealth effects is in line with our hypothesis that the normative mechanism should not be thought of as exclusively taking effect in the uppermost echelons of the wealth distribution. Second, the insurance function of wealth has been argued to be more universal in character because the need for insurance against educational risks is largely unmet by public insurance mechanisms (Pfeffer and Hällsten 2011). Here, the insurance function of wealth may allow children to explore their capabilities more freely and

thereby promote achievement. We also note that the importance of wealth's insurance function may remain or even increase during later transitions, such as college enrollment, labor market entry, or early unemployment.

To derive expectations about the potential importance of family wealth for education in other nations, we need to compare their institutional and macro-social contexts to those described here. For instance, our findings for Sweden could be considered to provide underestimates of the long-term consequences of wealth inequality in other contexts if there – unlike in Sweden – are a purchasing mechanism that operates on top of insurance and normative mechanisms. For this very reason, we would be surprised if the profound role of wealth that we documented for Sweden would be any smaller in the U.S., where all three mechanisms of intergenerational wealth effects are likely at work. In the U.S., the normative influence of wealth on children should be relevant as Americans' strong belief in a mobile society spurs the quest for status maintenance via education. The most apparent difference between Sweden and the U.S., of course, lies in the purchasing mechanism. In the U.S., economic barriers to high-quality schools and higher education should be substantially higher thanks to a tight link between the quality of schools and housing wealth – as the most central component of the typical U.S. families' wealth portfolio – as well as high and rising costs of higher education.

The resulting hypothesis of a profound multigenerational significance of wealth in the U.S. should be addressed empirically in future research. If it is valid, current research on educational inequality in the U.S. that focuses on socioeconomic characteristics exclusive of family wealth and on just the immediate family background – though already producing alarming findings (Duncan and Murnane 2011) – still underestimates the degree and incompletely captures the nature of educational inequality. The potential need to improve the description and understanding of educational inequality in the U.S. is particularly acute given its sharply rising levels of wealth inequality.

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Appendix A. Additional methodological considerations for the cousin fixed effects strategy

Here, we elaborate on additional methodological considerations for our cousin fixed effect approach. We clarify two separate potential concerns – both of which turn out not to be an empirical challenge to our reported results.

Assortative mating on wealth in the parent generation

As also explained earlier, the fixed effect strategy we apply here is not available for the two-generational case: In most cases, a paternal fixed effect would eliminate also variation in maternal wealth. In contrast, for the three-generational case, a patrilineal grandparent fixed effect – i.e. a patrilineal cousin fixed effect – would only eliminate all variation in matrilineal wealth in the case of perfect assortative mating on wealth in the middle generation: If all parents in our sample had chosen marriage partners of the same wealth level as their own, the fixed effect would also capture the full variation in the other lineage. Fortunately, this is the not empirical situation we are faced with. The correlation between patrilineal and matrilineal grandparental wealth is low (approximately r=.15, regardless of the specific wealth measure used) suggesting that assortative mating in the parent generation studied here exists but is weak. In comparison, Charles, Hurst and Killewald (2013) estimate a correlation of .40 between spouse's parental wealth for the U.S.. By that comparison, assortative mating on wealth appears to be quite low in Sweden. As a consequence, the identification of the multi-generational wealth effect through grandparental wealth levels that differ between the two lineages turns out not to be overly restrictive in the Swedish case.

The contribution of patrilineal grandparental wealth

Our main wealth measure is based on the wealth holdings of both matrilineal and patrilineal grandparents. However, our analysis focuses on the effects of matrilineal wealth: The cousin fixed effect – defined based on shared patrilineal grandparents – should, in principle, eliminate any differences on the patrilineal side, including patrilineal grandparental wealth, leaving us with a wealth measure that reflects matrilineal grandparental wealth. Below, we first show that thanks to the transformation of wealth measures that we have chosen, even in the cousin fixed effect approach, we are able to take into account some of the variation in patrilineal grandparents' wealth. Second, we will demonstrate empirically that the matrilineal measure includes *most*

information on both grandparental lineages. The cousin fixed effect *mainly* works to remove unobserved heterogeneity and thus provides the strongest measure of grandparental wealth effects.

The impact of non-linear transformation

As our wealth measures are based on ranks, a non-linear transformation, patrilineal grandparental wealth still further differentiates the rank levels between otherwise comparable levels of matrilineal wealth, bringing back some information on patrilineal grandparental wealth in the cousin fixed effect design. We illustrate this with an example below. For the purpose of this illustration, the specific numbers have no direct relevance.

Fixed effect specifications are based on the following equation:

$$(Y_i - Y_{mean}) = a + \sum b\,(X_i - X_{mean}) + e$$

For our cousin fixed effects design, we compute Y_{mean} and X_{mean} over patrilineal grandparents.

Our main focus lies on grandparental wealth (X), i.e. Wealth – $Wealth_{mean}$. Suppose that we have two cousins, A and B, with different levels of matrilineal wealth, expressed in raw currency (in thousands):

Cousin A: Matrilineal wealth = 10

Cousin B: Matrilineal wealth = 20

Applying the fixed effect, i.e. cousin de-meaning, yields the following.

Cousin A: Wealth – $Wealth_{mean}$ = 10-15= -5

Cousin B: Wealth – $Wealth_{mean}$ = 20-15= 5

Now, we add patrilineal wealth, say of 10,000, which will result in different levels of wealth but leaves the de-meaned terms unaltered:

(Matrilineal + Patrilineal wealth) – $(\text{Matrilineal + Patrilineal wealth})_{mean}$

Cousin A: = (10+10) – 25 = -5

Cousin B: = (20+10) – 25 = 5

That is, regardless of patrilineal wealth the estimates are the same. However, when we apply a non-linear transformation, such as ranks, the same no longer holds true simply because a rank score does not correspond to constant levels of wealth.

Cousin A: Matrilineal wealth 10=> rank .55

Cousin B: Matrilineal wealth 20=> rank .67

Cousin A: Wealth – Wealth mean = .55- 61 = -.06

Cousin B: Wealth – Wealth mean = .67-.61 = .06

Adding patrilineal wealth of 10,000 yields the following rank levels:

Cousin A: Matrilineal + Patrilineal wealth 20=> rank .67

Cousin B: Matrilineal + Patrilineal wealth 30=> rank .71

Cousin A: Wealth – $\text{Wealth}_{\text{mean}}$ A = .67-.69 = -.02

Cousin B: Wealth – $\text{Wealth}_{\text{mean}}$ B = .71-.69 = .02

These estimates are obviously not identical: The added 10,000 have a very different impact depending on the levels of maternal wealth. In other words, differences in levels of patrilineal grandparental wealth are taken into account.

Comparison to approach that fully takes into account patrilineal wealth

Even though the above example shows that the patrilineal wealth adds some information, the question remains to what extent this information provides a substantial contribution in the cousin-fixed effect design, or whether the decline in the grand-parental wealth coefficient when introducing the cousin fixed effect just reflects removal of the effect of patrilineal grandparental wealth. In additional comparative analyses that also include a measure of matrilineal grandparental wealth alone instead of overall grandparental wealth, reported in Table S 1, we find the following:[15]

- The grandparental wealth coefficient is about 20 percent lower if we use *matrilineal* grandparental wealth only, instead of *overall (matrilineal + patrilineal)* grandparental wealth, irrespective of whether controls and fixed effects are included or not (compare models 1 to 2, 3 to 4, and 5 to 6).
- The grandparental wealth coefficient declines by about 20 percent when introducing the cousin fixed effect, irrespective of whether we are using *overall (matrilineal + patrilineal)* grandparental wealth or *matrilineal* grandparental wealth only (compare models 3 to 5 and 4 to 6).

The similarity of the proportional difference described in (i) strongly suggests that patrilineal and matrilineal wealth overlap to a great extent; the lion's part of grandparental wealth is captured by only one lineage. Hence, condition (i) shows that patrilineal wealth adds a small but non-negligible portion to the wealth effects that according to condition (ii) is not washed out with the cousin fixed effect. That is, precisely as suggested in the example in 2.1, we find empirical evidence that the patrilineal grandparental wealth contributes to our overall grandparental wealth measure

[15] Since these measures are rank scores, the coefficients are directly comparable and do not depend on the change in scales when the two lineages are merged.

by helping to differentiate within levels of matrilineal wealth. The cousin fixed effect, in contrast, chiefly captures confounding factors and not the patrilineal wealth contribution itself. Our results thus suggest that the benefit of ruling out unobserved factors through a cousin fixed effect comes at quite low costs in terms of not fully capturing grand-parental wealth from both lineages.

Appendix B. Marginal structural models

The problem to be resolved in our study is the need to control for variables that are on the causal path between grandparental wealth and children's educational outcomes, such as parental wealth, while these same controls may induce over-control and collider bias (Elwert and Winship 2014): Over-controlling essentially means that variance that originates in grandparent's wealth position is mistakenly ascribed to other control variables. Collider bias describes the role of unobserved factors in impacting the outcome through their association with control variables, such as parental wealth, once the latter are conditioned on. Traditional mediation analyses, where the effects of causally prior variables are divided into direct vs. indirect effects by controlling vs. not controlling for the causally subsequent mediators rest on the strong assumption that all unobservables are orthogonal to the included mediators. Our application of marginal structural models (MSM) proceeds in a different way: To control for confounders of wealth in each generation, such as other socio-economic characteristics of families, we create weighted pseudo-populations in which wealth is not associated with these other confounders. To do this, we create inverse probability-of-treatment weights (IPTW), which estimate the probability of receiving the actual treatment one has experienced (wealth). Since our estimation problem closely resembles that of Sharkey and Elwert (2011), we also follow their methodological choice: the individual level weights for grandparental wealth deciles are derived from an ordinal logistic regression of grandparental wealth deciles on grandparental socio-economic characteristics, and weights for parent wealth deciles from an ordinal logistic regression of parental wealth deciles on grandparents' wealth, grandparents' socio-economic characteristics, and parents' own socio-economic characteristics.[16] The final weights are then the predicted probabilities of being in the observed wealth decile for grandparents and parents multiplied across the two each generations: [17]

$$W_{IPT} = 1/[P(Wealth_{GP}|SES_{GP}) \times P(Wealth_{P}|SES_{P},Wealth_{GP},SES_{GP})] \quad \text{(eq. 1)}$$

[16] We also run tests based on more detailed wealth categories (20 and 40) and more flexible multinomial models and the results are essentially the same. These results also do not deviate markedly from our linear regression models where we use the full continuous rank of wealth.

[17] As a reminder, our use of MSM is targeted at estimating total three-generational wealth effects. The adjustments for other socio-economic characteristics are based on the same intuition found in two-generational studies of wealth effects, namely that other socio-economic characteristics are controlled for to tease out the independent influence of parental wealth. This intuition also implies that these other socio-economic characteristics are causally prior to wealth, which we consider a defensible assumption. To the extent that, instead, wealth is causally prior to the other socio-economic measures included here (education, occupation, and income), controlling for the latter would introduce over-control bias in the wealth effect estimates within both generations.

This weighting procedure tends to decrease statistical precision substantially, so we make use of stabilized weights as a remedy (Robins, Hernán and Brumback 2000). Stabilized weights are computed by exchanging the unit numerator in eq. 1 with the unconditional probability of observed wealth levels [$P(Wealth_{GP}) \times P(Wealth_{P})$], reducing variability in the weights and improving efficiency. The outcome equation we then estimate is a standard linear equation of the form

$$Y = a + b_1 \times \text{Grandparental Wealth} + b_2 \times \text{Parental Wealth} \qquad \text{(eq. 2)}$$

weighted by the stabilized IPTW. The total wealth effect is captured by $b_1 + b_2$, and the contribution of each generation by b_1 and b_2, respectively. We note that, for our MSM models, we are required to adjust our estimation strategy in two ways: First, we need to drop the cousin fixed effect control for patrilineal lineages (since the MSM weighting strategy yet cannot incorporate within-unit estimation and the combination of both strategies awaits further methodological development). Doing so may introduce some upward bias in the MSM estimates, though our prior FE models are informative about the extent of that bias. Second, we analyze wealth in terms of discrete treatments using wealth deciles, again reflecting the need for further methodological development that would allow implementing dose-response treatment effect specifications into an MSM framework.

Table A 1. The distribution of wealth

Percentile	Net worth	Financial	Home	Net home (Home – Debt)	Real (excl. home)	Net real (Real – Debt)	Debt
Parents							
10	-191	3	0	0	0	-161	88
25	23	19	384	0	0	-2	274
50	467	79	839	215	0	0	544
75	1,295	249	1,478	684	197	141	889
90	2,653	623	2,326	1,331	887	767	1,366
95	3,895	1,041	3,001	1,856	1,694	1,489	1,779
99	7,518	2,498	4,586	3,071	4,456	3,840	3,065
Grandparents [a]							
10	-1	3	0	0	0	-24	0
25	121	35	0	0	0	0	0
50	579	167	324	183	0	0	28
75	1,402	494	807	607	81	66	206
90	2,600	1,065	1,450	1,169	546	507	466
95	3,639	1,614	1,945	1,613	1,017	961	676
99	6,666	3,413	3,046	2,577	2,553	2,403	1,279

Note: Wealth values are in thousand SEK in 2003 prices (1 USD ≈ 7.3 SEK; December 2003). [a] These figures refers to maternal grandparents only. This delimitation is done in order to achieve wealth measures based on approximately the same number of adults in each generation.

Table A 2. Correlations between grandparents' and parents' wealth and SES

		a	b						
a	Ps' net worth, rank	1							
b	GPs' net worth, rank	0.40	1						
		c	d	e	f	g	h	i	j
c	Ps' financial wealth, rank	1							
d	Ps' home wealth, rank	0.49	1						
e	Ps' real (not home) wealth	0.33	0.14	1					
f	Ps' debt, rank	0.16	0.65	0.16	1				
g	GPs' financial wealth, rank	0.46	0.34	0.19	0.14	1			
h	GPs' home wealth, rank	0.17	0.28	0.03	0.20	0.43	1		
i	GPs' real (not home) wealth	0.12	0.10	0.13	0.08	0.31	0.24	1	
j	GPs' debt, rank	-0.16	0.01	-0.08	0.16	-0.01	0.49	0.22	1
		k	l	m	n	o	p		
k	Ps' financial wealth, rank	1							
l	Ps' net home wealth, rank	0.50	1						
m	Ps' net real wealth, rank	0.47	0.46	1					
n	GPs' financial wealth, rank	0.46	0.34	0.29	1				
o	GPs' net home wealth, rank	0.24	0.28	0.16	0.47	1			
p	GPs' net real wealth, rank	0.17	0.12	0.17	0.37	0.31	1		
		q	r	s	t				
q	GPs' net worth, rank	1							
r	GPs' education value, rank	0.33	1						
s	GPs' occupation value, rank	0.34	0.59	1					
t	GPs' perm. income, rank	0.35	0.49	0.39	1				

Note: Panels c-j display underlying raw wealth measures, including debt, used to compute the net wealth measures in panels k-p that are used in the regressions. P = parents, GP = grandparents.

Table S 1. Regression of grandchildren's GPA on different specifications of grandparental wealth

	(1)	(2)	(3)	(4)	(5)	(6)
All GPs' net worth rank	0.2363***		0.1502***		0.1221***	
Maternal GPs' net worth rank		0.1909***		0.1204***		0.0969***
Gender, immigration, birth year (C, P, GP)	Yes	Yes	Yes	Yes	Yes	Yes
GP SES			Yes	Yes	Yes	Yes
GP divorced/es			Yes	Yes	Yes	Yes
Cousin FE					Yes	Yes
# Individuals	968,895	968,895	968,895	968,895	968,895	968,895
# Grandparent FE					434,779	434,779
Adjusted R2	0.145	0.1318	0.1794	0.1757	0.0872	0.0881

Table S 2. Influence of aunts'/uncles' wealth on GPA rank

	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample	w/ aunts/uncles		Full sample	w/ aunts/uncles	
All GPs' net worth, rank	0.1183***	0.1206***	0.1213***	0.0457***	0.0470***	0.0366***
All GPs' education value, rank	-0.0363***	-0.0351***	-0.0340**	-0.0282**	-0.0265**	-0.0250**
All GPs' education value, rank squared	0.1228***	0.1224***	0.1225***	0.0675***	0.0654***	0.0496***
All GPs' occupation value, rank	0.0414***	0.0413***	0.0424***	0.0180***	0.0175***	0.0107**
All GPs' perm. income, rank	0.0352***	0.0361***	0.0352***	-0.0011	-0.0012	-0.0092*
Aunts'/uncles' net worth, rank			-0.0042			0.0203***
Aunts'/uncles' education value, rank			0.0219***			0.0321***
Aunts'/uncles' occupation value, rank			0.008			0.0325***
Aunts'/uncles' perm. income, rank			0.007			0.0031
Uncle's cognitive ability, rank			-0.0641***			0.0313***
Uncle's non-cognitive skills, rank			-0.0201***			0.0218***
Ps' net worth, rank				0.0966***	0.0975***	0.1008***
Ps' education value, rank				0.2084***	0.2075***	0.2039***
Ps' occupation value, rank				0.0865***	0.0863***	0.0932***
Ps' non-employment, ranks				-0.0079	-0.0075	-0.003
Ps' non-employment, rank squared				-0.0665***	-0.0663***	-0.0667***
Ps' perm. income, rank				-0.0080*	-0.0064	-0.0019
Fathers' Cog. ability, rank				0.0771***	0.0770***	0.1007***
Fathers' Non-cog. skills, percentiles rank				0.0326***	0.0326***	0.0457***
Gender, immigration, birth years, deaths	Yes	Yes	Yes	Yes	Yes	Yes
GP divorce	Yes	Yes	Yes	Yes	Yes	Yes
Cousin fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
P divorce	Yes	Yes	Yes	Yes	Yes	Yes
School characteristics	No	No	No	Yes	Yes	Yes
# Individuals	1,010,584	806,052	806,052	1,010,584	806,052	806,052
# Grandparent FE	448,931	340,477	340,477	448,931	340,477	340,477
Adjusted R2	0.0863	0.0868	0.0881	0.1304	0.1365	0.138

Note: Statistical significance levels at * p<.05, ** p<.01, and *** p<.001 based on two-tailed tests, standard errors adjusted for clustering within patrilineal grandparents.