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# The Effects of Grandparents on Children's Schooling: Evidence From Rural China

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**Abstract** The issue of whether the social class of grandparents affects grandchildren's socioeconomic outcomes net of the characteristics of the middle generation is much debated in the social mobility literature. Using data from the 2002 Chinese Household Income Project, we investigate the direct effects of grandparents on grandchildren's educational attainment in rural China. We find that the influence of grandparents is contingent on living arrangements. Although the educational level of coresident grandparents directly affects the educational attainment of their grandchildren, with an effect size similar to that of parental education, the education of noncoresident and deceased grandparents does not have any effect. These findings suggest that grandparents can directly affect grandchildren's educational outcomes through sociopsychological pathways. Our study not only adds an important case study to the literature but also sheds new light on theoretical interpretations of grandparent effects when they are found.

**Keywords** Multigenerational mobility · Grandparent effects · Coresidence · Children's education · Rural China

## Introduction

In his presidential address at the 2010 annual meeting of the Population Association of America, Robert Mare (2011) urged demographers to pay more attention to multigenerational processes and influences. He pointed out that research on intergenerational mobility has been limited mostly to studies of two generations—namely, parents and

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their offspring—to the neglect of the effects of grandparents and other extended family members. Mare argued that although the nuclear family–based approach may be appropriate for some specific social contexts (e.g., twentieth century American society), it overlooks the importance of family lineage in generating and maintaining social inequality in general. A potentially fruitful context for studying multigenerational effects is Asia, where the role of the extended family is more prominent than in the West. If multigenerational influences—for example, grandparents' effects on children's educational outcomes—do exist anywhere, we should find them in Asian societies.

Previous research has found that grandparents do not exert significant direct influences on grandchildren's outcomes in Western societies because their influences are completely mediated through the middle generation (e.g., Erola and Moisio 2006; Warren and Hauser 1997). We revisit this research topic by examining the effects of grandparents' education on children's educational attainment in rural China. Our approach departs from prior research in taking the living arrangement of grandparents into account. China is a suitable site for such an approach because of its high rate of multigenerational coresidence. In the Chinese tradition, the ideal family structure is a patrilineal extended household with multiple generations living under the same roof (Bian et al. 1998; Chu and Yu 2010; Chu et al. 2011; Greenhalgh 1985; Lavely and Ren 1992; Thornton and Lin 1994; Whyte 2004; Whyte and Xu 2003). We argue that coresident and noncoresident grandparents are categorically different in their influences on grandchildren. Because coresident grandparents are involved in day-to-day childrearing, they play a prominent parent-like role in their grandchildren's lives (Chen et al. 2011). Conversely, noncoresident grandparents see their grandchildren occasionally and thus can exert only a limited influence on them. To test these hypotheses, we analyze a nationally representative sample of rural children from the 2002 Chinese Household Income Project (CHIP). We find that the effect of coresident grandparents' education on grandchildren's educational attainment is as large as that of parental education, but the education of noncoresident and deceased grandparents has no effect net of parental characteristics. On average, living with grandparents reduces the likelihood of school dropout, but that effect varies substantially with the education of coresident grandparents.

## Do Grandparents Matter?

Sociologists and demographers have long been interested in the question of social mobility—that is, the extent to which a person's socioeconomic standing is determined by his or her family of origin. As Mare (2011) pointed out, this research field is mostly dominated by a two-generation paradigm that views family influence as a Markovian process—the idea that the future generation is independent of its past generations, conditional on the present generation (i.e., depends *only* on the present generation). In other words, grandparents' and grandchildren's social classes are associated only because grandparents influence parents and parents in turn influence their children (the grandchildren). If the intergenerational influence is indeed a Markovian process, the effect of an ancestor from $X$ generations ago can be expressed as the association between two consecutive generations (parents and their children) raised to the $X$th power (Bartholomew 1982). The complicated process of multigenerational family influences can thus be conveniently summarized by a single association.

The available research on intergenerational continuity across three generations, based primarily on the mid–twentieth century American experience, generally supports this Markovian view of grandparent effects. For example, Cherlin and Furstenberg (1986) explored the intergenerational transmission of values and found that grandparents pass on a legacy to their grandchildren if and only if they are successful in transmitting their values to their children. Analyzing data from the Wisconsin Longitudinal Study, Warren and Hauser (1997) examined the association of grandparents' and grandchildren's social statuses. Using structural equation models to account for measurement errors, and after controlling for parents' characteristics, they found that the schooling, occupational status, and income of grandparents had few significant effects on their grandchildren's educational level or occupational status. Erola and Moisio (2006), using Finnish Data and the mobility table approach, arrived at the same conclusion: taking more than two consecutive generations into account adds very little additional explanatory power to the analysis of intergenerational mobility.

A new body of research challenges the traditional Markovian-type models of family influences. For example, after controlling for parental occupations, income, and homeownership, Chan and Boliver (2013) found a net association between grandparents' and grandchildren's occupational classes in England. Jæger (2012), using data from the Wisconsin Longitudinal Study, reported that the education of grandparents exerts a direct effect on the educational success of their grandchildren, but the effect is very small and limited to children raised by the poorest parents. In our view, prior analyses have not adequately conceptualized the mechanisms of grandparent effects. As a result, not enough research effort has been expended on exploring the social context in which multigenerational influences are mostly likely to exist.

To see why grandparents may matter, we borrow from the extensive literature on why parents matter. The literature on parental effects has focused on three causal pathways: biological, economic, and socioemotional (Ermisch 2008; Furstenberg 2011; Heckman 2006, 2011; McLanahan and Percheski 2008; McLanahan and Sandefur 1994; Teachman 1987). If grandparents are found to exert a significant influence on grandchildren after parents' characteristics are controlled for, the causal mechanism cannot be biological because genetic influences are mediated by the middle generation. The main mechanism is unlikely to be economic, either: research on parental effects shows that family income is a very crude proxy of the real determinants of child outcomes, far less important than parenting practices (Costello et al. 2003; Cunha and Heckman 2009). This leaves the socioemotional pathway as the most plausible direct link between grandparents and grandchildren.

Socioemotionally, children can benefit from grandparents in many ways. According to the confluence model (Zajonc and Markus 1975), an influential theory of birth order effects on IQ, children's intelligence is in part determined by the average cognitive level of the people they interact with in the family. An implication of the confluence model is that the presence of grandparents—especially educated grandparents—may enhance a family's intellectual environment and benefit children's cognitive development. Grandparents may contribute to children's educational achievement directly by reading to their grandchildren, helping them with homework, and providing discipline and supervision (Bengtson 1975; Chen et al. 2011; King and Elder 1997). Grandparents also play a role in the socialization of children by serving as role models and promoting traditional values, such as respect, the importance of education, and work ethics. Good

values and behaviors can, in turn, improve children's academic performances (Stevenson and Stigler 1994).

Unlike genetic influences and the provision of financial resources, however, socioemotional influences require frequent interactions between grandparents and grandchildren. If socioemotional support is the primary mechanism of grandparent effect, then coresident grandparents—who tend to be deeply involved in child rearing—should exert significant influences on grandchildren's well-being, and the influences of noncoresident grandparents should be much weaker because of their limited interactions with grandchildren. In other words, grandchildren's socioeconomic outcomes should vary by the characteristics of coresident grandparents but not those of noncoresident grandparents. If, contrary to our expectation, grandparent effects mainly operate through genetic influences or financial resources, then coresident and noncoresident grandparents should play a similar role in their grandchildren's lives.

## Multigenerational Coresidence in China

To test our hypothesis that grandparent effect is moderated by coresidence, we analyze data from China, where multigenerational coresidence is common and many grandparents are intimately involved in raising grandchildren. At the risk of oversimplification, the traditional Chinese family is a complicated social system, involving multiple generations and marital unions along the male lineage, with the eldest male at the top of the family hierarchy (Greenhalgh 1985; Knapp 2005; Thornton and Lin 1994; Whyte 2004; Xie and Zhu 2009). The core value of the Chinese family system is filial piety, the notion that children should respect their elderly parents (Knapp 2005; Whyte 2004). In this family system, a child is not just a child of his/her parents but instead a child of the whole extended family, subject to both the authority and the care of the head of the family—typically the grandfather. Hence, grandparents not only live with grandchildren but also have both the authority and the obligation to exert influences on them. Of course, Chinese traditional culture has been significantly transformed by several revolutions in the past century and by recent rapid socioeconomic development (Chu et al. 2011). Nonetheless, the traditional family system is still relevant and continues to provide the social context in which grandparents are allowed or even expected to be intimately involved in raising grandchildren.

In China, multigenerational coresidence is not only a cultural tradition but also a practice reinforced by state policies and socioeconomic conditions (Chu et al. 2011; Zhang 2004). For example, restrictions on migration through the *hukou* (household registration) system help maintain close ties among extended family members (Davis-Friedmann 1991), and housing shortages in urban areas have pressured extended families to live together (Logan et al. 1998). Importantly, women's high labor force participation rate (Han and Zhang 2010) and the elderly's reliance on families for financial support and care make multigenerational coresidence a convenient living arrangement for the exchange of services between generations. As research has shown, multigenerational coresidence in China is responsive to the practical needs of elderly parents, their adult children, and grandchildren (Chu et al. 2011; Logan and Bian 1999). It first serves the younger generation's need for childcare and later fulfills the older generation's need for old-age care (Chen 2005; Chen et al. 2011; Zhang 2004).

Although the tendency toward multigenerational coresidence has declined in recent years, the rate remains high, in part because the rapid fertility decline in China's recent past has increased the ratio of grandparents to adult children (Zeng and Wang 2004). The percentage of multigenerational households is five times as high in China as it is in the United States: 19 % versus 4 %, respectively (Zeng and Wang 2004). In China in 2005, two-thirds of people aged 65 and older lived with adult children, and 26 % of people aged 18 and younger lived with grandparents (based on our calculation of the 2005 China Inter-Census Survey data), compared with 18 % and 9 % in the United States, respectively (Kreider 2007).[1]

Another major pattern of multigenerational coresidence in China is that it is *not* selective on family resources. In the United States, children living with grandparents come disproportionately from minority backgrounds and disrupted families. In 2004, for example, 57 % of children not living with either parent and 14 % of those in single-parent families lived with grandparents, compared with only 4 % of those in two-parent families (Kreider 2007). In China, the likelihood of living with grandparents does not depend nearly as much on parental absence as it does in the United States. Our analysis of the 2005 China Inter-Census Survey data shows that 44 % of the children not living with either parent, 24 % of those in single-parent families, and 28 % of those in two-parent families lived with grandparents. Thus, in contrast to the U.S. pattern, where grandparents tend to *substitute* for parents, Chinese grandparents tend to supplement parental presence.

Although American children living with grandparents are more likely to live in poverty than are children living in households with no grandparents present (Kreider 2007), this is not the case in China. Research shows no substantial socioeconomic differences between adult children who coreside with their parents and those who do not (Chu et al. 2011; Logan and Bian 1999; Zhang 2004). In fact, the only notable pattern of selection of coresidence in China is a strong preference for living with the husband's rather than the wife's parents, reflecting the patriarchal values of Chinese society (Chen 2005; Chu et al. 2011).

Because multigenerational coresidence in the United States is associated with socioeconomic disadvantages—especially being raised by single mothers—the effects of coresident grandparents have largely been studied in the context of single parenthood (Szinovacz 1998). Many studies have reported that children from single-mother families do better in school and exhibit fewer behavioral problems when they live with extended families (Aquilino 1996; Deleire and Kalil 2002; Entwisle and Alexander 1996; Leadbeater and Bishop 1994; Thompson et al. 1992). Our literature search did not yield any studies on the effects of coresident grandparents on children's educational attainment in mainland China. We found two studies on this topic regarding Taiwan, however. Both reported that students from two-parent families as well as from single-parent families who live with grandparents have higher standardized test scores than those who do not live with grandparents (Kuan and Yang 2004; Pong and Chen 2010). Although studies of multigenerational coresidence have generally reported positive effects of living with grandparents, they typically focus on household structure—not coresident grandparents' social status—as a determinant of children's outcomes. As a

[1] The proportion of elderly living with adult children is much higher than the proportion of children living with grandparents because there are more young people than older people in both populations.

result, this body of literature does not reveal the extent of multigenerational social mobility.

## Data and Methods

The Chinese Household Income Project (CHIP) is a repeated cross-sectional study conducted by China's National Bureau of Statistics in 1988, 1995, 2002, and 2007. Our study uses a unique feature of the 2002 wave: the collection of education data on parents of both the household head and the spouse, regardless of the parents' survival and coresidence statuses. Because divorce and remarriage are extremely rare in rural China,[2] the parents of the head and the spouse in most cases constitute the full set of grandparents of the couple's children. The information on all four grandparents allows us to address our main question: *Do the effects of grandparents' education on children's educational attainment vary by living arrangement?*

Chinese society is deeply segmented into rural China and urban China by household registration status (*hukou*), with the rural much disadvantaged relative to the urban (Wu and Treiman 2004). The 2002 CHIP drew separate national samples of rural, urban, and migrant households. The first two samples cover households living in their places of registration, and the last sample captures families that are registered in rural areas but have left to live in urban areas. We limit analysis to the rural sample because there is little variation in our outcome variable (school dropout) in the urban sample and because there are very few coresident grandparents in the migrant sample.

The rural sample includes 8,840 children aged 7 to 18. We limit analysis to those who lived with both parents in a household headed by a parent (usually the father) because complete education data on all four grandparents were collected for this group only. More than 90 % of the children in the rural sample lived in such an arrangement. Most of the remaining children lived in a household headed by a grandparent (with or without parents) or lived with single parents.

About 30 % of the sample has missing data on one or more grandparents (usually those who were deceased or not living with the sampled households). We dropped households with missing data on all four grandparents (about 10 % of the sample) but imputed missing data for cases with one to three grandparents. In total, five data sets were imputed using the predictive mean matching method, and the regression results were aggregated.[3] The final analysis sample consists of 7,249 children living in 4,537 households.

Our primary goal is to estimate the effects of grandparents' education on grandchildren's educational attainment by living arrangement. Given our focus on children, many of whom have not yet completed schooling, years of schooling would not be an appropriate outcome variable. Instead, we model school dropout using

[2] For example, among those who had ever been married, 94.6 % were currently married, 0.4 % were divorced, and 5.1 % were widowed.

[3] We used the MI package in Stata 12 to impute the missing value of schooling for 228 paternal grandfathers, 655 paternal grandmothers, 313 maternal grandfathers, and 786 maternal grandmothers. The imputation used the predictive mean matching method with household income, grandparents' characteristics (year of birth, survival status, and Communist Party membership) as well as parental characteristics (education and occupation) as inputs.

survival analysis, treating children still in school as right-censored cases.[4] The time variable here is grade level, a discrete variable. Accordingly, we choose the discrete model with a logit link—$\text{logit}(h(t|\mathbf{x}))=\alpha_t+\mathbf{x}\boldsymbol{\beta}$—where $t$ denotes grade level and $\mathbf{x}$ denotes covariates. The outcome variable $h(t|\mathbf{x})$ is the hazard of dropout at grade level $t$: that is, the probability that a child with covariate values $\mathbf{x}$ drops out of school at $t$ given that he/she has stayed in school up to $t-1$. $\alpha_t$ represents the grade-specific baseline hazard in logit scale. Covariates $\mathbf{x}$ are specified to have multiplicative effects on the hazard of dropout, and the parameter vector $\boldsymbol{\beta}$ gives relative risks associated with covariates. The model is estimated on a person-period data set with indicators for grade levels.

We start with a simple model to estimate the overall effect of living with grandparents on dropout:

$$\text{logit}\left(h\left(t\middle|\mathbf{x}\right)\right)=\alpha_t+\beta_1 D+\boldsymbol{\beta}_2\mathbf{Z}. \tag{1}$$

Dummy variable $D$ indicates whether the child lives with any grandparents. It is the variable of interest here. $\mathbf{Z}$ represents a vector of control variables, which include the child's birth year (centered at 1990), sex, parental education, and parental occupations.

Each child has four grandparents, regardless of whether they were observed or even known to the child. Grandparents can be classified into three mutually exclusive types: *deceased* (DG), *noncoresident* (NCG, alive but not living with sampled children), and *coresident* (CG, living with sampled children). In estimating the effect of living with grandparents, Model 1 does not distinguish the types of grandparents. The next model allows the child's schooling outcome to vary by the number of grandparents in each category:

$$\text{logit}\left(h\left(t\middle|\mathbf{x}\right)\right)=\alpha_t+\beta_1 N_{CG}+\beta_2 N_{NCG}+\boldsymbol{\beta}_3\mathbf{Z}, \tag{2}$$

where $N_{CG}$ and $N_{NCG}$ are the numbers of coresident and noncoresident grandparents, respectively. $\beta_1$ captures the effect of living with one grandparent, and $\beta_2$ captures the effect of having one living but noncoresident grandparent, holding constant the statuses of the other three grandparents and the control variables. Model 2 does not include the number of DG, $N_{DG}$, because $N_{DG}$ is determined by $N_{CG}$ and $N_{NCG}$: $N_{CG}+N_{NCG}+N_{DG}=4$. In other words, having a deceased grandparent is the implicit reference category in estimating the effects of having a coresident grandparent and a noncoresident grandparent on the likelihood of dropout.

The data are cross-sectional. Thus, the key independent variables ($D$, $N_{CG}$, and $N_{NCG}$) and the covariates ($\mathbf{Z}$) are all time-invariant. In particular, the measure of living arrangement was taken at the time of the interview and does not capture past coresidence experience. For example, a deceased or noncoresident grandparent may have lived with the sampled grandchild before the survey, and a coresident grandparent may have lived apart from the grandchild in the past. As is well known, the main consequence of random measurement errors in the independent variable is attenuation bias: the estimate shrinks toward zero (Bound et al. 2001). Thus, the estimated effects of coresidence from our analysis are on the conservative side.

[4] We also used enrollment status as the outcome variable in an earlier analysis with the logit model. The substantive results were similar and thus are not reported here. We prefer survival analysis because it uses information on the timing of dropout, whereas the enrollment analysis considers only current enrollment status.

Model 3 estimates the overall effect of grandparents' education on the hazard of dropout with the following specification:

$$\text{logit}\left(h\left(t\middle|\mathbf{x}\right)\right)=\alpha_t+\beta_1 N_{CG}+\beta_2 N_{NCG}+\beta_3 E_G+\boldsymbol{\beta}_4\mathbf{Z}, \quad (3)$$

where $E_G$ is the sum of schooling of all four grandparents. For the sake of parsimony, we do not distinguish between grandfathers and grandmothers or between paternal and maternal grandparents here, but instead use the aggregate measure $E_G$ for a one-parameter test of the overall grandparent education effect. This is tantamount to including the education of four grandparents separately but constraining their coefficients to be equal.

To test our main hypothesis that the education of coresident grandparents has a greater effect on children's educational attainment than that of noncoresident and deceased grandparents, we add interactions between grandparents' status and education as follows:

$$\text{logit}\left(h\left(t\middle|\mathbf{x}\right)\right)=\alpha_t+\beta_1 N_{CG}+\beta_2 N_{NCG}+\beta_3 E_{CG}+\beta_4 E_{NCG}+\beta_5 E_{DG}+\boldsymbol{\beta}_6\mathbf{Z}, \quad (4)$$

where $E_{CG}$, $E_{NCG}$, and $E_{DG}$ denote the education of CG, NCG, and DG, respectively. As with $E_G$, the three education variables here are each measured as the sum of schooling of grandparents in the corresponding category. For example, if a child lives with two grandparents, $E_{CG}$ equals the sum of their schooling. If a child lives with one grandparent, $E_{CG}$ equals that grandparent's schooling. Children not living with any grandparents receive 0 on $E_{CG}$. The parameters $\beta_3$, $\beta_4$, and $\beta_5$ are the effects of $E_{CG}$, $E_{NCG}$, and $E_{DG}$ on the hazard of dropout, respectively. Comparing Model 4 with Model 3, we see that the overall grandparent education effect is now specified as a weighted sum of the education effects of CG, NCG, and DG.[5]

The introduction of interactions between grandparents' status and education in Model 4 changes the interpretation of $\beta_1$ and $\beta_2$. In Models 2 and 3, $\beta_1$ and $\beta_2$ are the effects of having a coresident grandparent and a noncoresident grandparent, respectively, on dropout relative to having a deceased grandparent. These estimated coefficients can be considered as "main effects" because they do not depend on the grandparent's educational attainment. However, the interpretation of $\beta_1$ and $\beta_2$ changes in Model 4: they now represent, respectively, the effects of having a coresident grandparent and a noncoresident grandparent, given that the grandparent has no schooling.

The key independent variable in our analysis—grandparents' education—was measured as years of schooling in the survey. The average schooling of grandparents varies significantly by sex and birth cohort. For example, the mean years of schooling is about 3 for grandparents and only 1.5 for grandmothers. A man with 6 years of schooling is at the 90th percentile among his contemporaries if he was born before 1920 but at only the 61st percentile if he was born in the 1940s. We converted years of schooling to a percentile score such that it measures a grandparent's or parent's relative education in

[5] Not all children have grandparents of all three types. This, however, does not affect the comparison of $\beta_3$, $\beta_4$, and $\beta_5$ because each child has four grandparents and receives the input of four grandparent education terms on the right side of the equation.

his or her same-sex 10-year birth cohort in the data. For example, a grandfather born in the 1940s with 6 years of schooling receives a percentile score of 61. An advantage of this standardization is that it allows us to conveniently compare the effects of $E_{CG}$, $E_{NCG}$, and $E_{DG}$ without having to control for compositional differences in birth cohort and sex across the three categories of grandparents (see upcoming Table 2).

Note that $E_{CG}$, $E_{NCG}$, and $E_{DG}$ are measured as the total percentile scores of CG, NCG, and DG, respectively. Each is an aggregate measure on as many as four grandparents. As a sensitivity analysis, we experimented with alternative aggregate measures of $E_{CG}$, $E_{NCG}$, and $E_{DG}$. In Model 5, $E_{CG}$, $E_{NCG}$, and $E_{DG}$ are measured as the mean percentile scores of CG, NCG, and DG, respectively. In Model 6, they are measured as the maximum percentile scores of CG, NCG, and DG, respectively. Finally, in Model 7, they are measured as the raw sums of schooling of the three types of grandparents. To maintain comparability, parental education is coded such that it is measured as percentile scores in Models 4–6 and as years of schooling in Model 7.

## Results

### Descriptive Statistics

Our sample consists of 5,954 children living in 3,704 two-generation households and 1,295 children living in 833 three-generation households. Table 1 compares the characteristics of the two-generation and three-generation households. Consistent with previous research (Chu et al. 2011), we did not find a systematic pattern of socioeconomic difference to suggest that multigenerational coresidence in rural China is selective on class or resources. The mean household income in 2002 was 10,774 *yuan* (US$1,300) for two-generation households and 11,328 *yuan* (US$1,368) for three-generation households. The difference is small and not statistically significant. Compared with those in two-generation households, the fathers in three-generation households are better educated (7.9 vs. 7.6 years of schooling, respectively). However, they are also two years younger, on average, and their advantage in schooling disappears when education is measured relative to birth cohorts using the percentile score. Although fathers in three-generation households are equally likely to be white-collar workers as their counterparts in two-generation households, they are more likely to be farmers (39 % vs. 32 %) and less likely to be wage laborers (51 % vs. 43 %).[6] There is no difference in the mothers' schooling or occupational distribution between the two types of households. The mean years of schooling for mothers is just over 6 years. Approximately 80 % of the mothers in this rural sample are farmers or homemakers, 15 % are manual laborers, and 5 % are white-collar workers. Table 1 also displays the mean years of schooling of grandparents, calculated from the full set of grandparents of sampled children. Grandparents in rural China have very little education. The mean years of schooling for grandparents is about 3 for grandfathers and 1.5 for grandmothers. There are no significant differences between two-generation and three-generation households, except that paternal grandmothers in two-generation

[6] The original measure of occupation has 12 categories. The categories have been collapsed to three major occupation groups because many of the nonfarming occupations have very low frequencies.

**Table 1** Sample characteristics by living arrangement

| | Two-Generation Households | | Three-Generation Households | | |
|---|---|---|---|---|---|
| | Mean or % | SD | Mean or % | SD | Pr(diff ≠ 0)[a] |
| Children's Characteristics | | | | | |
| Mean age | 13.6 | 3.1 | 13.2 | 3.2 | <.001 |
| Ages 7–9 (%) | 12.8 | 33.4 | 16.5 | 37.2 | <.001 |
| Ages 10–12 (%) | 21.9 | 41.4 | 23.7 | 42.5 | |
| Ages 13–15 (%) | 31.7 | 46.5 | 32.2 | 46.7 | |
| Ages 16–18 (%) | 33.6 | 47.2 | 27.6 | 44.7 | <.001 |
| Female (%) | 46.4 | 49.9 | 45.1 | 49.8 | |
| Number of children | 5,954 | | 1,295 | | |
| Household Characteristics | | | | | |
| Household income in 2002 (yuan) | 10,774 | 8,678 | 11,328 | 8,705 | |
| Father's age | 41.7 | 6.8 | 39.5 | 6.1 | <.001 |
| Father's years of schooling | 7.6 | 2.4 | 7.9 | 2.2 | <.05 |
| Father's education in percentile score | 51.7 | 27.9 | 51.9 | 28.1 | |
| Father's occupation | | | | | |
| Farmer (%) | 32.2 | 46.7 | 38.7 | 48.7 | <.001 |
| Wage laborer (%) | 51.4 | 50.0 | 43.0 | 49.5 | <.001 |
| White-collar (%) | 16.4 | 37.1 | 18.4 | 38.7 | |
| Mother's age | 39.8 | 6.3 | 37.8 | 5.9 | <.001 |
| Mother's years of schooling | 6.2 | 2.9 | 6.1 | 2.8 | |
| Mother's education in percentile score | 51.2 | 28.4 | 48.0 | 28.9 | <.01 |
| Mother's occupation | | | | | |
| Farmer/home keeper (%) | 78.8 | 40.9 | 80.8 | 39.4 | |
| Wage laborer (%) | 15.8 | 36.5 | 15.2 | 36.0 | |
| White-collar (%) | 5.4 | 22.6 | 4.0 | 19.5 | |
| Paternal grandfather's years of schooling | 3.2 | 2.7 | 3.1 | 2.9 | |
| Paternal grandmother's years of schooling | 1.4 | 2.1 | 1.1 | 2.0 | <.001 |
| Maternal grandfather's years of schooling | 3.1 | 2.7 | 3.1 | 2.6 | |
| Maternal grandmother's years of schooling | 1.5 | 2.1 | 1.6 | 2.1 | |
| Number of Households | 3,704 | | 833 | | |

[a] Only $p$ values < .05 are displayed.

households are somewhat better educated than those in three-generation households. Overall, multigenerational households do not seem to be positively or negatively selected in family resources.

Table 2 compares the composition and characteristics of deceased, noncoresident, and coresident grandparents. Of the 18,148 (4 × 4,537) grandparents in our sample of 4,537 households, 35 % are deceased, nearly 60 % are noncoresident, and only 6 % are coresident. The low percentage of coresident grandparents is partly the result of our child-based sampling. Noncoresident and coresident grandparents are distinguished not

**Table 2** Grandparents' characteristics by survival and coresidence statuses

| | Deceased | Noncoresident | Coresident |
|---|---|---|---|
| Composition | | | |
| % Paternal grandfather | 32.2 | 19.4 | 38.1 |
| % Paternal grandmother | 21.5 | 24.0 | 56.5 |
| % Maternal grandfather | 27.2 | 25.9 | 2.2 |
| % Maternal grandmother | 19.0 | 30.7 | 3.3 |
| Mean Birth Year | 1926.5 | 1936.2 | 1933.1 |
| Mean Age | — | 66.5 | 69.8 |
| % Female | 40.5 | 54.7 | 59.7 |
| Mean Education | | | |
| Years of schooling | 1.9 | 2.6 | 2.0 |
| Percentile score | 46.6 | 47.8 | 45.1 |
| Observations | 6,411 | 10,688 | 1,049 |

*Note:* Coresident grandparents and noncoresident grandparents are distinguished by their relationship to the sampled households.

by their own living arrangements but by their relationship to the sampled children. In other words, noncoresident grandparents—that is, those who did not live with the grandchildren in our sample—may live with grandchildren not captured by the survey (i.e., cousins of the sampled children). As discussed earlier, coresidence remains a common living arrangement in contemporary China. For example, 80 % of our sample of rural residents aged 65 and older lived with children and/or grandchildren. This suggests that many noncoresident grandparents in fact live with out-of-sample grandchildren.

As Table 2 shows, 57 % of the coresident grandparents are paternal grandmothers, and 38 % are paternal grandfathers. This is consistent with past research, which has shown that children are far more likely to live with paternal grandparents than with maternal grandparents (Chu et al. 2011; Zhang 2004). Among *deceased* grandparents, grandfathers outnumber grandmothers because of women's longer life expectancies, and paternal grandparents outnumber maternal grandparents because the husband tends to be older than the wife and thus tends to have older parents.

As one might expect, deceased grandparents were born, on average, a few years earlier than grandparents who are alive. Coresident grandparents are about three years older than noncoresident grandparents. This can be attributed to the tendency to live with paternal grandparents, who are, on average, older than maternal grandparents. The pattern is also consistent with the previous research finding that the rate of coresidence increases as grandparents age and need more support (Chen 2005; Zeng and Wang 2004). About 40 % of deceased grandparents, 55 % of noncoresident grandparents, and 60 % of coresident grandparents are female. Reflecting these sex and cohort compositional differences, noncoresident grandparents have the most schooling (averaging 2.6 years), and deceased grandparents have the least (averaging 1.9 years). When sex and cohort compositions are adjusted for using the percentile score as the measure of education, noncoresident grandparents' advantage in schooling is greatly reduced, with

a mean percentile score of 47.8 compared with 46.6 for deceased grandparents and 45.1 for coresident grandparents.[7]

## Grandparent Effects on Dropout

Figure 1 displays the Kaplan-Meier estimates of cumulative dropout rates at each grade level for children in two-generation and three-generation households. Attrition rates are relatively low during primary school years (grades 1 to 6), with a graduation rate of 96 %. Ninety-seven percent of the primary school graduates continue on to junior high school (grades 7 to 9), but only 80 % of those who attended junior high schools graduate. In comparison, only 76 % of the junior high school graduates make the transition to senior high school (grades 10 to 12), and 89 % of them graduate. The figure reveals differences in dropout rates by living arrangement: 81 % and 57 % of the children living with grandparents graduate from junior high and senior high schools, compared with 76 % and 51 % (respectively) of those not living with grandparents.

Table 3 presents estimates from discrete models of dropout. To account for multistage cluster sampling, robust standard errors were used. Models 1 and 2 test the main effect of living with grandparents, using different parameterizations. A positive effect of coresidence is found in both models. Model 1 shows that living with one or more grandparents reduces the hazard of dropout by 19 % (1 – exp(–0.208)), controlling for the child's sex and age and also parents' education, occupations, and ages. Model 2 compares three types of grandparents: coresident, noncoresident, and deceased. The results show that both having a coresident grandparent and having a noncoresident grandparent reduce the hazard of dropout relative to having a decreased grandparent. Furthermore, the effect of a coresident grandparent is much greater than that of a noncoresident grandparent (–0.221 vs. –0.073, $\text{Prob}(\beta_1 = \beta_2) < .05$). This suggests that grandparents' survival status *per se* does not matter nearly as much as their living arrangements for children's educational outcomes.

Model 3 estimates the overall effect of grandparents' education on dropout. The coefficient of grandparents' education is –0.123; that is, all else being equal, changing one grandparent's education from the bottom of the distribution to the top (i.e., from the 0th percentile to the 100th percentile) reduces the risk of dropout by 12 % (1 – exp(–0.123)). Although statistically significant, this effect is not large. The coefficient of parental education, measured on the same scale, is more than seven times that of a grandparent's education (−0.930 for father and −0.892 for mother). Increasing the education of *one parent* from the 0th percentile to the 100th percentile, for example, will reduce the risk of dropout by 60 %, but increasing *all four* grandparents' education from the 0th percentile to the 100th percentile will reduce the risk by only 40 %.

The main result of our study is displayed under Model 4, which estimates the effects of grandparents' education on dropout by grandparents' survival status and living arrangement. The coefficients of the education of coresident grandparents, noncoresident grandparents, and deceased grandparents are −0.749, –0.032, and –0.187, respectively.[8] Consistent with our expectation, although the education of

[7] The difference between noncoresident and coresident grandparents is statistically significant ($p$ value < .01).
[8] The $p$ values of the null hypotheses that the coefficient of $E_C$ equals those of $E_{NC}$ and $E_D$ are .036 and .106, respectively.

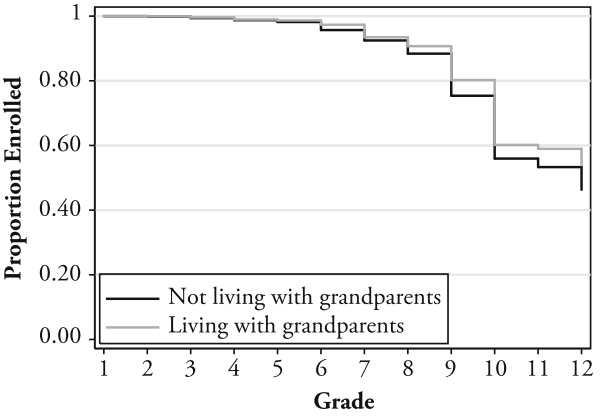


**Fig. 1** Kaplan-Meier survival estimates of school dropout

noncoresident and deceased grandparents has little or no effect on grandchildren's dropout rate, the effect of coresident grandparents' education is quite large—in fact, comparable in magnitude with those of father's and mother's education (–0.749 compared with –0.920 and –0.897, respectively). These results suggest that grandparents can play an important role in their grandchildren's schooling if they all live under the same roof.

The coefficients of the numbers of coresident and noncoresident grandparents in Model 4 are small (0.012 and –0.139, respectively). This means that if a grandparent has little education, his/her survival status or living arrangement does not affect grandchildren's educational attainment. However, if the grandparent is well educated, multigenerational coresidence becomes beneficial. For example, moving a grandparent with a percentile score of 100 into a grandchild's household would reduce the hazard of dropout by 43 %.[9] Recall that in Model 1, we estimated that multigenerational coresidence is associated with a reduction of 19 % in the hazard of dropout. That 19 % reduction is an average effect; the actual benefit of coresidence increases with a grandparent's education.

Table 4 presents the results of our sensitivity analysis using alternative measures of grandparents' education. To save space, we display only the education effects. As the table shows, no matter how we aggregate grandparents' education—as the sum, the mean, or the maximum of percentile scores, or as the sum of years of schooling—the general pattern of Model 4 is replicated. The magnitude of the coefficient of coresident grandparents' education is comparable with that of parental education, but the education of noncoresident and deceased grandparents either does not matter or has a much smaller effect. In Model 7, the coefficients of grandparents' and parents' education are much smaller because of the change in measurement scale. However, the same substantive results hold true.

Note that the different parameterizations of grandparent education in Models 4–7 lead to different interpretations of the coresidence effect. For example, under Models 4 and 7, a grandchild's educational outcome depends on the *total* human capital stock of grandparents of each type. Based on our results, moving a grandparent into a

[9] This is calculated as $1 - \exp(0.012 + 0.139 - 0.749 + 0.032) = 0.43$.

**Table 3** Logit models of hazards of dropout

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Living With Grandparents | –0.208* | | | |
| | (0.095) | | | |
| Number of Coresident Grandparents | | –0.221** | –0.228** | 0.012 |
| | | (0.076) | (0.076) | (0.150) |
| Number of Noncoresident Grandparents | | –0.073* | –0.070* | –0.139* |
| | | (0.030) | (0.030) | (0.062) |
| Grandparents' Education | | | –0.123* | |
| | | | (0.050) | |
| Education of Coresident Grandparents (× 100) | | | | –0.749* |
| | | | | (0.335) |
| Education of Noncoresident Grandparents (× 100) | | | | –0.032 |
| | | | | (0.080) |
| Education of Deceased Grandparents ( × 100) | | | | –0.187* |
| | | | | (0.081) |
| Child's Birth Year | –0.210** | –0.211** | –0.212** | –0.214** |
| | (0.031) | (0.031) | (0.032) | (0.032) |
| Child's Sex (female) | 0.323** | 0.321** | 0.327** | 0.329** |
| | (0.069) | (0.069) | (0.069) | (0.069) |
| Father's Education | –0.934** | –0.927** | –0.930** | –0.920** |
| | (0.137) | (0.137) | (0.137) | (0.137) |
| Father's Occupation (ref. = farmer) | | | | |
| Wage laborer | –0.173* | –0.169* | –0.154* | –0.151* |
| | (0.075) | (0.075) | (0.075) | (0.075) |
| White-collar | –0.573** | –0.554** | –0.535** | –0.529** |
| | (0.114) | (0.114) | (0.114) | (0.114) |
| Father's Age | –0.033** | –0.037** | –0.036** | –0.035** |
| | (0.012) | (0.012) | (0.012) | (0.012) |
| Mother's Education | –0.962** | –0.946** | –0.892** | –0.897** |
| | (0.134) | (0.134) | (0.134) | (0.135) |
| Mother's Occupation (ref. = farmer/housekeeper) | | | | |
| Wage laborer | –0.460** | –0.447** | –0.440** | –0.441** |
| | (0.107) | (0.107) | (0.108) | (0.108) |
| White-collar | –0.379 | –0.358 | –0.339 | –0.355 |
| | (0.194) | (0.192) | (0.191) | (0.190) |
| Mother's Age | 0.020 | 0.020 | 0.020 | 0.019 |
| | (0.013) | (0.013) | (0.013) | (0.013) |
| Grade Dummy Variables | Included | Included | Included | Included |
| Observations | 7,200 | 7,200 | 7,200 | 7,200 |

*Note:* Robust standard errors are in parentheses.

*$p < .05$; **$p < .01$

**Table 4** Selected coefficients from logit models using alternative measures of grandparents' education

| Education Measured as: | Model 4, Sum of Percentile Scores | Model 5, Mean Percentile Score | Model 6, Max. Percentile Score | Model 7, Sum of Years of Schooling |
|---|---|---|---|---|
| Number of CG | 0.012 | –0.045 | 0.005 | –0.091 |
| | (0.150) | (0.121) | (0.135) | (0.087) |
| Number of NCG | –0.139* | –0.094* | –0.110* | –0.090* |
| | (0.062) | (0.037) | (0.049) | (0.041) |
| Education of CG | –0.749* | –0.663* | –0.806* | –0.096* |
| | (0.335) | (0.337) | (0.351) | (0.038) |
| Education of NCG | –0.032 | –0.201 | –0.151 | 0.002 |
| | (0.080) | (0.182) | (0.181) | (0.008) |
| Education of DG | –0.187* | –0.340* | –0.377* | –0.023* |
| | (0.081) | (0.155) | (0.147) | (0.010) |
| Father's Education | –0.920** | –0.936** | –0.926** | –0.099** |
| | (0.137) | (0.137) | (0.137) | (0.016) |
| Mother's Education | –0.897** | –0.891** | –0.891** | –0.090** |
| | (0.135) | (0.135) | (0.134) | (0.013) |
| Observations | 7,200 | 7,200 | 7,200 | 7,200 |

*Notes:* Robust standard errors are in parentheses. All four models control for grade dummy variables, child's birth year and sex, and parental ages and occupations.

*$p < .05$; **$p < .01$

grandchild's household will always reduce the child's risk of dropout by adding to the human capital stock in the household. Under Model 5, moving a grandparent with little education into the grandchild's household can potentially increase the child's risk of dropout if that move lowers the average human capital stock of grandparents in the household. Under Model 6, a grandchild's outcome depends on the best-educated grandparent in the household. This model implies that as long as the living arrangement of the best-educated coresident grandparent does not change, moving less-educated grandparents into and/or out of the household does not matter. On the basis of our data, it is not possible to determine empirically which model should be chosen over the alternative ones. However, as far as our key research question is concerned, this sensitivity analysis has convincingly shown that the various parameterizations lead to the same conclusion: the education of coresident grandparents directly affects school dropout, and the magnitude of that effect is similar to the effect of parental education.

## Discussion and Conclusion

Does grandparents' education directly influence their grandchildren's educational attainment after we control for parents' characteristics? Our analysis of the 2002 CHIP data shows that it does, but the effect is contingent on living arrangements. The effect of coresident grandparents' education is large and significant, but the education of

noncoresident grandparents and deceased grandparents has very little effect. This finding leads us to the conclusion that coresidence is an important moderator of the grandparent effect. Stated differently, the benefit of living with grandparents varies by grandparents' education: although living with grandparents of little education does not affect children's educational attainment, living with well-educated grandparents significantly reduces children's likelihood of school dropout. In sum, our results show that grandparents do exert a direct effect on their grandchildren, which is characterized by the interaction between grandparents' education and living arrangements.

Of particular interest is the finding that the effect of coresident grandparents' education is almost as large as that of parental education. This not only indicates that grandparents can play a parent-like role in socializing children but also suggests that our findings are unlikely to result from poor measurement.

Two measurement-related objections could be raised against our study. First, the controls of parental education and occupations used in this study may not fully capture family background; as a result, the coefficients of grandparents' education may have picked up the effects of unobserved parental characteristics correlated with both children's schooling and grandparents' education (e.g., household income and parental involvement). Although our measures are admittedly crude, unobserved parental characteristics are unlikely to fully account for the large effect of coresident grandparents' education we found. Furthermore, if there were an omitted variable bias, it would have affected the estimates of deceased and noncoresident grandparents' education effects as well; however, our estimated coefficients of deceased and noncoresident grandparents' education are much smaller, suggesting that the interaction effect of grandparents' education and living arrangement is real.

A second potential criticism of our study is that the interaction effect of grandparents' education and living arrangement may result from measurement errors of grandparents' education. It is possible that the characteristics of grandparents who did not live in the sampled households are measured with greater errors than those of coresident grandparents. Such a pattern of measurement errors could have suppressed the effects of noncoresident and deceased grandparents (known as the *attenuation effect*), relative to the effect of coresident grandparents. However, the estimated effect of coresident grandparents' education is almost as large as that of parental education. This result cannot be attributed to attenuation effect because there is no reason to suspect that coresident grandparents' education is more accurately measured than parental education. In other words, attenuation bias does not invalidate the main finding of our study: *coresident grandparents exert a significant direct effect on grandchildren's educational outcomes*.

In conclusion, our study has two implications for social mobility research. First, living arrangements are of paramount importance for grandparents' influences on children's outcomes. This suggests that causal processes of intergenerational influences occur primarily inside households through daily interactions. Our research thus reaffirms the primary importance of the socioemotional pathway for intergenerational effects. More comparative work both across different societies and over time is needed to further evaluate the claim that parents and grandparents matter mostly because of their roles in rearing and socializing children.

Second, our study demonstrates that the grandparent effect is almost completely moderated by living arrangement. If the same pattern exists in the United States, then

the low prevalence of multigenerational coresidence in America may partly explain why past research did not find a direct grandparent effect. In the United States, only 9 % of children live with grandparents, compared with more than 25 % of Chinese children living in multigenerational households. Future work can test our conjecture when appropriate U.S. data become available.

Although the current rate of multigenerational coresidence is low in the United States, demographers have noted a recent trend reversal toward the traditional multigenerational family (Pew Research Center 2010). From 1940 to 1980, the share of Americans living in such households had declined from 25 % to 12 %. Since 1980, however, the proportion has grown to 16%. Possible underlying reasons for the return of multigenerational households are longer life expectancy, rising cost of living, economic instability, and increasing numbers of immigrants from societies with coresidence cultures. If this trend continues, the two-generation paradigm that had dominated social mobility research in the United States will soon be due for an overhaul.

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