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Grandfathers and children's schooling in Sub-Saharan Africa

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Abstract

According to the classical grandmother hypothesis, the presence of a grandmother is important for the survival of her grandchildren. About the role of grandfathers, theory is less clear. Grandfathers are usually associated with more distant and authoritarian ways of involvement. However, also their reproductive success is increased by the survival of their grandchildren. To gain more insight into the importance of grandfathers in the sub-Saharan African context, we study the relationship between grandfather's coresidence and children's schooling on the basis of data for 900.000 children aged 7–15 in 33 African countries. While controlling for risk factors at household and community level, we find children living with their grandfather to have significantly higher odds of being in school than children who are not living with their grandfather. This effect increases with grandfather's age and is particularly strong for older children and for girls. This study is the first to document a positive relationship between the presence of a grandfather and the well-being of children in the sub-Saharan African context.

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1. Introduction

According to evolutionary theory, the presence of a grandmother is important for the survival of grandchildren. The classical grandmother hypothesis assumes that the prolonged survival of women after their fertile ages has developed during human evolution, because it offers women the possibility to increase their own reproductive success by helping their children to raise their children (Hamilton, 1964; Hawkes et al., 1997; Hawkes, 2004). But what about grandfathers? Is there such a thing as a grandfather's version of the classical grandmother hypothesis? Although the reproductive success of grandfathers is also increased by the survival of their grandchildren, they get less attention in the literature. There are a few historical studies reporting both positive and negative associations between the presence of a grandfather and child survival in Poland, Canada, Germany and Italy (Beise, 2005; Derosas, 2002; Kemkes-Grottenthaler, 2005; Tymicki, 2009). Some more recent studies examining the association between grandfathers and child survival in Africa found hardly any association (Borgerhoff Mulder, 2007; Gibson & Mace, 2005; Sear, 2008; Sear, Mace, & McGregor, 2000). This does not necessary mean that African grandfathers are not important at all for their grandchildren, but it suggests that for identifying grandparental effects we may have to look at other outcomes than child survival and/or study these effects under specific circumstances.

It is for example possible that grandfathers become important when parents are missing or when there is no grandmother who can help their (grand)children. It is also possible that grandfathers become of greater importance when children are older. While (grand)mothers are supposed to be focused on feeding and caring of young children, (grand)fathers might be more focused on the societal position of their grandchildren. It might for example be possible that the social status and masculinity of African grandfathers to a certain extent depends on the educational achievements of their grandchildren.

Given the substantial number of sub-Saharan African (SSA) children living in households with coresidence grandparents and the increasing importance of education for employment chances and economic growth in this continent (Lutz et al., 2008; UNESCO, 2014), gaining insight into the role grandfathers play for children's schooling has become increasingly important. The current paper aims to provide this insight. We determine the strength of the relationship between

grandfather's coresidence and children's schooling in SSA and how this relationship is influenced by the circumstances in which the household is situated.

To be able to do this, we have built a database with information on almost 900.000 children aged 7-15, living in 33 countries. By applying multilevel logistic regression analysis on this database, we aim to answer the following research questions:

- What is the overall relationship between grandfather's coresidence and their grandchildren's educational participation?
- To what extent do socio-economic, demographic and cultural characteristics at the household and context level influence this relationship?

A major step forward of our approach is that we study the influence of context factors on the grandfather effect at the level of 597 sub-national regions -- and at the level of 29.925 communities – within 33 countries. This means that we have considerable power to study effects of context factors in a multivariate way and can answer questions about the role of the context better than in earlier studies.

In the next section, we first discuss the importance of education and the reasons why grandfathers in SSA may be living with their (grand)children. Then our theoretical framework is presented and hypotheses are formulated. Section 3 describes the data and methods that will be used. In section 4 our results are presented. Concluding remarks are given in section 5.

2. Background

Grandfathers and schooling

Schooling can be seen as an activity that influences future benefits through the imbedding of resources, human capital, in people. Next to physical capital, human capital is crucial for economic development as well as for children's prospects in life (Becker, 1962). Although much research has already been done on the determinants of children's schooling in poor countries (Glick & Sahn, 2006; Huisman & Smits, 2015; Lloyd & Blanc, 1996; Mukherjee & Das, 2008; Smits & Huisman, 2013) the role of the grandfather for children's schooling has received little attention in the literature. Only a few studies provide some statistical evidence regarding this relationship. For example, Parker and Short (2009) found no effect of living with a grandfather and children's schooling in Lesotho and Zeng and Xie (2014) showed for rural China that the

educational level of coresident grandparents is positively associated with the educational attainment of their grandchildren.

There is also research comparing grandparent-headed households and households headed by other relatives regarding schooling outcomes. Children of grandparent-headed households in Malawi, Mozambique and Zambia have better educational outcomes than those living in households headed by other relatives, such as an aunt or niece (e.g. Ainsworth et al., 2005; Case et al., 2004; Nyamukapa and Gregson, 2005). Other studies investigate the difference in school attendance between orphans and non-orphans (e.g. Bicego et al., 2003; Nyambedha et al., 2003; Nyamukapa & Gregson, 2005), but in these studies grandparents play a minor role. Broad comparative research that can teach us how the relationship between grandfather's coresidence and children's schooling varies across circumstances is lacking for Africa, as well as for other low-income contexts.

Why are grandfathers living with their (grand)children?

To increase our understanding of the role played by coresidence grandfathers with respect to the schooling of their grandchildren, a first important question to be answered is why do grandparents reside with their (grand)children. In the African context, the reasons for this are diverse. In some regions and among some groups the cultural tradition exists that one or more children remain living with their parents after marriage (e.g. Kandiyoti, 1988; Fox, 1967; Korotayev, 2003). The partners of these children then come to live in the family home and become a member of the extended family system. Under poor circumstances, sharing costs of living in this way increases survival chances and care needs can be fulfilled more easily. Living together with their children also constitutes a natural old-age security system for the (grand)parents (Laferrère and Wolff, 2006). Over time, the situation may gradually change from one in which the grandparents are the major driving forces of the household to one in which the next generation takes over. The grandparents then become the helping hands, as long as their health allows this.

Another way in which (grand)parents and children may come to live together is when children after marriage establish their household elsewhere, but the grandparents move in later. This might for example be for financial reasons, or because the grandparents need care or one of them has

died. Depending on the health status of the (grand)parents, they may then be a resource or a burden for the household.

Still another possibility is that children come to live with their grandparents because their parents are dead or ill. When parents die, grandparents are usually the ones that take over the care for their grandchildren. In sub-Saharan Africa, where overall mortality levels are high and an estimated 15 million children have lost one or both of their parent(s), this is a very common situation (UNAIDS, 2013). Depending on the circumstances, the child may move to the household of the grandparent(s) or the grandparent(s) may come to live in the parental home.

2.1 Theoretical framework

Generative grandfathering or resource competition?

Women may live long after their reproductive period; a phenomenon which is not very common in nature. In most species breeding is possible throughout adult life. Regardless of the actual evolutionary origin of this phenomenon, it offers women (grandmothers) the possibility to increase their reproductive success by helping their daughters and sons raising their children (Hamilton, 1964; Hawkes et al., 1997; Hawkes, 2004). But what about men? Men are able to reproduce until their death, which enables them to enhance their inclusive fitness throughout their lives. Does this mean that they are not involved in taking care of their grandchildren?

Theory concerning the relationship between grandfathers and grandchildren in developing countries is scarce. Intuitively, given the supposed strong bond between mothers and daughters, grandmothers are expected to help their daughters with the care for their children (Coall & Hertwig, 2010; Hawkes, 2003, 2004; Sear & Mace, 2008). Particularly in developing countries, where extended household structures are still pervasive, grandmothers are supposed to play a role of importance in this respect. Regarding grandfathers this is different. Grandfathers are usually associated with more distant and authoritarian ways of involvement (Bates & Taylor, 2012; Mann, Tarrant, & Leeson, 2015) and have therefore got much less theoretical attention in the child survival and health literature, so we cannot draw extensively from the literature in this field. That is why we derive theoretical ideas from studies in other fields, in particular the gerontological literature on grandparenthood in developed countries like the US and UK (e.g. Bates & Taylor, 2012; Creasey & Koblewski, 1991; Mann et al., 2015).

A useful framework for studying and understanding the role of grandfathers has been built by Bates (2009). At the heart of his conceptual framework of g*enerative grandfathering* is the developmental stage of 'generativity', introduced by Erikson (1963) as one of the eight stages in psychosocial development. In the *generative* stage of life, establishing and guiding the next generation forms a central theme. Grandfathering and generativity are connected by Bates through the generative work of grandfathers, which can be described as the efforts grandfathers put forth when nurturing and caring for their offspring. This involves lineage work, spiritual work, recreation work, family identity work, and investment work (Bates, 2009).

Some of these forms of generative work may have a direct effect on schooling such as 'mentoring work' or 'investment work'. *Mentoring work* concerns the efforts grandfathers put forth to teach, instruct and coach their grandchildren. In doing so, grandfathers also transfer a part of their own knowledge to their grandchildren. This implies that the educational level of a grandfather might be important for schooling as well. *Investment work* concerns the ability and willingness of grandfathers to invest in the educational, occupational and financial needs of their grandchildren. Other forms of generative work like 'lineage work' and 'spiritual work' might help grandchildren to develop their own identity and to become a stable personality, which is also important for schooling. We hypothesize that the average effect of grandfather's coresidence through generative work is positive for their grandchildren's schooling. This *positive grandfather hypothesis* is based on the expectation that grandfathers who are living with their grandchildren have a low threshold to invest in them. According to Bates & Taylor (2012) contact frequency and participating in activities are key elements of a positive grandfather role and coresidence grandfathers are in the best situation for having a high contact frequency and participate in activities with their grandchildren.

It seems obvious to assume that the degree and quality of generative work grandfathers put forth to their grandchildren varies and depends on the characteristics of the grandfather. Important characteristics of the grandfather that may play a role are his age and educational level. Higher educated grandfathers have experienced themselves the benefits of good education, which may make them better equipped to teach, instruct and coach their grandchildren. It might also make them more eager to teach their grandchildren and to stimulate them to go to school than grandfathers with no or less education.

When (grand)fathers get older, they become more experienced. Their image of leadership and masculinity shifts and they may become more emotionally expressive and affectionate towards their grandchildren. They may wish to teach about interpersonal relationships and to transfer values to their grandchildren (Fuller-Thomson & Minkler, 2001; Waldrop et al., 1999). Such a mentoring and teaching role might become a particularly rewarding experience for grandfathers, if the degree of success of their grandchildren contributes to the level of respect they gain from their social environment. However, at some point the grandfather may become too old to take care of his grandchildren, or even of himself, and he might become a drain for the household. Grandfathers should also not be too young. If grandfathers are very young, they are busy with their own work and have to put their energy in caring for their own offspring and have less possibilities to take care of their grandchildren. The relationship between grandfathers' age and the role they may play for their grandchildren is thus expected to be parabolic, with their contribution being more important at an intermediate age than when they are very young or old. A similar relationship is expected for grandmother's age. Hence, regarding the relationship between the age of grandparents and their importance as a positive resource for grandchildren we would hypothesize nonlinear (parabolic) relationship, with their contribution to be highest in the middle age range (less other dominant responsibilities and not yet too old to contribute). This *parabolic age effect hypothesis* will be tested by looking at nonlinear effects of grandparent's age in our analysis.

Grandfathers and child survival

Empirical research on grandfathers and children's schooling in Africa is sparse. Parker & Short (2009) are an exception and tested this relationship for Lesotho and found no significant effect of a coresidence grandfather. Other research has been focussing on child survival as outcome variable instead of schooling. A meta-analysis conducted by Sear & Mace (2008) gives a broad overview of the empirical work in this field. Their analysis shows that grandfathers in 4 out of 20 studies were positively associated with child survival, in 3 studies negatively and in 13 studies there was no significant effect at all. For grandmothers these figures were 16 positively, 3 negatively and 7 no effect out of 26 studies respectively. The results indicate that grandfathers are less important than grandmothers when it comes to child survival. Most of the studies included in the analysis concerned pre-modern European, Asian, North and South American countries. In the

few African studies available (4) there were no significant connections reported between grandfather's presence and child survival (Borgerhoff Mulder, 2007; Gibson & Mace, 2005; Sear, 2008; Sear et al., 2000).

The role of the circumstances

Because of the variation in grandfather effects found in previous research, the main focus of the current paper is on the role of the circumstances. Factors reflecting these circumstances moderate the grandfather coresidence effect and are divided into two groups: resource- and gender-related factors, represented in Figure 1 by arrows A and B. The strength of the grandfather effect is expected to vary according to the availability of these factors at household and context level (research question 2). For example on whether or not the parents and other household members are present and on specific characteristics of the household like household wealth, work status of the mother, occupation of the father and the presence of siblings. Factors related to the context in which the household is situated are for example the district level of development and polygamy, but also the cluster level of education. In the next section, these factors and other control variables are discussed.

[Figure 1 about here]

Resource related factors

Resource related factors at the level of the household are income, wealth, education and employment of the parents. The availability of these resources may influence the grandfather effect in several respects. Children of poor families are less enrolled in school, are more involved in child labor, and suffer from many other negative outcomes, including high levels of child mortality, disease and stunting (Basu and Tzannatos, 2003; Bourdillon, 2006; Duncan and Brooks-Gunn, 1997; Hope, 2005; Webbink et al., 2012). Their educational enrolment is lower, because the direct and indirect costs of schooling may be a heavy economic burden to their parents (Admassie, 2003; Ananga, 2011). Grandfathers can compensate the opportunity costs of schooling of their grandchildren. They can enable parents to work from home or prevent children from taking over work when their parents are working or missing (Smits & Huisman, 2013).

Regarding parental education and father's occupation, there is broad evidence that children from better educated parents and whose fathers have a non-farm job go to school and stay in school more often (Buchmann & Brakewood, 2000; Colclough et al., 2000; Ersado, 2005; Mingat, 2006; Smits & Gündüz-Hoşgör, 2006). Better educated parents (have) experience(d) the benefits of education themselves and therefore are expected to weigh off the costs and benefits more in favour of schooling than parents with little education (Huisman & Smits, 2009; Piotrowski & Paat, 2012). Also fathers with a non-fam job are expected -- and have been found (Breen & Goldthorpe, 1997; Huisman & Smits, 2015) -- to attach more value to schooling than those who work in the agricultural sector. Under such more favourable circumstances, presence of a grandfather might make less of a difference.

Grandparents might also be a burden to the household resources. The *local resource competition hypothesis* (e.g. Borgerhoff Mulder, 2007; Sear and Mace, 2008) predicts that altruistic behaviour of family members may be reduced when there is scarcity of local resources. Several studies support this hypothesis. Strassmann (2011) found the coresidence of a grandmother among the Dogon in Mali to be negatively related to child survival and growth. She attributes this to the fact that older grandmothers become net-consumers and therefore competitors with their grandchildren in the resource-poor society of the Dogon. This might also be applicable to grandfathers. Sear (2008) discovered that among the Chewa in Malawi child mortality rates are higher in the presence of matrilineal kin. She supposed this negative effect to be caused by resource competition between kin. Borgerhoff Mulder (2007) observed while studying land ownership in Kenya that wealth affects the extent of kin altruism. Paternal relatives (specifically father's brothers) appear to buffer young children from mortality much more effectively in rich than in poor households. To what extent there is a positive grandfather effect on children's schooling might thus depend on the circumstances, with the effect being weaker when the grandfather is old and/or when the household is living under poor circumstances.

The presence of a grandfather is expected to be particularly important if parents are dead or absent from the household. Parental death is known to have a negative impact on children's well-being and schooling outcomes (e.g. Case and Ardington, 2006; Evans and Miguel, 2007; Nyamukapa and Gregson, 2005). Single parenthood is also associated with negative effects on children's schooling (Martin, 2012; Pong & Ju, 2000; Potter, 2010). It seems likely that under

these circumstances, coresidence of the grandfather may be particularly beneficial to children's well-being and schooling.

Important resources at the local context are the educational and transport infrastructure, which both may influence the possibility of children to go to school. In sub-Saharan Africa, the availability of (good quality) schools and infrastructure varies considerably according to the overall level of urbanization and development of the region. In more modern and urban areas, infrastructure is generally better and state influence stronger, which means that educational laws may be better enforced. The effects of globalization may also be stronger and value patterns that stress the importance of education and equality among sexes more commonly spread. This might put more pressure on parents to send their children to school (Huisman & Smits, 2009; Tansel, 2002). Smits and Gündüz-Hoşgör (2006) found for Turkey that children living in urban areas have significantly higher schooling attainments, and Fafchamps & Wahba (2006) found for Nepal that children living near towns and cities are more likely to attend school. Hence, the expectation is that particularly in rural areas a coresidence grandfather might increase young children's chances to go to school.

Gender-related factors

Most of the studies examining the relationship between the presence of grandparents and the well-being of grandchildren report different outcomes for boys and girls (e.g. Borgerhoff Mulder, 2007; Gibson and Mace, 2005; Jamison et al., 2002; Strassmann, 2011). Hence gender-related factors are included in our analysis as well. With respect to grandparents there is evidence that granddaughters tend to report closer contact with grandmothers and grandsons with grandfathers (Hagestad & Speicher, 1981; Mann & Leeson, 2013). In line with this empirical evidence we expect boys to benefit more from a coresidence grandfather than girls.

There is evidence that a stronger position of women is associated with higher children's education, health and well-being (e.g. Hobcraft, 1993; Mukherjee and Das, 2008). Given that in regions where the position of women is stronger the position of mothers and grandmothers also tends to be stronger. The expectation therefore is that in such regions the presence of a grandfather is less important.

Besides the position of women, the presence and extent of polygamy might be important too. Strassmann (2011: p.1) observed that in polygamous families, child mortality and stunting rates

are significantly higher. She attributed this to the fact that polygamy creates conflicts within families associated with asymmetries in genetic relatedness. If there is more uncertainty about genetic relatedness among family members, the risk of conflict increases. Omariba & Boyle (2007) found that children from polygamous families are more likely to die compared to those from monogamous families. Kandiyoti (1988: p.277) argues that in case of polygamy the continuing obligations of both men and women to their own kin do not foster a notion of the family or household as a corporate entity. To what extent this is also true for grandfathers living in these families is not clear. Hence, whether the effect on schooling of the presence of a grandfather in such families is stronger or weaker than in a monogamous family remains an empirical question to be answered in our analyses.

Other factors

Other factors that may affect the grandfather coresidence effect are the number of children in the household and the birth order of a child. Regarding the number of children, literature indicates that the probability of going to school is smaller for children with more siblings (Booth & Kee, 2009; Huisman & Smits, 2009). A likely explanation is that children with more brothers and sisters have to share the available resources. With regard to birth order there is evidence that older children, in particular older girls, have lower schooling rates, probably because they have to work in the household or earn money to supplement household income (Buchmann & Hannum, 2001; Emerson and Souza, 2008; Webbink et al., 2013). In both cases, the presence of a grandfather may provide additional resources to compensate for these situations. We therefore expect the presence of a grandfather in the household to be more important in high fertility situations and for elder daughters.

3. Data and methods

Data

For this study, combined datasets from the Demographic and Health Surveys have been used (DHS; www.dhsprogram.com). The data are derived from the Database Developing World (www.datdevworld.org). DHS are large, nationally representative household surveys. For each survey, non-overlapping area units (often enumeration areas) are randomly selected. These areas (called ‘clusters’ henceforth) are usually communities, villages, or city quarters. In the selected

clusters, all households are listed and a random sample of 25-30 households is selected for the interviews. The DHS consists of a household survey, in which basic information is collected of all household members, and separate women's and men's surveys. In the women's surveys, all usual resident women aged 15 to 49 are invited for an oral interview. In this interview, information is obtained on socioeconomic, demographic, and health related issues.

To get a maximum discriminatory power, the data of all available DHS surveys for SSA countries held since 2000 have been pooled. For South Africa and Togo data for 1998 are used, as at the start of the project no other DHS surveys for these countries were available. To control for the fact that the surveys are held in different years and that for most countries several surveys were brought together, an indicator for survey year is included in the analysis. In appendix I, additional information about the sample can be found. Response rates are generally very high, over 95% in all but one survey.

Our combined dataset contains information derived from 69 surveys on 917.788 children (467.528 boys and 450.260 girls) aged 7–15 living in 29.925 local communities (sample clusters) within 597 sub-national regions (called 'districts' henceforth) of 33 SSA countries. The household level data have been supplemented with context information at the level of districts and communities/clusters. To get representative samples of the countries, the household weights provided by DHS are used in all analyses. Because of missing cases on the variables parental education, (grand)parental age, polygamy, number of brothers and sisters, wealth and educational participation, and some unrealistic cases for (grand)parental age, in total 19.782 (2,2%) children have been removed from the dataset. Unrealistic cases are parents with an age below 19 or grandparents aged below 31 (as the included children are at least aged 7). Our analysis therefore covers 898.006 children (457.286 boys and 440.720 girls). Structural missings on characteristics of parents and grandparents who were absent from the household (e.g. education or occupation of a death father) are addressed using the dummy variable adjustment procedure, which leads to unbiased estimates of these variables (Allison, 2001; Little and Rubin, 2002).

Method and Variables

The dataset is characterized by a hierarchical structure. Households are nested within sample clusters, nested within districts, nested within countries. We use three-level logistic regression analysis to address the nesting of the households within sample clusters and districts, and include

fixed effects dummies at the national level, to control for the nesting within countries. This strategy allows us to fully control for clustering and confounding at the national level, while retaining the possibility to study the role of context factors at the district and cluster level.

The dependent variable "educational participation" is a dummy variable indicating whether (1) or not (0) children aged 7–15 were attending school at the time of the interview. The upper age limit of 15 is chosen because above that age less children are living with their parents (e.g. because of early marriage, education, or parental death). The lower age limit is set at 7, because in most SSA countries a substantial number of children start schooling at a later than compulsory age (Huisman and Smits, 2009). The models are estimated with MLwiN, using second-order penalized quasi-likelihood (PQL2), the recommended estimating technique for multilevel logistic regression analysis (Goldstein and Rasbash, 1996).

The major independent variable is a dummy variable indicating whether (1) or not (0) children are living with a grandfather. Children living with their grandfather are identified in the DHS-data by using the household roster, which defines for all household members the relationship to the household head. Children are identified as living with a grandfather if (1) they are grandchildren of a male household head; (2) they are grandchildren of a female household head whose husband is also living in the household; (3) they are children of the household head, and the father or father in law of the household head is also living in the household; (4) they are children of a brother or sister of the household head, and the father of the household head is also living in the household. All other children living in the household, including adopted and foster children, are considered as not living with their grandfather. Given the restricted information on the relationships within the households, it cannot be completely precluded that some of these children still live together with a grandfather, for example if they belong to the categories "Other family members" or "Not related household members". However, given that the number of school-aged children in the data who belong to these categories is very small (3%), the number of them living with a grandfather is expected to be negligible.

Other independent variables are age and educational level of the grandparents, measured in years, and resource- and gender-related factors at household and context level. The presence of each parent is measured with two dummies, one indicating whether (1) or not (0) the parent is absent from the household and one indicating whether (1) or not (0) the parent is dead. Age of the child and age of its (grand)parents are interval variables. The variables 'number of sisters' and

‘number of brothers’ are also interval variables ranging from 0 to ‘10 or more’. This is also the case concerning the values of ‘birth order’ which run from 0 to ‘18 or more’.

The models contain a number of control factors that are known or can be expected to influence children’s educational participation. Household wealth, father’s occupation, parental education and employment of the mother are factors that have been known to influence children’s educational participation (Evangelista de Carvalho Filho, 2012; Glewwe & Jacoby, 2004; Mingat, 2006; Shavit & Blossfeld, 1993; Smits & Gündüz-Hoşgör, 2006).

Because income is lacking in the DHS data, household wealth was measured by the International Wealth Index (IWI; Smits and Steendijk 2014), a comparative asset-based wealth index. IWI indicates to what extent the household owns a basic set of assets, valued highly by people across the globe, such as TV’s, cars, telephones and housing characteristics like the quality of the floor material and toilet facility. Education of the parents is measured in years of education completed which ranges from 0 to 16 years. Occupation of the father is measured by three dummy variables, indicating whether (1) or not (0) the father was employed in a farm, lower non-farm (sales, services, manual), or upper non-farm (professional, technical, managerial, clerical) occupation. Employment of the mother is measured by a dummy variable indicating whether (1) or not (2) the mother aside from her housework did any other work last week. The questions used in the DHS surveys for measuring women’s employment are: “Aside from your own housework, have you done any work in the last seven days?” And if the answer was no: “As you know, some women take up jobs for which they are paid in cash or kind. Others sell things, have a small business or work on the family farm or in the family business. In the last seven days, have you done any of these things or any other work? Women who answered yes on one of these questions are considered as being employed.

To indicate the relative position of the mother in the household we follow earlier research (Blanc & Wolff, 2001; Luz & Agadjanian, 2015; Spierings et al., 2010) and use the age difference between parents (age mother minus age father). This variable was recoded into three dummy variables with a respective age-difference of up to -6, -6 to 0, and 0 and more, thus indicating a step by step strengthening of the relative position of the mother or in other words a weakening of the position of the father.

To study the importance of context factors, socio-economic characteristics (level of development, urbanization, education) and gender related cultural characteristics (age difference

between spouses, polygamy) of the region have been added to the models. Level of development is indicated by the mean of the International Wealth Index in the region. Given that this index at the national level is highly correlated with the Human Development Index and with GNP per capita (Smits and Steendijk, 2015) it is expected to be a good development indicator at the sub-national level as well. Urbanization is measured by a dummy variable indicating whether (1) or not (0) the household is living in a rural area. Education is measured by the mean years of education of people aged 20-40 in the area. The relative position of women in the context where the household lives is indicated by the average age difference between parents as an interval variable and by the percentage of polygamous households in the area. Polygamous households are households where the male household head has more than one wife.

Given that for African countries hardly any indicator is available at the sub-national level, context factors are created by aggregating household level variables to the sample cluster and district level. Sample clusters are villages or neighbourhoods and therefore reflect the nearby community in which the household lives very well. Using context variables at the cluster level therefore seems preferable over using such variables at the more distant district level. However, the sample clusters in our data are rather small (at most 30 households and often much less). This means that there is little variation at that level and measurement is less precise. At the district level, sample sizes are much larger. There is evidence that context effects can be caught rather well by more distant variables (Smits, Keij-Deerenberg, & Westert, 2005), although education at cluster level forms an exception. Kravdal (2006) found that the context level of education works well at cluster level. We therefore include context education at cluster level and the other context factors at district level.

To find out whether and in which ways the effect of a coresiding grandfather differs across circumstances, interactions between the grandfather dummy and all other variables at household and context level are tested. These other variables include the gender of the (grand)child, presence of its mother and father, socio-economic and gender factors at household and context level, and the time variable. In this interaction analysis, centred versions of the involved variables are used, so that the main effects can be interpreted as average effects. Only the significant results of our interaction analysis are reported.

4. Results

Descriptive statistics of the variables used in our models reveal that 6,8% of the children aged 7-15 in our sample is living with at least one grandfather and 16,2% is living with at least one grandmother (Table 1).

-- Table 1 about here --

Almost 73% of the children is attending school at the time of interview. The average age of grandfathers in the sample is almost 68 years against nearly 63 years for grandmothers. There are more children living with a missing father than with a missing mother. In 23,4% of the cases the mother is absent or dead and for 35,5% of the children the father is absent or dead. Most of the children in our population are living in a rural area (71%). On average grandfathers have obtained more years of education (2.7 years) than grandmothers (1,5 years) and parents in general are better educated than grandparents.

The grandfather effect

Table 2 shows the coefficients and odds ratios of our multilevel logistic regression model for the effect of grandfather's coresidence on the educational participation of children aged 7-15. The model includes grandfather's and grandmother's coresidence, characteristics of the grandparents, of the parents, of the household the child is living in and factors at cluster and district level like wealth, educational level and the relative position of women.

-- Table 2 about here --

The coresidence of a grandfather is positively associated with the educational participation of his grandchild(ren). This effect is significant and substantial. When controlling for confounding factors at household and context level, the odds of being in school are about 15% higher for children living with a grandfather. This finding is in line with our *positive grandfather hypothesis* which predicts grandfather's coresidence to be beneficial to grandchildren's schooling.

Characteristics of grandparents

Grandmother's coresidence is also positively associated with children's schooling. When controlling for confounding factors at household and context level, the odds of being in school are about 35% higher for children with a coresiding grandmother. The strength of the grandmother effect depends nonlinearly on her age. If the grandmother is young or old, the effect is weaker than when she is in her middle age. The shape of the relationships is displayed in Figure 2. We observe that the grandmother effect is strongest for grandmothers aged 69 and that for young (under 50) or very old (over 90) grandmothers it is much weaker. In contrast to grandmother's age we do not find a non-linear association between the grandfather effect and his age. Older grandfathers seem to be able to contribute more to the schooling of their grandchildren than young grandfathers.

-- Figure 2 about here --

The findings are in line with the idea that young grandparents may be less of a resource as they are reproductive themselves. In case of (very) old grandparents we observe that grandmothers may be more of a burden than a resource for the household. However, for grandfathers we observe exactly the opposite effect and see a grandfather who is progressively important for children's schooling when he becomes older.

Furthermore, we find that the level of education of grandparents is positively associated with schooling. For grandmothers this relationship is somewhat stronger than for grandfathers. The random effect variances and covariances related to the coresidence of a grandfather are presented at the bottom of Table 2. The grandfather effect varies substantially across districts and clusters. The (co)variances are highly significant and sizable.

Other confounding factors

The models perform in line with what is already known with respect to the educational participation of children (e.g. Huisman & Smits, 2009; 2015). Table 2 presents the results of all other factors in the model. Children's schooling rates are higher when their parents are higher educated, not absent or dead and their mother is employed. Schooling rates are also higher when the household is wealthier, father is a 'non-farm' worker, when there are less brothers in the

household and there is a more traditional situation with regard to the age difference between parents (father older than mother). Educational participation is also positively associated with children living in an urban area and in an area with higher educational levels.

Children are less in school when they are living with their uncle. District level of development has a negative sign, which is unexpected. This is probably due to some multicollinearity with household level of development, as both are based on the same wealth index. Indeed, when household level wealth is removed from the models, the coefficient of district level of development becomes positive. This multicollinearity is not problematic for our outcomes regarding the grandfather effect, as it is between two control factors in the models (Allison, 2012; Voss, 2004). Removing either or both wealth-based variables from the models does not affect these outcomes at all. Given that the models perform well in all other respects, we accept it as a good models for studying the effect of grandfather's coresidence on children's schooling.

The role of the context: interaction effects

Interactions between the grandfather effect and all other variables in the model were tested and the significant interactions were added to the model. There are a substantial number of significant interactions between grandfather's coresidence and variables at the household level. A first important interaction is with the age of the grandchild. As grandchildren grow older, the importance of a coresiding grandfather increases. Secondly, girls seem to profit more of the presence of their grandfather than boys. For girls, the odds of being in school increase by 23% ($P<0.01$ not in table) in households with a coresiding grandfather, whereas for boys this increase is only 7% and not significant (not in table).

Presence of a grandfather is particularly important if the mother is dead or missing from the household. In those situations, the presence of a grandfather increase the odds of being in school by 27 to 41% respectively. Interestingly, in case of a dead or missing father, a coresiding grandfather does not make a significant difference for children's schooling. Hence it seems that grandfathers may replace a missing mother, but less so a missing father.

In households with a coresiding grandmother or where the mother is older than the father, the presence of a grandfather is less important. In case of older grandmothers we observe the opposite effect.

-- Table 3 about here --

There are no significant interactions with characteristics of the context in which the household is situated. Both education (at cluster level) and level of development (at district level) show no significant interactions with the grandfather variable. This seems to indicate that presence of a grandfather is not more favourable for children's schooling in situations where schooling opportunities are already rather good. In districts where the age difference between spouses is smaller, the effect of the presence of a grandfather also does not differ. No significant interaction effect of living in a polygamous household was found, which indicates that the effect on children's schooling of a coresiding grandfather does not significantly differ from children not living in polygamous households.

Grandfathers are not more important if the household is situated in a rural or an urban area. No significant interaction between the grandfather effect and year of survey was found, indicating that the importance of a coresiding grandfather is more or less stable over time.

5. Conclusion and discussion

On the basis of data on almost 900.000 children aged 7–15, living in 33 SSA countries, we find evidence that children living with their grandfather have higher odds of being in school than children who are not living with their grandfather. Children with a coresiding grandfather on average have 15% higher odds of being in school. This effect is quite substantial, even though it is weaker than the effect of a coresiding grandmother (who increases the odds of being in school by 38%). The finding of a positive grandfather effect is in line with the *generative grandfathering* framework of Bates (2009), which supposes grandfathers to actively support and guide the next generation in their *generative* stage of life.

We also expected the degree and quality of generative work grandfathers put forth to their grandchildren to vary and to depend upon the characteristics of the grandfather, in particular their educational level and age. Regarding their educational level, we argued that grandfathers who have experienced the benefits of good education might be better equipped to teach, instruct and coach their grandchildren. It might also make them more eager to teach their grandchildren and to stimulate them to go to school than grandfathers with no or less education. This expectation is

supported by our results. The level of education of coresiding grandfathers is positively associated with the schooling of their grandchildren.

For grandfather's age we hypothesized that when grandfathers get older, they become more emotionally expressive and affectionate towards their grandchildren and may wish to teach about interpersonal relationships and to transfer values to them (Fuller-Thomson & Minkler, 2001; Waldrop et al., 1999). This hypothesis is also confirmed by our results (see Figure 2). The effect of the presence of a grandfather is more positive if the grandfather is older. We also hypothesized that at some point the grandfather would become too old to take care of his grandchildren and become a drain for the household, but this expectation was not supported by our data. This might have to do with the fact that the number of observations of very old grandfathers in our dataset is limited.

To gain insight into the circumstances under which a grandfather is more or less important for children's schooling, an interaction analysis was performed. An important finding of this analysis is that there is a significant positive interaction between grandfathers' coresidence and their grandchildren's age. Hence the presence of a grandfather is more positive for the schooling of older grandchildren. This finding supports our hypothesis that grandfathers might be particularly focused on the societal position of their grandchildren, because the level of respect they gain in society might depend on the societal success of their grandchildren. Because this societal success of the grandchildren may depend to a substantial degree on the level of schooling they obtain, grandfathers have an incentive to keep their children in school and to help them to move on from primary to secondary education.

Based on previous studies, in which granddaughters tend to report closer contact with grandmothers and grandsons with grandfathers, we expected boys to benefit more from a co-residing grandfather than girls (Hagestad & Speicher, 1981; Mann & Leeson, 2013). However, our results show the opposite effect. Girls profit more from a co-residing grandfather than boys. This might indicate that grandfathers also take over (household)tasks that otherwise would have been done by girls. It might also have to do with the overall weaker position of girls compared to boys in African households, which implies that for girls more improvement is possible than for boys and that additional resources (in this case the support given by the grandfather) might benefit them more (convergence).

Our interaction analysis further reveals that the grandfather effect is stronger when the mother is dead or missing from the household. However, it is hardly affected by the absence or death of the father. This might be due to the fact that African mothers are more important for children's schooling than African fathers. The effect of a missing mother on African children's schooling is much stronger than that of a missing father (e.g. Case & Ardington, 2006; Evans & Miguel, 2007; Lloyd & Blanc, 1996; Parker & Short, 2009). Households with a missing mother therefore might be more in need of a helping grandfather than households with a missing father. At least, when there is no grandmother in the household. Our interaction analysis shows that the effect of a coresiding grandfather is less strong if there is also a grandmother is present. Hence grandfathers and grandmothers are to a certain extent substitutes of each other. Either of them can take over household tasks or may contribute in other ways that increase the possibilities of children to go to school. When the grandfather and grandmother are together in the household, the individual contribution of both of them decreases. However, this also depends on grandmother's age, as the importance of grandfathers for children's schooling increases significantly if the grandmother is older. So African grandfathers and grandmothers also supplement each other to a certain extent.

A little surprisingly, we find no significant interactions with socio-economic factors at household or context level. Our ideas that grandfathers might be more important under more difficult circumstances or in situations of scarcity are thus not confirmed by our data. Also our expectations regarding the role of cultural factors, are not confirmed by the data. Given the negative effects of polygamy on child survival documented in earlier research (e.g. Omariba & Boyle, 2007; Strassmann, 2011), we were wondering whether the grandfather effect on schooling would be affected by polygamy. This turned out not to be the case. Neither at household level, nor at community level, polygamy had a significant effect. Regarding the strength of the relative position of fathers versus mothers in the household, we found that in the rather unusual situation that the mother of the child is older than the father, having a coresiding grandfather is less important for children's schooling. Hence a weak position of the father seems to go together with a weaker position of the grandfather.

Our study is the first to document a positive effect of the presence of a grandfather on the well-being of children in sub-Saharan Africa. Earlier studies for this region did not find any grandfather effect, neither on young children's survival chances (Borgerhoff Mulder, 2007; Gibson & Mace, 2005; Sear, 2008; Sear et al., 2000) nor on children's schooling (Parker & Short,

2009). This might have to do with the relatively small scale of these studies, the focus on very young children of the four African studies, or the fact that those studies did not control for all relevant socio-demographic factors. The fact that the grandfather effect is substantially weaker than the grandmother effect probably also plays a role. A large database and powerful design were needed to make it visible against the background of confounding factors.

Some caution is required regarding our conclusions, as our study has several limitations. First, it is based on cross-sectional data. Hence, although important new information is obtained on the association between grandfathers' coresidence and children's schooling and on the variation of this relationship across circumstances, no strict conclusions in terms of causal relations can be drawn. Second, it was not possible to distinguish effectively between maternal and paternal grandfathers, as this information is not available for most households in our database. This is regrettable, as earlier studies found differences in children's well-being depending on whether they were living with a paternal or maternal grandfather (Borgerhoff Mulder, 2007; Sear, 2008; Strassmann, 2011). To what extent and in what way this has influenced our results is not clear, as previous research did not point towards a systematic difference to the advantage or disadvantage of one of them. Third, as our data does not contain information on non-residing grandfathers, it was not possible to say something about the distance gradient in grandfather support. Grandfathers who live in the vicinity of their (grand)children are probably better able to support them than grandfathers who live farther away. Insight into the nature of this relationship is essential for policymakers and social agents who want to strengthen existing family ties in order to improve the position of children. Further research is therefore needed on this distant gradient, as well as on some other missing factors, like the lineage of the grandfather and the role played by local organizations, like schools, governmental services and NGO's.

In sum, we found evidence in favour of the existence of a positive grandfather effect on children's schooling across a broad range of circumstances in the SSA context. The effect is particularly strong for older children, for girls and when the grandfather is older. Grandfathers and grandmothers are to a certain extent substitutes of each other. However, if both a grandfather and a grandmother are present in the household, the grandfather effect becomes negative. This suggests that grandfathers tend to lean to a certain extent on their wife when they are old and that grandmothers have less energy left for their grandchildren if their husband is also present. Compared to earlier research our study is a major step forward, as it provides -- for the first time -

- a broad comparative analysis of the role played by context factors for the relationship between grandfathers coresidence and child well-being, in particular children's schooling. Our findings make clear that grandfathers should not be overlooked when designing policies aimed at strengthening the position of grandparents and children in the SSA context.

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Figure 1.*Conceptual model of relationship between grandfathers' coresidence and children's schooling in sub-Saharan Africa*

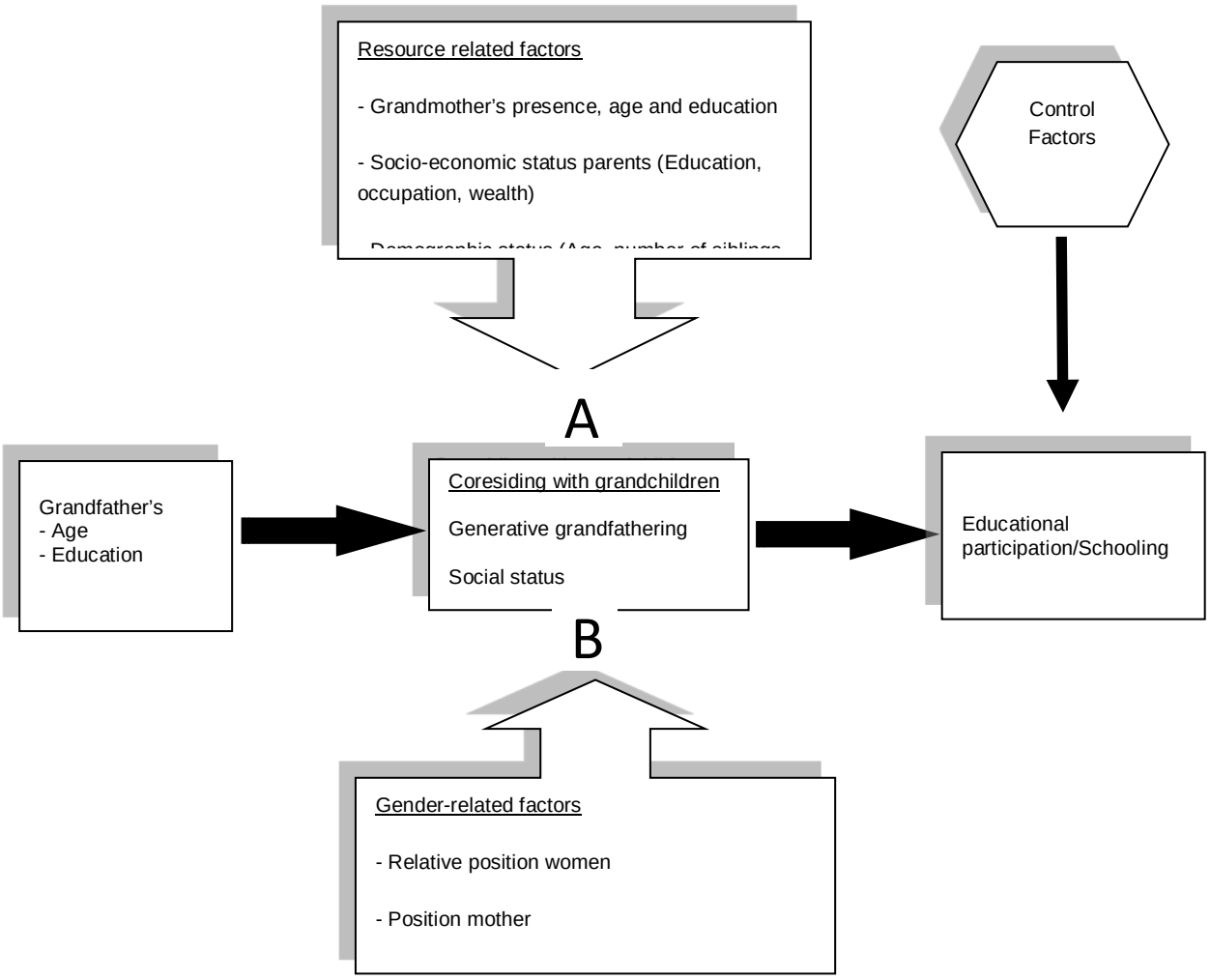

Figure 2. *Log odds of being in school and age of coresidence grandparents*

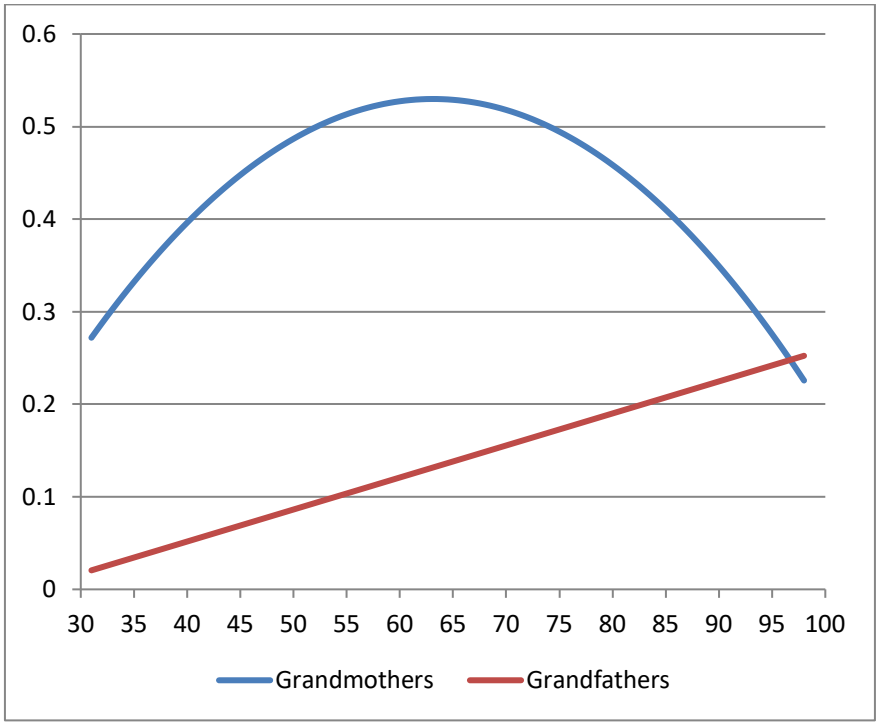

Table 1. *Descriptive statistics: Percentages, means of characteristics of children aged 7-15*

Variables	%, mean	Min	Max	SD
School attendance (dependent variable)	72.9%	0	1	0.44
Household factors				
Grandfather in the household	6.8%	0	1	0.25
Age grandfather	67.7	31	98	2.74
Education grandfather (years)	2.7	0	16	1.02
Grandmother in household	16.2%	0	1	0.37
Age grandmother	62.9	31	98	4.37
Education grandmother (years)	1.5	0	16	1.14
Sex is girl	49.1%	0	1	0.50
Age child	10.7	7	15	2.54
Age mother	38.0	19	98	7.39
Age father	46.9	19	98	8.80
Birth order	3.30	1	18	1.94
Number of Sisters	1.92	0	10	1.65
Number of Brothers	2.04	0	10	1.74
Mother alive, not in household	19.0%	0	1	0.39
Father alive, not in household	25.9%	0	1	0.44
Mother dead	4.4%	0	1	0.20
Father dead	9.6%	0	1	0.29
Household wealth (IWI)	27.0	0	100	22.73
Education father (years)	4.13	0	16	3.79
Education mother (years)	2.99	0	16	3.47
Mother employed	57,5%	0	1	0.43
Occupation Father:				
Farm (reference category)	19.2%	0	1	0.32
Lower non-farm	9.4%	0	1	0.23
Upper non-farm	3,2%	0	1	0.14
Relative position mother (age mother-age father):				
Father ≥6 years older than mother (reference category)	64.8%	0	1	0.37
Father 6-0 years older than mother	31.8%	0	1	0.36
Father younger than mother	3.3%	0	1	0.14
Polygamous household	12.9%	0	1	0.33
Context factors				
Living in rural area	70.7%	0	1	0.46
Level of development (district)	27.02	0.99	88.96	16.93
Relative position women (district)	-8.99	-27.1	0.04	2.64
Educational level (years, cluster)	2.9	0	12.5	1.30
Polygamy (district)	29.0%	0	1	0.19

Source: DHS (1998-2013).

Table 2. *β-coefficients, standard errors and odds ratios of ln(grandfather's and grandmother's coresidence) and control factors on the educational participation of children aged 7-15 in 33 SSA countries*†

Grandparental factors	β	S.E.	Exp(β)
Intercept	1.60***	0.167	
Grandfather in household	.135***	0.040	1.15
Grandmother in household	.321***	0.017	1.38
Age grandfather	.003**	0.001	1.00
Age grandmother	.031***	0.009	1.03
Age grandmother square	-.0002***	0.000	1.00
Education grandfather (years)	.046***	0.006	1.05
Education grandmother (years)	.073***	0.006	1.08
Child factors			
Age child	.028***	0.009	1.03
Sex (0=boy; 1=girl)	-.241***	0.027	0.79
Birth order child	-.023***	0.003	0.98
Household factors			
Age mother	.042***	0.005	1.04
Age mother square	-.0004***	0.000	1.00
Number of sisters	.008***	0.003	1.01
Number of brothers	-.026***	0.003	0.97
Mother alive, not in household	-.512***	0.169	0.60
Father alive, not in household	-.312*	0.170	0.73
Mother dead	-.575***	0.168	0.56
Father dead	-.350**	0.170	0.70
Household wealth (IWI)	.026***	0.001	1.03
Education father (years)	.075***	0.003	1.08
Education mother (years)	.085***	0.003	1.09
Mother employed	.133***	0.017	1.14
Occupation father (ref=farm)			
- Lower non-farm	.106***	0.024	1.11
- Upper non-farm	.219***	0.047	1.25
Position mother (ref=father >6 yrs older)			
- Father 0-6 years older than mother	-.055***	0.013	0.94
- Father younger than mother	-.193***	0.030	0.83
Polygamous household	-.113***	0.016	0.89
Uncle in household	-.059**	0.024	0.94
Aunt in household	.011	0.024	1.01
Context factors			
Living in rural area	-.683***	0.108	0.51
Level of development (district)	-.017***	0.003	0.98
Educational level (cluster)	.126***	0.014	1.13
Position women (district)	.075***	0.026	1.08
Polygamy (district)	0.56	0.355	1.75
Year	.070***	0.008	1.07
Variance components			
District level (3)			
- Variance intercept schooling	.387***	0.030	
- Random effect covariance Gf	.034***	0.012	
- Random effect variance Gf	.024***	0.008	
Cluster level (2)			
- Variance intercept schooling	.760***	0.030	
- Random effect covariance Gf	-.046***	0.015	
- Random effect variance Gf	.594***	0.043	

*******P<0.01 **P<0.05 *P<0.1 (n=898.006 of which 61.281 living with a grandfather and 655.783 is attending school)

†The model includes the full set of country-level fixed effects dummies to control for confounding and clustering at the national level

Table 3. *β-coefficients and odds ratios for the significant interaction effects of ln(grandfather)*

Main effects presence grandparents	β	S.E.	Exp(β)
Grandfather (Gf) in household	.135***	0.040	1.15
Interaction effects grandfather			
Gf * Age child	.026***	0.008	1.03
Gf * Sex is girl	.145***	0.029	1.16
Gf * Mother alive, not in household	.341***	0.037	1.41
Gf * Mother dead	.241***	0.053	1.27
Gf * Grandmother in the household	-.262***	0.052	0.77
Gf * Age grandmother	.007**	0.003	1.01
Gf * Father younger than mother	-.210***	0.078	0.81

***P<0.01 **P<0.05 *P<0.1

APPENDIX A. DHS country data, year of survey(s) and household response rates

Country	**Year(s)**	**HH Resp. rate (%)**
Benin	2001, 2006, 2011	97.0, 99.1, 98.6
Burkina Faso	2003, 2010	99.4, 99.2
Burundi	2010	99.1
Cameroon	2004, 2011	97.6, 99.0
Chad	2004	99.4
Cote d'Ivoire	2005, 2011	95.5, 98.1
Congo DR	2007, 2013	99.3, 99.9
Congo Brazzaville	2005, 2011	99.2, 99.8
Ethiopia	2000, 2005, 2011	99.3, 98.5, 98.1
Gabon	2000, 2012	97.6, 99.3
Ghana	2003, 2008	98.7, 98.9
Guinea	2005, 2012	99.2, 99.5
Kenya	2003, 2008	96.3, 97.7
Lesotho	2004, 2010	95.2, 97.6
Liberia	2007, 2013	97.2, 99.4
Madagascar	2004, 2009	97.8, 98.8
Malawi	2000, 2004, 2010	99.0, 97.8, 98.1
Mali	2001, 2006, 2013	97.9, 98.8, 98.4
Mauritania	2001	98.4
Mozambique	2003, 2011	80.6, 99.8
Namibia	2000, 2006, 2013	96.9, 97.8, 96.9
Niger	2006, 2012	98.0, 98.0
Nigeria	2003, 2008, 2013	98.6, 98.3, 99.0
Rwanda	2000, 2005, 2010	99.7, 99.7, 99.8
Senegal	2005, 2011, 2012	98.5, 98.4, 98.7
Sierra Leone	2008, 2013	97.6, 99.3
South Africa	1998	97.0
Swaziland	2006	95.2
Tanzania	2004, 2010	98.8, 98.8
Togo	1998	98.6
Uganda	2001, 2006, 2011	95.8, 95.3, 97.5
Zambia	2002, 2007	98.2, 97.8
Zimbabwe	2006, 2011	95.0, 96.0