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Abstract
This paper analyzes the effects of grandparents' economic, cultural, and social capital on grandchildren's educational success. We analyze data from Denmark and hypothesize that grandparents' economic capital should be of little importance in the Scandinavian context, while their cultural and social capital should be relatively more important. Our results partly confirm these hypotheses since, after controlling for parents' capital, we find that grandparents' cultural capital (but not their economic and social capital) has a positive effect on the likelihood that grandchildren choose the academic track in upper secondary education over the vocational track or no education. These results suggest that, at least in the Scandinavian context, the ways in which grandparents affect grandchildren's educational success is via transmission of non-economic resources.

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Introduction

In recent years research on family background and children's educational and socioeconomic success has begun adopting a multi-generation approach. This new approach is motivated by growing empirical evidence that, in addition to parents, other family members such as grandparents and aunts and uncles also affect children's outcomes. This new evidence challenges the two-generation approach (e.g., Bourdieu 1977; Becker and Tomes 1986) prevalent in social stratification research, which argues that parents affect children but in which there are no direct transmissions from other family members (Björklund and Salvanes 2010; Mare 2011).

Inspired by Bourdieu, this paper adds to existing multi-generation research by empirically measuring grandparents' economic, cultural, and social capital and by analyzing the effect of these three forms of capital on grandchildren's choice of secondary education. We analyze three-generation data from Denmark which include empirical measures of economic, cultural, and social capital for the parents and grandparents of the respondents whose educational choices we study.

Our main hypothesis is that the three forms of capital differ in their impact on grandchildren's educational success. Grandparents' economic capital should be of little importance for grandchildren's educational success in Denmark because this country is characterized by low income inequality, free education, and a comprehensive social security system. By contrast, the Danish secondary education system is highly stratified, which means that grandparents' cultural and social capital could affect grandchildren's educational success. Danish secondary education consists of two tracks: an academic track and a vocational track. The academic track, upper secondary education, offers a very academically oriented curriculum in which children who possess cultural capital are especially likely to succeed (Jæger and Holm 2007). If grandparents inculcate cultural capital in children over and above that provided by parents, we expect grandparents' cultural capital to have positive effect on the likelihood that grandchildren succeed in upper secondary education.

Students who chose vocational education must find an apprenticeship position with an employer in order to complete their education. Consequently, students and their families need to be well-connected because successful completion of the vocational track is contingent upon students finding an apprenticeship position.

The main contribution of this paper is that we distinguish the three different types of capital in the grandparent and parent generations and analyze the effects of these capitals on educational outcomes in the grandchild generation. Previous multi-generation research has only to a limited degree distinguished different types of resources in the grandparent generation. Most studies use grandparents' social class position as a proxy for the available resources in the grandparent generation (e.g., Goyder and Curtis 1977; Beck 1983; Biblarz, Bengtson, and Bucur 1996; Erola and Moisio 2007; Chan and Boliver 2013; Hertel and Groh-Samberg 2014). Other studies include direct measures of grandparents' socioeconomic resources, for example education and income (e.g., Peters 1992; Warren and Hauser 1997; Sacerdote 2005; Loury 2006; Sauder 2006; Lindahl et al. 2011; Zeng and Xie 2011; Wightman and Danziger 2014), while a third group of studies uses data on siblings and cousins to infer about the total effect of the extended family (including grandparents) on children's outcomes (e.g., Jæger 2012; Hällsten 2014). Our data allow us to measure qualitatively different types of resources in the parent and grandparent generations, and in particular non-economic resources such as cultural and social capital which have not been included in previous multi-generation research. Furthermore, because we measure the three types of capital both in the parent and grandparent generations, we are able to control for indirect ("Markovian") transmissions of capital from grandparents to parents and to isolate the direct effect of grandparents' capital on grandchildren's educational choices.

Results from the empirical analysis suggest that, net of parents' capital, grandparents' cultural capital has a positive effect on the likelihood that grandchildren choose academic versus a

vocational or no secondary education and, moreover, there are no discernible effects of their economic and social capital on educational choices. We interpret these findings to indicate that, at least in the Scandinavian context, the intergenerational transmission of economic resources appears to follow a Markov process while non-economic resources may operate across multiple generations.

Theoretical Background

Two-Generation Models

Most theoretical models of intergenerational transmissions are two-generation models which focus on the effect of parents on children (or on the effect of mothers and fathers, respectively). In economics, human capital theory proposes that, in addition to transmitting innate endowments to children, parents also invest actively in fostering skills in children that promote educational and socioeconomic success (e.g., Becker and Tomes 1986; Goldberger 1989). Thus, parents are assumed to use their economic and other resources to cultivate productive skills in children, for example academic ability, social skills, and good health, all of which facilitate long-term success. In sociology, cultural and social capital theory argues that, in addition to economic resources, parents also use different types of non-monetary resources to promote children's educational success (e.g., Bourdieu 1977; Coleman 1990).

Bourdieu (1977, 1986) proposed a theoretical framework for conceptualizing the different types of resources that parents do (or do not) possess and which may directly or indirectly affect children's educational success. The main types of resources are economic, cultural, and social capital. *Economic capital* refers to monetary assets such as income, wealth, property, and other material possessions. *Cultural capital* refers to familiarity with dominant cultural codes and to the ability to exploit this familiarity, whether internalized via knowledge and behaviors or objectified

via possession of cultural objects, to one's own advantage. *Social capital* refers to the scope and quality of gainful social networks.

Bourdieu argues that families possess different amounts and compositions of capital and that each type of capital, invested directly or transmitted to children, may yield a comparative advantage in the educational system. Economic capital may be used to finance the direct costs of education, for example tuition fees, or indirect costs such as housing or extracurricular activities. Cultural capital is transmitted from parents to children through socialization, and it contributes to educational success by enabling children to present an impression of academic brilliance in school that is rewarded by teachers. Social capital may promote educational success if parents possess social connections that facilitate access to, for example, prestigious educational institutions or educational tracks that require students to find an apprenticeship position with an employer.

Bourdieu's theory provides a multidimensional approach to conceptualizing the different resources that parents possess and which they invest in order to promote children's educational success. However, like most theories of intergenerational transmissions, Bourdieu's theory focuses on two generations and does not take into account the possibility that other family members, for example grandparents, may also possess resources that directly affect children's outcomes. We now discuss this possibility.

A Three-Generation Approach

In an influential paper Mare (2011) argues that two-generation models may not capture all the different ways in which family background affects children's outcomes. In particular, he highlights that most models of intergenerational transmissions assume a *Markov process* in which endowments and resources are transmitted sequentially from one generation to the next. There is empirical evidence that members of the extended family, and especially grandparents, play an

important role in most children's lives (Hirshorn 1988; Bengtson 2001). There is also evidence that grandparents' resources have a direct effect on child outcomes that may be consequential for long-term success, for example cognitive development (Tinsley and Parke 1987; Modin and Fritzell 2009; Ferguson and Ready 2011) and academic achievement (Falbo 1991; Scholl Perry 1996). Consequently, grandparents may contribute to children's outcomes over and above parents.

In this paper we propose that, in the same way as parents' resources, grandparents' resources may also be conceptualized via Bourdieu's forms of capital. The relative importance of each type of capital in the grandparent generation depends on the institutional setting and on the extent to which the intergenerational transmission of each type of capital follows a Markov process. We illustrate this process in the model in Figure 1 which includes three generations: grandparents, parents and grandchildren.

- Figure 1 here -

Grandparents transmit their economic, cultural, and social capital to parents. This process is illustrated by the dotted arrows in Figure 1. Parents in turn use their capital (some of which is inherited from grandparents) to promote grandchildren's educational and socioeconomic success. This is the process of social reproduction described by Bourdieu. As discussed above, parents may use their economic capital to pay tuition fees, their cultural capital (transmitted to children) to ensure that children have a comparative advantage in the educational system, and their social capital to get their child into a prestigious educational institution or track. All of these investments lead to a higher likelihood of educational success. The question is how grandparents, in addition to transmitting capital to parents, use their remaining (or later acquired) capital to promote grandchildren's success.

We argue that grandparents may use their *economic capital* in two ways. First, in addition to transmitting economic capital to parents (via, for example, *in vivos* loans or others forms of economic transfers), grandparents may also channel economic resources directly to grandchildren (via, for example, savings, gifts or other material possessions). Second, grandparents' economic capital may act as a buffer which protects grandchildren if parents experience adverse social events such as illness or unemployment. There is some empirical evidence to substantiate these ideas since extended families pool economic resources in order reduce the negative consequences of economic shocks (e.g., Altonji, Hayashi, and Kotlikoff 1992; Lacroix, Picot, and Sofer 1998).

Grandparents may also use their *cultural capital* to promote grandchildren's educational success. In Bourdieu's theoretical model the intergenerational transmission of cultural capital principally takes place during childhood (Bourdieu 1977) and, consequently, grandparents have invested in transmitting their cultural capital to parents. In addition to transmitting cultural capital to parents, grandparents may also transmit cultural capital directly to grandchildren. Research shows that children spend a lot of time with grandparents during childhood (Bengtson 2001). During this time grandparents may try to inculcate cultural capital in grandchildren, for example by providing a stimulating cultural environment or by organizing cultural activities (for example trips to the theater or extracurricular activities). Moreover, grandparents may also act as cultural role models in ways that shape grandchildren's cultural tastes and preferences and, in the longer run, their educational choices (Kohn 1977; Kohn and Slomczynski 1990).

Finally, grandparents may use their *social capital* to promote children's educational success. In addition to transmitting social capital to parents (e.g., Weiss 2012), grandparents may also possess social connections (possibly acquired after those initially transmitted to parents) that could help grandchildren. For example, grandparents may know the right people in school admissions board or those in charge of extracurricular activities that signal high academic potential (Picou and

Carter 1976; Sandefur, Meier, and Campbell 2006). Although the role of social capital in generating educational success is rather indirect in Bourdieu's theory, our data include indicators of social capital that directly capture if grandparents have social connections that are potentially gainful with regard to educational success.

This section has presented several channels through which grandparents' economic, cultural, and social capital could have a direct effect on grandchildren's educational success. The relative importance of these direct channels depends on, one the one hand, the strength of the indirect, Markovian transmission of capital from grandparents to parents and, on the other hand, on the institutional context. We now turn to these questions.

Institutional Context and Hypotheses

The institutional context of this study is secondary education in Denmark. This country, which belongs to the Scandinavian mobility regime (DiPrete 2002), is characterized by a high level of income redistribution, free education, and a universal social security and health care system. We argue that in this institutional context some types of capital are more valuable than others with regard to promoting (grand)children's educational success.

The combination of a high level of income redistribution, free education and generous and non-means tested educational grants means that parents' and grandparents' *economic capital* should be of little importance for children's educational success. The main reason for this hypothesis is that it is difficult to convert economic capital into direct educational advantage. One possibility would be to send children to a private elementary school.[1] The proportion of students who attend private

[1] Private elementary schools in Denmark receive a state subsidy which covers around 85% of the normal costs of running the school. Parent fees cover the remaining 15%. There are practically no private secondary or higher education institutions in Denmark.

elementary schools in Denmark is low (around 15%), and on average private schools do not produce better academic performance than public schools (most private schools focus on alternative pedagogical principles rather than on academic achievement). Thus, there is no long-term pay-off with regard to academic performance by sending children to a private school and, consequently, there is little reason to expect parents' and grandparents' economic capital *in itself* to lead to a higher likelihood of educational success. Previous research provides some support for this assertion as social class differences in educational attainment in Denmark are only to a limited extent attributable to differences in parents' economic resources (e.g., Davies et al. 2002; Jæger and Holm 2007).

In contrast to economic capital, we hypothesize that in the Danish context non-monetary resources such as *cultural* and *social capital* should be relatively more important for children's educational choices. The motivation underlying this hypothesis is that the Danish educational system is highly internally stratified and path-dependent. Upon completion of nine years of elementary school at approximately age 15, students must choose between either leaving school or entering one of two tracks in secondary education: vocational education and upper secondary education.

Vocational education (for example, plumber, electrician, and hairdresser) typically takes three or four years and combines school-based training with an apprenticeship position with an employer. In most cases students enter the labor market directly upon completing their vocational education, often getting their first job with the employer with whom they served as an apprentice. Vocational education does not provide eligibility for higher education, for example at university, and credentials earned in the vocational education system cannot be transferred to other types of secondary (or higher) education. What is special about vocational education in Denmark is that in order to successfully complete a vocational education the student must find an apprenticeship

position with an employer. Vocational education institutions can sometimes help the student find an apprenticeship position, but if the student is unable to find an apprenticeship position he or she will not be able to complete their vocational education.[2] This institutional setup means that having social connections that can help with finding an apprenticeship position is crucial for students who enroll in vocational education programs. Based on these considerations, we expect parents' and grandparents' social capital, and especially social connections with employers who could provide an apprenticeship position for grandchildren, to have a positive effect on educational success in vocational education. Moreover, we expect grandparents' social capital to be potentially as important as parents' social capital because, in addition to transmitting social capital to parents, grandparents may have cultivated new social connections and networks that could benefit grandchildren.

Upper secondary education is the academic track in Danish secondary education and usually takes three years to complete. There are two types of tracks in upper secondary education: the regular track and three vocationally oriented tracks. Both the regular and the vocationally oriented tracks provide eligibility for higher education at university or University College, but they differ in the curriculum and the types of higher educations that students typically attend upon completing upper secondary education. The curriculum in the regular track is very academically oriented and is directed towards traditional university subjects (mandatory subjects include, for example, science,

[2] Some vocational education institutions offer in-house apprenticeship positions for students who are unable to find a regular apprenticeship position with an employer. Even if offered, in-house apprenticeship positions are less desirable than regular ones for three reasons. First, they do not provide the same "on the job" qualifications as regular apprenticeship positions. Second, they signal that the student, being unable to find a regular apprenticeship position, is a low-quality worker. Third, students in in-house apprenticeship positions receive an educational grant which is lower than the wage offered in a regular apprenticeship position.

foreign languages, history, literature, and art history). The curriculum in the vocationally oriented tracks is more practical and focuses on, for example, technical subjects (mechanical engineering, IT, physics, etc.) or mercantile ones (accounting, business economics, math, etc.). Successful completion of both tracks in upper secondary education, and especially the regular track, depends to a considerable extent on possessing cultural capital (Jæger and Holm 2007; Jæger 2009). Both tracks have an explicitly academic curriculum and, consequently, mastering the cultural codes in these educational environments means having an important comparative advantage. Consequently, we expect that students from families in which parents and grandparents possess much cultural capital have a higher likelihood of choosing upper secondary education over vocational or no education. We also expect that, within upper secondary education, those who come from families who possess more cultural capital will be more inclined towards choosing the regular (and very academically oriented) track over one of the vocationally oriented tracks. The reason why is that returns to cultural capital are arguably higher in the regular track than in the vocational tracks because the curriculum and the learning environment in the regular track is more geared towards appreciating and rewarding cultural capital. Another reason why cultural capital is particularly important in upper secondary education in general, and in the regular track in particular, is that the Grade Point Average (GPA) from upper secondary education (whether the regular or the vocationally oriented tracks) is the single most important factor which determines eligibility for higher education.[3] Consequently, having a high GPA is instrumental for getting into a prestigious

[3] Almost all higher education institutions admit students solely in the basis of their GPA from upper secondary education and, as a consequence, extracurricular activities or non-academic merits play little or no role in admission. Furthermore, unlike in some other countries, students in Danish upper secondary education cannot improve their GPA after having completed upper secondary education, for example by (re)taking courses or doing extra credit coursework. This means that the student's GPA must be maximized while in school.

university program and, holding academic ability and other factors constant, possessing cultural capital could help students obtain a higher GPA.

In summary, we hypothesize that the different types of capital yield different returns when students choose among different options in Danish secondary education. We hypothesize that parents' and grandparents' economic capital should have little direct effect on children's choice of secondary education, while their social and cultural capital should matter. Students whose parents and grandparents possess social capital should be more likely to prefer vocational education over no education because social connections might help them find an apprenticeship position. These social connections should not matter with regard to being successful in more academically oriented types of secondary education. Moreover, we argue that parents' and grandparents' cultural capital has a positive effect on the likelihood that grandchildren choose upper secondary education over vocational or no education. We also argue that because returns to cultural capital are higher in the regular (academic) track in upper secondary education than in the vocationally oriented tracks, students from families who possess more cultural capital should also prefer the regular track over the vocationally oriented tracks. Grandparents' cultural capital may have a direct effect on grandchildren's educational decisions if, in addition to transmitting cultural capital to parents, they also provide a culturally stimulating learning environment for grandchildren and instill norms about the social desirability of choosing an academically oriented education.

Data and Variables

Data

We analyze data from the Danish Longitudinal Survey of Youth (DLSY). The DLSY is an ongoing cohort study of 3,151 individuals born in or around 1954. The respondents in the DLSY were first interviewed in 1968 when they were around 14 years old and have since been interviewed in 1970,

1971, 1973, 1976, 1992, 2001, and in 2004 when they were around 50 years old. Response rates have remained high over time, with around 75% percent of the original sample members being interviewed in the latest round of data collection (2004). In addition to the main DLSY respondents, the DLSY also includes a separate survey with the parents of the DLSY respondents (carried out in 1969) and a survey which samples all children born to all DLSY respondents (carried out in 2010). In total, we have information on three generations from in the same family: grandparents (born around 1925-1935), parents (born around 1954), and grandchildren (born around 1975-1985).

We analyze the choice of secondary education for the grandchild generation. The response rate in the grandchild survey which was carried out in 2010 is 82% (see Jæger 2011). We use the DLSY because it includes, first, three generations from the same family, second, information on choice of secondary education for grandchildren and, third, empirical indicators of economic, cultural, and social capital for both the parent and grandparent generations (empirical indicators are presented below). This information allows us to analyze if there is a direct effect of grandparents' capital on grandchildren's educational choices net of parents' capital. It should be kept in mind that we do not observe economic, cultural, and social capital for both maternal and paternal grandparents, but only for one set of grandparents: the parents of the main DLSY parent. As a consequence, we cannot analyze all the potential effects of grandparents on grandchildren. We only include grandchildren age 18 and older, which leaves a sample of 2,383 respondents. Table 1 provides summary statistics on all variables included in the analysis.

– Table 1 here –

Dependent Variable

Our dependent variable is grandchildren's choice of secondary education at the end of elementary school (at around age 15). We distinguish the following four ordered educational categories: (1) no education beyond elementary school; (2) vocational education; (3) vocationally oriented upper secondary education; and (4) regular upper secondary education. Table 1 shows the distribution of educational choices in the data, which is roughly similar to that observed in the population (we have a slight overrepresentation of highly educated grandchildren because these respondents are more likely than low-educated respondents to participate in surveys). As explained below, we treat the variable measuring educational choice as an ordinal variable that captures the relative ordering of the different educational alternatives with regard to difficulty, social status, and expected economic returns.

Explanatory Variables

We use two batteries of explanatory variables in the analysis. The first battery is a set of empirical items used to capture economic, cultural, and social capital in the parent and grandparent generation. With few exceptions, we use the same indicators in both generations and, as discussed in more detail below, we conceptualize the different forms of capital as latent variables. The second battery is a set of control variables pertaining to the grandchild generation (demographic characteristics and cognitive ability).

We include three empirical indicators of *economic capital*: (1) household income, (2) car ownership, and (3) summer house ownership. Our measure of household income in the grandparent generation is total gross income for the main provider in the family in 1967 measured in thousands of Danish Kroner (DKK). In most cases the main provider in the family is the father. The income data are from administrative registers rather than from the survey data. In the parent generation our measure of household income is the combined gross earnings of the DLSY respondent and his or

her spouse (if any) in 1992. If information on income is missing in 1992, we impute missing information using income data from the 2001 wave. Our measure of car ownership is a dummy variable coded 1 if (grand)parents report owning their own car and 0 otherwise. Information on whether grandparents owned their own car was provided by the DLSY respondents in the 2001 wave. Finally, our measure of summer house ownership is a dummy indicating whether (grand)parents own(ed) their own summer house (i.e., a second holiday home).

We include three empirical indicators of *cultural capital*: (1) educational attainment, (2) newspaper subscription, and (3) participation in classes or courses. Our measure of educational attainment measures years of completed schooling for the (grand)parent with the highest educational attainment. Information on grandparents' educational attainment was obtained from the 1969 wave, while information on parents' educational attainment was obtained from the 1992 wave. Missing information on parents' educational attainment in 1992 was imputed based on their reported educational attainment in 1973. Our second measure of cultural capital is a dummy variable indicating if (grand)parents subscribe(d) to a daily newspaper. Information on grandparents was provided by parents in the 2001 wave. Our third measure of cultural capital is a dummy variable indicating if (grand)parents regularly participate(d) in classes and courses in their leisure time (for example, lectures or arts/crafts classes). Information on grandparents is from the 1969 wave, while information on parents is from the 1992 wave.

We include three indicators of *social capital* capturing if (grand)parents have social connections or contacts that could (1) help with finding an apprenticeship position; (2) help if a child wanted to study or work abroad; and (3) give advice on choice of education. In the 2001 wave parents were asked if they possessed the types of social connections described above. For each indicator, parents could either reply "yes" (coded 1) and "no" (coded 0). In the 2004 wave parents were asked to respond to the same questions, but this time on behalf of their parents. Consequently,

the empirical indicators of social capital for the grandparent generation are retrospective and pertain to social connections that could help the parent generation. Although our indicators of grandparents' social capital do not refer to the grandchild generation, we interpret these indicators as proxies for whether grandparents possess social connections that could benefit grandchildren.

In addition to these indicators of (grand)parents' capital, we also include three control variables pertaining to grandchildren. These controls are sex (dummy variable for women), age in years, and the respondent's score on a cognitive ability test.[4]

Empirical Setup

We now present the empirical strategy. First, we discuss how we model the effect of grandparents' economic, cultural, and social capital on grandchildren's choice of secondary education. Second, we discuss how we conceptualize the different types of capital as latent variables.

The aim of the empirical analysis is to analyze the effect of grandparents' capital on grandchildren's choice of secondary education. We treat the variable measuring educational choice as an ordered variable that captures the increasing academic demands, social status, and future economic returns associated with the four different options. No education after elementary school is associated with a high risk of low income and a low-status occupation in adulthood. Vocational education yields higher economic and social returns than no education, while upper secondary education, complemented with some type of higher education, is associated with the highest likelihood of ending up in a high-income and high-status occupation. Also, within upper secondary education the regular track is more academically demanding than the vocationally oriented tracks

[4] The cognitive ability test is a sub battery of the IST (Intelligence Structure Test) 2000R test. This test is similar to the Raven Progressive Matrices test and measures general cognitive ability. It is scored 0-20.

and is more often associated with subsequently enrolling in prestigious and high-return university programs (law, medicine, etc.) with high future returns (Holm et al. 2013).

We use two versions of the ordered logit model to analyze the effect of grandparents' capital on grandchildren's educational choice. First, we use the standard ordered logit model (e.g., Long 1997). This approach provides baseline estimates of the effect of grandparents' economic, cultural, and social capital on the likelihood that grandchildren choose a higher rather than a lower level of secondary education. Second, we use the generalized ordered logit model (William 2009) to analyze in more detail if grandparents' capital makes some educational options more likely than others. Although we think of the four educational categories as a reflecting a hierarchy of educational outcomes with increasing difficulty and returns, it may be that the different types of capital possessed by grandparents "push" grandchildren from lower to higher educational categories at a different pace. Previously, we motivated such differences in "push" by arguing that grandparents' economic capital should matter little for grandchildren's educational choices in general; their cultural capital should have a particularly strong effect on the likelihood of being "pushed" from no education or vocational education to one of the upper secondary education tracks; and their social capital should have a particularly strong effect on the likelihood of being "pushed" from no education to vocational education (but should have little effect on the likelihood of being "pushed" further into higher educational levels).

We operationalize the idea that the different types of capital "push" at different ends of the ordered scale measuring educational outcomes by testing for non-proportional odds for the effect of grandparents' capital on grandchildren's educational choice. Non-proportional odds mean that the effects of grandparents' capital differ across the ordered categories of the dependent variable or, in other words, grandparents' capital "push" grandchildren from lower to higher educational categories at a different pace. The generalized ordered logit model allows us to test for non-

proportional odds and to estimate the effect of grandparents' capital on the three thresholds in the (generalized) ordered logit model (threshold 1: no education beyond elementary school → vocational education; threshold 2: vocational education → vocationally oriented upper secondary education; threshold 3: vocationally oriented upper secondary education → regular upper secondary education).[5]

In addition to ordered logit models, we also use Principal Component Analysis (PCA) to construct empirical measures of economic, cultural, and social capital. We have three observed indicators of each type of capital in each generation (see Table 1). In line with Bourdieu (1984, 1986), we think of the different types of capital as latent variables and, based on PCA models run on the set of items used to capture each type of capital, we estimate an observed variable for each type of capital which captures (grand)parents relative position within the distribution of capital (each variables is standardized to have mean zero and standard deviation one). We estimate the factors individually for each generation using the Stata routine polychoricpca (Kolenikov, S., and Angeles, G. (2004). Table A1 provides summary information on the results from the PCA models.

Finally, as our data include siblings in the grandchild generation and we adjust all standard errors for clustering of respondents (grandchildren) within families (parents).

Results

We present the empirical results in two sections. In the first section we present baseline results for the effects of parents' and grandparents' economic, cultural, and social capital on grandchildren's choice of secondary education. In the second section we test for non-proportional odds and analyze

[5] We use the Stata ado program "gologit2" to estimate the generalized ordered logit models (Williams 2009). We use the implementation of the Brant test in the ado "Spost 9" to test for non-proportional odds in the standard ordered logit model.

the extent to which grandparents' capital "push" grandchildren from lower to higher educational levels at a different pace.

Table 2 presents results from ordered logit regressions of grandchildren's educational choice on grandparents' and parents' economic, cultural, and social capital. The table shows results from four model specifications: Models M1 and M2 are ordered logit models which do (M2) and do not (M1) include parents' capital while models M3 and M4 are generalized ordered logit models with the same variables and in which the effects of grandparents' and parents' economic capital as well as the controls (grandchildren's sex, age, and cognitive ability) are allowed to vary across the thresholds in the ordered logit model.

– Table 2 here –

The baseline model M1 includes grandparents' capital and the controls. In this model, grandparents' cultural capital has the expected effect on grandchildren's educational choice, as we find a positive effect of grandparents' cultural capital on the likelihood of choosing a higher rather than a lower level of secondary education. None of the other types of capital are significant.

In model M2 we include the variables capturing parents' economic, cultural, and social capital. The idea in this model is to control for Markovian transmission of capital from grandparents to parents and to isolate the direct effect of grandparents' capital on grandchildren's educational choices. Parents' economic and cultural capitals have the expected effects on grandchildren's educational choices, although parents' economic capital is only marginally significant ($p < 0.10$). Grandchildren whose parents have higher levels of economic and cultural capital are more likely to choose upper secondary education rather than vocational or no education. Furthermore, we find that the coefficient on parents' social capital is positive but not statistically significant.

Returning to the effects of grandparents' capital in M2, we find that grandparents' cultural capital remains positive and statistically significant after we control for parents' capital. The average marginal effect (AME) of increasing grandparents' cultural capital by one unit (in this case one standard deviation) increases the probability of grandchildren choosing the general upper secondary track by 4.5 percentage points. These results indicate that grandparents' cultural capital, for example capital which manifests in a culturally stimulating family environment, has a direct effect on grandchildren's educational choices over and above that provided by parents. As before, grandparents' social capital has no effect.

The overall impression from the initial empirical analysis is that among the three forms of capital only grandparents' cultural capital has a direct effect on grandchildren's choice of secondary education. In the next sections we present a more detailed analysis and attempt to quantify the effect of grandparents' (cultural) capital on grandchildren's educational choices. This analysis is motivated by our hypothesis that grandparents' capital may not be equally important for all educational decisions.

The ordered logit model used in M1 and M2 assumes that the conditional odds of moving from a lower to a higher category on the dependent variable are the same across all levels of the dependent variable. This is the same as saying that the effect of grandparents' capital on grandchildren's educational choices is the same across all educational levels. The generalized ordered logit model relaxes this assumption by estimating the effect of grandparents' capital for each transition from a lower to a higher educational level.

Table 2 also summarizes *p*-values for Brant tests of the assumption of proportional odds carried out jointly for all the indicators of grandparents' capital (bottom of table) and for each

indicator separately (results from Brant tests shown next to variable label).[6] The *p*-values for the overall Brant test for M3 ($\chi^2 = 112.76$, df = 12, $p = 0.000$) and M4 ($\chi^2 = 135.75$, df = 18, $p = 0.000$) are both statistically significant, thus indicating that the assumption of proportional odds is violated. Models M3 and M4 in Table 2 are generalized ordered logit models in which we allow the effects of the variables which violates the non-proportional odds assumption to vary (i.e., to have none-proportional odds) across the four levels of our ordered dependent variable. In M3 we allow the effect of the controls to vary, while we in M4 allow the effects of parents' economic capital (and the controls) to vary across thresholds.

The substantive results from M4 are similar to those from M2. Grandparents' cultural capital still has a highly significant positive effect on grandchildren's educational choice even after we control for parents' capital, which suggests that children whose grandparents possess more cultural capital are more likely to choose an academically oriented track in secondary education compared to children whose grandparents possess less cultural capital. We gauge the substantive importance of this effect below. Grandparents' economic capital remains insignificant in M4. Parents' economic capital was marginally significant in M2, but in M4 we find that parents' economic capital has a highly significant positive effect on the likelihood of choosing the vocational track over no education and a significant positive effect on the likelihood of choosing one of the vocationally oriented upper secondary tracks over vocational and no education. This result suggests that parents' economic capital "pushes" at different paces on the thresholds. Parents' and grandparents' social capital are both insignificant.

[6] The Brant test is based on a series of (in our case three) binary logit models of the probability of belonging to a particular or a higher category of the dependent variable. In these models each explanatory variable has a separate regression coefficient, and the Brant test is a test of whether these coefficients vary in a statistically significant manner across the binary logit models. The assumption of proportional odds is equivalent to assuming that the coefficients (which express the log of the odds of belonging to a higher versus a lower category) do not vary across models.

In the last part of the analysis we attempt to quantify the empirical results. The regression coefficients in Table 2 say little about the substantive effects of grandparents' and parents' capital on grandchildren's educational choices. Table 3 summarizes estimates of AMEs for each of the variables capturing grandparents' and parents' capital that are statistically significant in M4. The AMEs capture the percent wise change in the proportion of grandchildren in each educational alternative as a function of a change of one unit in each type of capital (and averaged over the entire sample), while holding other factors constant.

– Table 3 here –

The AMEs provide an interesting quantification of the effects found in M4. We find that grandparents' cultural capital has a substantive effect on grandchildren's educational choices. Table 3 shows that increasing grandparents' cultural capital by one unit (and holding all other variables constant) leads to an increase of 4.7 percentage points in the proportion of grandchildren who choose the regular track in upper secondary education. This is a nontrivial effect. In comparison, an increase in parents' cultural capital of one unit increases the proportion of children who choose the regular upper secondary track by 11 percentage points. So, in relative terms it seems that the effect of grandparents' cultural capital is just under half of that of parents' cultural capital. In line with our theoretical framework, we interpret this effect to capture that children from families in which (parents and) grandparents possess cultural capital may be more comfortable with enrolling in academically challenging (but also potentially more rewarding) tracks in secondary education compared to children from less culturally endowed families.

Discussion

In this paper we analyze the effect of grandparents' economic, cultural, and social capital on grandchildren's choice of secondary education. The paper is motivated by Bourdieu's conceptualization of family resources as qualitatively different types of capital and by previous multi-generation research suggesting that socioeconomic resources in the extended family affect children's outcomes. Its main contribution is that it includes direct measures of economic, cultural, and social capital both in the grandparent and parent generation, which means that we can isolate the direct effect of grandparents' capital on grandchildren's educational choices net of parents' capital. We hypothesize that grandparents' economic capital should be of comparatively little importance in the Danish context, which is characterized by a high income redistribution, free education, and comprehensive social security. By contrast, the compartmentalized and highly path-dependent structure of Danish secondary education means that grandparents' cultural and social capital should be more useful resources.

Our empirical results confirm theoretical expectations to some extent. We find that grandparents' economic and social capital have no discernible effects on grandchildren's educational choices. We find, however, that children whose grandparents possess much cultural capital are more likely to enroll in the academically oriented track in upper secondary education than in other types of education (or no education). This result fits theoretical expectations. One explanation of this effect might be that extended families share cultural and social environments (but not necessarily social networks and income) for extended periods of time, which rubs off on grandchildren. A second reason might be that, from the perspective of grandparents, transaction costs associated with transmitting cultural capital to grandchildren is lower than those associated with maintaining large social networks or accumulating wealth. Finally, it might be that cultural capital, and especially embodied cultural capital, is a latent family trait (possibly transmitted via genetic endowments and environmental influences) that is transmitted across multiple generations.

We are unable to determine which explanation is correct with the current data, but future research should identify the channels (environments, networks, genes) through which cultural capital operates across multiple generations.

The general message from this paper is that non-monetary resources in the extended family have substantive direct effects across multiple generations. Previous research has mainly focused on the role of grandparents' (socio)economic resources, but our research demonstrates that, at least in the Scandinavian context, "soft" resources in the extended family are more important than "hard" economic resources. Future research should aim to empirically measure more of these "soft" resources (for example, educational aspirations and social environments) in the extended family and assess their long-term consequences for educational and socioeconomic outcomes in the next generations.

Several limitations in the present research should be highlighted. First, our empirical sample is relatively small. Second, our empirical indicators of economic, cultural, and social capital are crude in comparison with how the different types of capital are usually measured in the literature. This limitation arises from the fact that we need empirical indicators that are comparable across generations. Third, we measure economic, cultural, and social capital for only one set of grandparents (the parents of the DLSY respondent). This design means that, due to assortative mating in the parent generation and, as a consequence, the fact that maternal and paternal grandparents' capital is likely to be positively correlated, our results should be considered lower-bound estimates of the total direct effect of grandparents' capital on children's educational outcomes. Notwithstanding these limitations, we think that our paper adds noteworthy new results to the literature on the causes and consequences of multigenerational effects.

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Figure 1. Illustration of Conceptual Framework

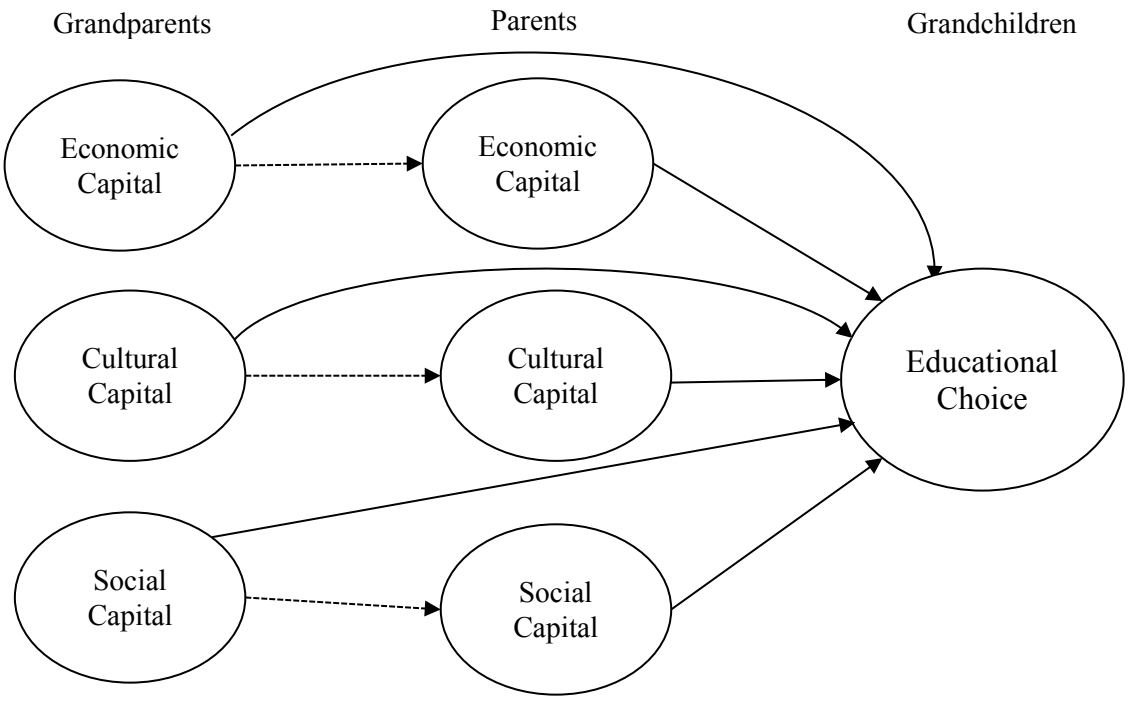

Table 1. Summary Statistics. Means and Standard Deviations

	Share	Mean	SD	Year of measurement*
Grandchildren				
Choice of secondary education		0.87	0.94	2010
1. No education beyond elementary school	0.07			
2.Vocational education	0.18			
3. Vocationally oriented secondary education	0.31			
4. Regular secondary education	0.44			
Sex (female)		0.52	0.50	2010
Age		27.91	4.80	2010
Cognitive ability		9.67	3.33	2010
Grandparents				
Economic capital[a]		*0.00*	*0.93*	
Income		32.17	14.86	1969
Car ownership		0.76	0.43	2001R
Summer house ownership		0.15	0.36	2001R
Cultural capital[a]		*0.00*	*0.94*	
Years of education		9.55	2.63	1969
Newspaper subscription		0.79	0.41	1969
Attends classes		0.17	0.38	1969
Social capital[a]		*-0.01*	*0.85*	
Connections: Apprenticeship		0.30	0.46	2004R
Connections: Work/study abroad		0.06	0.24	2004R
Connections: Educational advice		0.24	0.43	2004R
Parents				
Economic capital[a]		*-0.00*	*0.82*	
Income		32.23	12.67	1992
Car ownership		0.84	0.37	2001
Summer house ownership		0.13	0.33	2001R
Cultural capital[a]		*-0.00*	*1.02*	
Years of education		13.34	2.35	1992
Newspaper subscription		0.67	0.47	1992
Attends classes		0.45	0.50	1992
Social capital[a]		*-0.01*	*0.99*	
Connections: Apprenticeship		0.48	0.50	2001
Connections: Work/study abroad		0.37	0.48	2001
Connections: Educational advice		0.50	0.50	2001

Note: $N = 2{,}383$. * "R" indicates that parents provide retrospective information on grandparents, [a] variable derived from PCA.

Table 2. Results from Ordered and Generalized Ordered Logit Regression Models of Grandchildren's Choice of Secondary Education. Parameter Estimates and Standard Errors in Parenthesis

	Ordered Logit		Generalized Ordered Logit	
	M1	M2	M3	M4
Grandparents				
Economic capital [a]	0.082 (0.052)	-0.004 (0.054)		
NE → VE			0.084 (0.053)	0.000 (0.055)
VE → VSE			0.084 (0.053)	0.000 (0.055)
VSE → RSE			0.084 (0.053)	0.000 (0.055)
Cultural capital	0.310 (0.056)***	0.231 (0.055)***		
NE → VE			0.307 (0.056)***	0.230 (0.055)***
VE → VSE			0.307 (0.056)***	0.230 (0.055)***
VSE → RSE			0.307 (0.056)***	0.230 (0.055)***
Social capital	0.034 (0.053)	-0.013 (0.054)		
NE → VE			0.037 (0.053)	-0.012 (0.054)
VE → VSE			0.037 (0.053)	-0.012 (0.054)
VSE → RSE			0.037 (0.053)	-0.012 (0.054)
Parents				
Economic capital [a]		0.122 (0.064)#		
NE → VE				0.423 (0.104)***
VE → VSE				0.186 (0.075)*
VSE → RSE				0.027 (0.070)
Cultural capital		0.536 (0.052)***		
NE → VE				0.540 (0.052)***
VE → VSE				0.540 (0.052)***
VSE → RSE				0.540 (0.052)***
Social capital		0.004 (0.051)		
NE → VE				0.006 (0.051)
VE → VSE				0.006 (0.051)
VSE → RSE				0.006 (0.051)
Control variables[b]	Yes	Yes	Yes	Yes
N	2,434	2,434	2,434	2,434
P-value for Brant test	0.000	0.000	.	.
Pseudo R^2	0.075	0.107	0.091	0.126
Log Likelihood	-2774.693	-2676.518	-2726.723	-2619.499

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, # $p < 0.10$. $N = 2{,}383$. [a] p-value for Brant test for this variable in M2 is above 0.05, [b] control variables = grandchild's sex, age, and cognitive ability. Abbreviations: NE = No education beyond elementary school, VE = Vocational education, VSE = Vocational oriented secondary education, RSE = Regular secondary education.

Table 3. Summary of Average Marginal Effects for Model M4

	NE	VE	VSE	RSE
Grandparents				
Economic capital	.	.	.	.
Cultural capital	-0.014	-0.020	-0.012	0.047
Social capital	.	.	.	.
Parents				
Economic capital	-0.026	-0.002	0.022	0.006
Cultural capital	-0.034	-0.047	-0.029	0.110
Social capital	.	.	.	.

Note: Abbreviations: NE = No education beyond elementary school, VE = Vocational education, VSE = Vocational oriented secondary education, RSE = Regular secondary education.

Table A1. Summary Information on Principal Factor Analysis. Eigenvalues, Proportion Explained and Factor Loadings of first derived latent factor.

	G1	G2
Economic Capital		
Eigenvalue	1.755	1.492
Proportion explained	0.585	0.497
Factor loadings		
- Income	0.500	0.474
- Car ownership	0.234	0.181
- Summer house ownership	1.009	1.015
Cultural Capital		
Eigenvalue	1.373	1.519
Proportion explained	0.458	0.506
Factor loadings		
- Years of education	0.675	0.632
- Newspaper subscription	0.098	0.317
- Attends classes	1.020	0.458
Social capital		
Eigenvalue	1.946	1.883
Proportion explained	0.649	0.628
Factor loadings		
- Connections: Apprenticeship	0.708	0.490
- Connections: Work/study abroad	0.974	0.548
- Connections: Educational advice	0.783	0.481