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Grandmothers and Children's Schooling in 33 sub-Saharan African Countries

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Abstract

An important debate in the anthropological literature concerns the benefits children in poor countries derive from the presence of a grandmother. The broadly held idea that grandmothers are beneficial for their grandchildren has been challenged by the finding that in a resource poor society (the Dogon in Mali) the presence of a grandmother could negatively affect the life chances of their grandchildren. Using a newly built database with information on 763.615 young children living in 33 sub-Saharan African countries, we study the effect of the presence of a grandmother on their grandchildren's educational participation under a broad range of circumstances. The results indicate that for children's schooling the effect of the presence of a grandmother varies across circumstances, but is always positive. Grandmothers are particularly important when the mother is missing and for girls. Regarding the role of circumstances, we find grandmothers to be more effective in situations with more opportunities, like in wealthier regions and in communities with a more highly educated population. Grandmothers are also more effective in rural areas and farm households; circumstances that for many of them may resemble the situation in which they grew up.

Keywords

Grandmothers, children's schooling, sub-Saharan Africa, multilevel analysis

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1. Introduction

An important recent debate in the anthropological literature concerns the benefits children in poor countries derive from the presence of a grandmother in the household. The broadly held idea that grandmothers are beneficial for their grandchildren (Hawkes et.al, 1997; Hrdy, 1999; Sear et al., 2000; Sear and Mace, 2008) was challenged by a study of Strassmann (2011) who reported that among the Dogon in Mali the presence of a grandmother had adverse effects on the lives of their young grandchildren. Coresidence of the paternal grandmother (father's mother) was associated with a twofold higher hazard of death of a grandchild by the age of five. One of the explanations given is that elderly grandmothers are net-consumers and therefore become competitors with their grandchildren in the resource-poor society of the Dogon. Strassmann (2011) also noticed that girls tend to grow faster in the absence of the maternal grandmother (mother's mother). These findings indicate that there are circumstances under which grandmothers' coresidence may have a negative impact on child well-being. This is a critical finding in light of the fact that in sub-Saharan Africa an estimated 15.1 million children have lost one or both of their parent(s) and that many of them have become highly dependent on the care of their grandmother(s) (UNAIDS, 2013). For developing policies aimed at improving the life chances of these children, it is important to find out under which circumstances coresidence of grandmothers is more or less positive for their grandchildren's well-being. The current paper aims to contribute to the field by providing new empirical evidence regarding the association between grandmothers' coresidence and children's schooling under varying circumstances in sub-Saharan Africa.

The focus on schooling is relatively new, as most of the literature so far, has focused on the relationship between grandmothers' coresidence and health factors, like infant and child mortality and body growth (e.g. Gibson and Mace, 2005; Sear et al., 2000; Borgerhoff Mulder, 2007; Jamison et al., 2002; for a broad overview see also Strassmann and Garrard, 2011 and Sear and Mace, 2008). The effect of the presence of grandmothers on the educational participation of children in developing countries has received much less attention. This is an important lack in our knowledge, because schooling plays a vital role in the opportunities of children in their prospective lives. In sub-Saharan Africa still 22% of the primary school age population is not in school and non-participation rates in secondary education are even (much) higher (UNESCO, 2014). In this paper, we build a theoretical framework describing the relationship between grandmother's co-residence and children's schooling and the way this relationship is affected by factors at the household and context

level. This framework is subsequently tested on the basis of a newly built database with information on 763.615 children aged 7–15 living in 33 sub-Saharan African countries. This database is unique in that it contains context characteristics at the level of 541 subnational regions (hereafter called 'districts') as well as at the level of 26.312 communities within the 33 countries. The possibilities for studying context effects are therefore much larger than in earlier research.

By applying multilevel logistic regression analysis -- including interaction models -- on this new database we aim to answer the following two research questions:

1. *What is the overall relationship between grandmother's coresidence and their grandchildren's educational participation?*
2 *To what extent and in which way is this relationship influenced by socio-economic, demographic and cultural characteristics at the household and context level?*

In the next section, the details of our theoretical framework are presented and hypotheses are derived from it. Section 3 describes the data and methods in more detail. In section 4 our results are presented. Concluding remarks are given in section 5.

2. Theoretical framework and literature review

The role of the grandmother

There are many studies showing positive effects of the presence of a grandmother on the well-being of their grandchildren. Hawkes et al. (1997) for example observed that in Tanzania Hadza-grandmothers appear to enhance the nutritional welfare of grandchildren by helping their daughters in provisioning food for the children. In rural Gambia maternal grandmothers double the survival chances of a Mandinka child by taking care of their grandchildren (Sear et al., 2000). In Ethiopia grandmothers had a positive effect on child survival by relieving their daughters of heavy domestic work. Non-reproductive maternal grandmothers in Ethiopia were positively associated with child height (Gibson and Mace, 2005).

A positive relationship between the presence of a grandmother and child well-being has been found in pre-modern societies as well (e.g. Lahdenperä et al., 2004; Jamison et al., 2002; Voland and Beise, 2002; Beise, 2005). According to Lahdenperä et al. (2004) the presence of grandmothers in 18th and 19th century Finland and Canada was associated with less mortality among their grandchildren. The significance of this effect depended however

on the age of grandmother and grandchild. When a grandchild was aged between two and five and grandmothers were under 60 at their birth, survival probabilities were significantly higher. Jamison et al. (2002), who analyzed historical data (1671-1871) of a small village in Japan (Shumon Aratame Cho), also noted a positive association between the presence of a maternal grandmother and child survival rates.

Studies in more affluent contemporary societies, like the U.S. and Europe, also revealed a positive role of grandmothers (e.g. Danielsbacka et al., 2011; Fuller-Thomson and Minkler, 2001; Hank and Buber, 2008; Kaptijn et al., 2013; Dimova and Wolff, 2010). In these studies child well-being was measured by other factors than nutritional welfare and offspring mortality. The grandmothers for example delivered childcare or helped their (grand)children financially.

Given the fact that the majority of studies reports positive 'grandmother effects', it is not surprising that the idea that grandmothers (or at least the maternal grandmother) are beneficial for their grandchildren, is broadly held among scholars in the field, as well as among the public at large. This is the reason why the findings of Strassmann (2011) of negative grandmother effects among the Dogon in Mali were received with surprise. The evidence provided by Strassmann (2011) strongly suggests that – at least under specific circumstances – presence of a grandmother may have adverse effects on the lives of their young grandchildren. She found for example that Dogon girls grow faster in the absence of the maternal grandmother. According to Strassmann (2011: p.10899) this is probably the result of the hard work they have to perform for their grandmother, like weeding in the garden. She also found the coresidence of a paternal grandmother to lead to a twofold higher hazard of death of a grandchild by the age of five. Strassmann attributes this to the fact that elderly grandmothers become net-consumers and therefore competitors with their grandchildren in the resource-poor society of the Dogon.

Prior to Strassmann's study, there were already indications that the presence of the maternal grandmother is not always positive for child well-being. Sear (2008) for example discovered that among the Chewa in Malawi child mortality rates are higher in the presence of matrilineal kin and in particular in the presence of the maternal grandmother. Resource competition between kin might be the cause of this negative effect according to Sear. When studying the Kipsigis in Kenya, Borgerhoff Mulder (2007) found no positive effect of the maternal grandmother, which she associated with the strong patrilineal organization of the Kipsigis.

Why do grandmothers invest in their (grand)children?

In case of parental death and especially when mothers die, grandmothers are usually the ones that take over the care of their grandchildren. In sub-Saharan Africa where an estimated 15.1 milllion children have lost one or both of their parent(s) this is a common situation (UNAIDS, 2013).

Next to this grandparental investment 'forced by the circumstances', evolutionary theory provides a biologically-driven argument of why grandparents, and in particular grandmothers, invest in their grandchildren (e.g. Hawkes et al., 1997, Hrdy, 1999, 2009; Sear and Mace, 2000, 2008). Starting point of this argument is Hamilton's (1964) inclusive fitness theory. According to this theory, individuals can enhance their inclusive fitness by reproducing themselves and/or by helping reproduce other kin, with whom they share a part of the same genes by descent. Regarding grandmothers the idea is that at a certain point in time the expected returns on producing offspring themselves is lower than the returns on helping rearing their grandchildren and other kin in terms of reproduction. In line with this reasoning, the classical grandmother hypothesis argues that the ending of fertility gives grandmothers the opportunity to influence the reproductive success of her children and thus indirectly the survival of her progeny and in this way also her own reproductive success (e.g. Hawkes, 2004).

There is also an economic argument of why (grand)parents may invest in their children (and thus indirectly in their grandchildren), namely to secure their old-age pension. In the absence of a pension system, as in most developing countries, (grand)parents invest in their children in order to have their old age needs fulfilled in future (Laferrère & Wolff, 2006).

Grandmother's effect on 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). In most developing countries the decision to invest in schooling of young children, is taken by their parents. Their decision is determined by different factors and is subject to changes over time. Parents weigh off the costs and benefits of the investment in schooling. The benefits are enjoyed generally in the future, in terms of a higher income of their children and therefore

better old-age security for themselves. The costs -- which have to be paid now -- concern both direct and indirect costs. Direct costs generally consist of fees, books and pencils, and a school uniform. Indirect costs reflect the costs of not being able to work at home or earn some money with child labor (Webbink et al., 2012). These so-called opportunity costs may vary over time, for example during harvest season when they will be higher than periods when there is less work. The direct and indirect costs are a heavy economic burden for many poor households (Admassie, 2003; Ananga, 2011). Therefore, we would expect that especially in poor households the presence of a grandmother could be beneficial to a child's educational participation and well-being. Grandmothers can compensate the opportunity costs of schooling of their grandchildren, who are not able to contribute to the household. Moreover, grandmothers can enable parents to work from home or prevent children, especially girls, from taking over household tasks when their mother is working (Huisman and Smits, 2009).

Although the effect of a coresident grandmother on educational participation of children in poor countries has received little attention in the literature, there are a few studies that provide some evidence regarding this relationship. For example, Parker and Short (2009) found for Lesotho that it is beneficial to the educational participation of children when living with a grandmother, and Zeng and Xie (2011) showed for rural China that the educational level of coresident grandparents directly affects the educational attainment of their grandchildren. There is also some research comparing grandparent-headed households and households headed by other relatives regarding schooling outcomes. Children of grandparent-headed households in for instance 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). However, broad comparative research that studies how the grandmother effect on children's education varies across different contexts in Africa is completely lacking.

The model

The model used in this study is presented in figure 1. Grandmothers' coresidence is the major independent variable and educational participation is the dependent variable. Based on the classic grandmother hypothesis we would expect the effect of grandmothers' coresidence on their grandchildren's schooling to be positive. The size and direction of the 'grandmother

effect' is supposed to be influenced by socio-economic, demographic and cultural factors at the household and context level.

Income, wealth, employment and education are the most important resources at the household level. The availability of these resources may influence the grandmother effect. Children of poor families are enrolled less in school and are more involved in child labour and experience many other negative outcomes like high levels of child mortality, diseases and stunting (Duncan and Brooks-Gunn, 1997; Basu and Tzannatos, 2003; Webbink et al., 2012; Bourdillon, 2006; Hope, 2005). Regarding parental education, there is broad evidence that children from better educated parents go to school and stay in school more often (Buchmann and Brakewood, 2000; Colclough et al., 2000; Ersado, 2005; Smits and Hoşgör, 2006). Because better educated parents (have) experience(d) the benefits of better education themselves, they weigh off the costs and benefits more in favour of schooling than parents with hardly any education (Breen and Goldthorpe, 1997; Huisman and Smits, 2009; Piotrowski and Paat, 2012).

The presence of parents is an important demographic factor at the household level that influences the grandmother effect. Parental death and especially maternal death is known to have a negative impact on children's well-being and schooling outcomes (see e.g. Case and Ardington, 2006; Evans and Miguel, 2007; Nyamukapa and Gregson, 2005). Given this fact, it seems obvious to assume that coresidence of the grandmother can be particularly beneficial to children's well-being and schooling under such circumstances. Research by Parker and Short (2009) in Lesotho seems to confirm this relationship. We therefore can hypothesize that in the absence of parents and especially when the mother is absent, the presence of a grandmother in the household will be more important.

Other demographic factors that influence schooling are the presence of siblings and birth order of the child. Regarding the presence of siblings, literature indicates that the chances that children with more siblings go to school are smaller. The idea is that children with more brothers and sisters have to divide the available resources. With regard to birth order there is evidence that older children generally, especially older girls, have lower schooling rates. An explanation is that older siblings have to work in the household or earn money to supplement household income (Buchmann and Hannum, 2001; Emerson and Souza, 2008; Huisman and Smits, 2009). Most literature in this field of study suggests different outcomes for boys and girls (e.g. Jamison et al., 2002; Borgerhoff Mulder, 2007; Gibson and Mace, 2005; Strassmann, 2011). Hence we will include a gender variable in our analysis as well.

Context factors

The grandmother effect is also expected to be influenced by context specific factors. Here we study the role of socio-economic and cultural factors. An important socio-economic factor is the availability of resources. The local resource competition hypothesis (see e.g. Borgerhoff Mulder,2007 and Sear and Mace, 2008) emphasizes the negative effects on altruistic behaviour of family members due to scarcity of local resources. Borgerhoff Mulder (2007) observed, using within-population variation in 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. This context factor may influence the grandmother-effect in the sense that, particularly in resource poor societies, grandmothers may also become competitors with their grandchildren.

Another socio-economic context factor which may influence the grandmother effect is the degree of urbanization and the general level of education. Urban areas are more exposed to the effects of globalization than rural areas and infrastructure is better developed. State influence is generally stronger and value patterns that stress the importance of education and equality among sexes are more commonly spread. This might put more pressure on parents to send their children to school (Huisman and Smits, 2009; Tansel, 2002). Smits and Gündüz-Hoşgör (2006) found for Turkey that children living in urban areas have significantly higher schooling attainments. Fafchamps and 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 parental resources are important for children's schooling. This might make coresidence of a grandmother in rural areas especially important.

Cultural factors included in the model are polygamy and the position of women in the region; factors closely related to the different forms of patriarchy. Strassmann (2011: p.1) observed that in more polygamous societies, child mortality and stunting rates were significantly higher. She attributes this to the fact that polygamy creates conflicts within families associated with asymmetries in genetic relatedness. In other words, there is more uncertainty about genetic relatedness among family members, which leads to conflicts between them. 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. Especially under these circumstances of uncertainty the

coresidence of a maternal grandmother could be beneficial to the well-being of her grandchildren.

Less cooperative forms of households, involving the relative autonomy of mother-child units, can be found in sub-Saharan Africa (Caldwell and Caldwell, 1987; Kandiyoti, 1988). Women are responsible for the day-to-day care of children and to a large extent for their economic support. Regarding this crucial role of women in raising children in sub-Saharan Africa, it is also important to look at the relative position of women in the region where the household is situated. There is evidence that a relatively strong position of women improves children's educational participation, health and well-being (e.g. Hobcraft,1993; Mukherjee and Das, 2008). A strong position of women probably also implies a strong position of grandmothers. Given that more empowered grandmothers are more capable of using their influence to the benefit of their children (Mukherjee & Das, 2008), we would expect in societies with a relatively strong position of women, the presence of a grandmother to be particularly beneficial to children's schooling.

3. Data and methods

Data

Demographic and Health Survey (DHS; www.dhsprogram.com) data of 33 sub-Saharan African countries was brought together into a new database with information on over 760.000 children (388.529 boys and 375.086 girls) aged 7–15 living in 26312 local communities (sample clusters) within 541 sub-national regions of 33 countries The data are derived from the Database Developing World (www.datdevworld.org). The data is supplemented with context information at the level of districts and communities/clusters. Giving the large sample size of our database, the district and cluster variables could be created by aggregating data from the household level. For each country the most recent surveys at time of data preparation were used. The oldest datasets are from 1998 (South Africa and Togo); the most recent one from 2012.

In appendix I additional information can be found about the sample, such as which countries are included in the data and the year in which the surveys were conducted. The response rates are generally very high, over 95% in most countries.

Method and Variables

The effects of socio-economic, demographic and cultural factors on schooling are studied using four-level multilevel logistic regression analysis. The models are estimated with MLwiN directed from Stata using Runmlwin (Leckie and Charlton, 2012), using second-order penalized quasi-likelihood (PQL2), the recommended estimating technique for multilevel logistic regression analysis (Goldstein and Rasbash, 1996) In our model the response or dependent variable comprises educational participation which is a dummy variable indicating whether children aged 7–15 were attending school at the time of the interview (yes=1, no=0). The upper age limit of 15 was chosen because above that age already a substantial number of children is not living with their parents anymore (e.g. because of early marriage, for educational reasons, or parental death). The lower age limit was set at 7 to avoid excluding children in countries where many children start schooling later than the compulsory age. Descriptives of the variables are presented in Table 1.

Table 1 about here

The major independent variable is a dummy variable indicating whether children are living in a household with at least one grandmother (1) or not (0). The lower age limit for grandmothers was set at 30 years. Of the children in our sample 16,8% is living with at least one grandmother (see Table 1).

Variables reflecting the circumstances that influence the relationship between grandmothers' coresidence and schooling can be divided into socio-economic and demographic factors. Four main demographic factors at the household level are taken into account: age of the child and of its mother, birth order, number of brothers and sisters and the presence of parents. The presence of parents is measured with two dummies, indicating whether (1) or not (0) the mother or father is missing from the household. According to the figures in Table 1, on average more fathers than mothers were missing in the households of our sample, 40,6% versus 29,9%. The variables 'number of sisters' and 'number of brothers' are interval variables ranging from 0-10. A small number of cases with a score above 10 on these variables were given the value 10. Birth order, age of the child and its mother are also

measured by interval variables. A small number of cases with a value on 'birth order' above 18 were given the value 18.

Next to demographic factors we included four socio-economic factors: household wealth, years of education of the parents, occupation of the father, work status of the mother and an indicator for the relative position of women. Because income is lacking in the 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. This makes the IWI an excellent yardstick to compare wealth across different countries. Education of the mother and father is measured in years of education completed. Occupation of the father is measured by three dummy variables: (1) Farm, (2) Lower non-farm (sales, services, manual), (3) Upper non-farm (professional, technical, managerial, clerical). Work status of the mother is a dummy variable indicating whether (1) or not (0) the mother was employed.

The relative position of the mother in the household is indicated by the age difference between the parents (age mother minus age father). For this purpose three dummy variables were created with a respectively age-difference of up to -6, -6 to 0, and 0 and more. The smaller or more positive the age difference, the stronger the relative position of women. The relative position of women in the context where the household lives is measured by aggregating the average age difference between parents to the district level. The larger the age difference to the disadvantage of the women, the weaker their position is considered to be. Urbanization as a context factor, is measured by a dummy variable indicating whether (1) or not (0) the child lives in a rural area. The variable years of education is aggregated at cluster level. Kravdal (2006) shows that average cluster-level education can be effectively used to indicate context educational achievement. Mean years of education at cluster level is 2.84. The variable polygamy at district level is calculated by aggregating the average level of polygamy at household level, indicating whether the household head has other wives (1) or not (0). In the districts on average 28,8% of the household heads has more than one wife. The International Wealth Index (Smits and Steendijk 2014) is an interval variable (0-100), measured at the level of the household and aggregated to district level as well.

To determine to what degree the effects of our major independent variable differ between boys and girls, an interaction between gender and grandmothers' coresidence was included in the model. To analyse whether living with a grandmother varies under different circumstances, for example when parents are missing or the availability of resources is

scarce, interactions with the variables mother missing, father missing and household wealth and several others were included in the model as well. When using interaction terms, centred versions of the involved variables were used. The main effects, therefore, can be interpreted as average effects. Children with a missing parent were given the mean score of the other children in the database on the variables indicating the characteristics of the parents (e.g. education mother, occupation father). Because we also include dummy variables indicating whether (1) or not (0) the mother or father is missing, this procedure leads to unbiased estimates of these variables (Allison, 2001).

4. Results

Table 2 presents the results of our multilevel logistic regression analysis. Model 1 contains only the main effects of the independent variables. Model 2 also includes interaction effects. A first important observation is that the classical assumption that grandmothers are good caretakers and contribute in a positive sense to the success in life of their grandchildren is indeed confirmed by our results. When controlling for other major risk factors, the odds of being in school are almost 25% higher when children are living with a grandmother.

Table 2 about here

When the father or mother is missing from the household, this has a negative effect on educational participation. The odds of being in school are 48% lower in case a child is living without its mother and 40% in case it is living without the father. Regarding the other socio-economic and demographic factors at household and context level there are a few surprises. Children are more often in school when the parents are more highly educated, the father is a 'non-farm' worker, if there are less siblings in the household, when the household is wealthier, when the mother is employed, when the age difference between father and mother is larger and when they live in a wealthier or a more highly educated environment. Children are also more in school when they live in an environment with a relatively strong position of women and when they live in a rural area. The last finding is somewhat surprising. However, bivariately the effect of living in a rural area is negative, hence the positive effect seems due to other variables in the model which characterize living in a rural area.

To find out by which conditions the grandmother effect is moderated, interactions were added to the model. Model 2 displays all significant interaction effects between

grandmother's presence and the other independent variables. The coefficients make clear that the expectation that especially girls benefit from living with a grandmother is confirmed. The additive effect on the odds of being in school, when living with a grandmother, is almost 12% higher for girls than for boys. Presence of a grandmother is also very important if the mother is missing from the household. In that situation, presence of a grandmother increases the odds of being in school by 33%. In case of a missing father we do not find such an effect. Regarding father's occupation, we observe that employment in a lower non-farm job reduces the grandmother effect significantly compared to a farm occupation. Hence grandmothers are more important in farm households than among non-farm manual workers. For upper non-farm workers such a difference is not present.

Regarding the context in which the household lives, we observe more positive grandmother effects in wealthier and more highly educated areas. Hence the returns of a grandmother in terms of children's education seem to be higher under more favourable circumstances. The only exception is again urbanization, with more positive grandmother effects in rural compared to urban areas. This might have to do with the fact that most of the grandmothers grew up in rural areas. Those who are still living there probably have more possibilities to contribute to the household than those who moved to the city, where they can make themselves less useful. Finally, in households where the position of women is stronger, the presence of a grandmother is also less important. This might be due to the stronger position of the mother, who therefore is less in need of support of a grandmother.

4.1 The grandmother effect under extreme circumstances

What does this study add to the debate about the role of grandmothers under difficult circumstances? Do we observe similar negative effects of the presence of a grandmother on children's schooling as Strassmann (2011) found with regard to child mortality and stunting among the Dogon? To a certain extent, our findings indeed go into that direction. The positive interactions with context wealth and education imply that the grandmother effect is lower in areas with a poorer and less educated population. However, from the figures presented in table 2 it is not directly clear whether the grandmother effect really becomes negative under extreme difficult circumstances (as was the case with Strassmann's findings). To determine whether or not this is the case, we have performed two additional test analyzes. One in which we examined the grandmother effect specifically among the Dogon. And one in which we examined the effect for children living under the most difficult circumstances in

our data: e.g. young children (aged 7-9), living at a farm, with an iwi-score of less than 10, in an area with the 20% lowest educational level. In both tests, the grandmother effect did not differ significantly from the effect we found for the total population of children. It remained significantly positive even under these very negative circumstances. Also with other combinations of negative circumstances we did not succeed in getting a negative grandmother effect. Hence, regarding educational participation of children, our study does not provide support for the idea of Strassmann (2011) that under resource poor circumstances the grandmother effect becomes negative, at least not regarding schooling.

5. Conclusion

This paper aims to contribute to a recent debate in the anthropological literature, regarding the benefits children in poor countries derive from the presence of a grandmother in the household. The broadly held idea that grandmothers are beneficial for their grandchildren was seriously challenged by a study of Strassmann (2011). She reported that among the Dogon in Mali under specific circumstances the presence of a grandmother had adverse effects on the lives of their young grandchildren. Earlier studies by Sear (2008) and Borgerhoff Mulder (2007) also indicated a possible negative impact of the presence of a grandmother. Does this mean that we have to adjust our positive image of the involved and caring grandmother? The findings presented in the current paper indicate that – at least with regard to educational participation of children – this is not the case.

On the basis of data on 763.615 children aged 7–15, living in 33 sub-Saharan African countries, we found broad evidence supporting the idea that living with a grandmother has a positive effect on the chances of young children to go to school. The effect varied across circumstances, but remained significantly positive in all situations studied. Children living with a grandmother have significantly higher odds (24%) of being in school. The effect is especially strong for girls and when the mother is missing from the household. These findings are in line with the idea that grandmothers may enable parents to work from home and prevent children, especially girls, from taking over household tasks. They also confirm the positive role played by grandmothers in case the mother has died, like in the case of AIDS orphans.

Our analysis further reveals the grandmother effect to vary according to specific social, demographic and cultural factors at household and context level. Grandmothers are particularly effective in situations with more opportunities, like in a more developed

(wealthier) environment or in communities with a more highly educated population. This suggests that presence of a grandmother allows households to make better use of favourable circumstances in their environment, like a better educational and transport infrastructure and a more solid tradition of going to school.

On the other hand we observe a grandmother to be less effective when living in an urban area and when the father is employed in a lower non-farm instead of a farm job. A possible explanation for this may be that most of the grandmothers in our data grew up in rural areas, often at farms. This means that they are probably more familiar with life in the countryside, and can contribute more to the household there, than in an urban environment. Finally, we observed a less effective grandmother in households where the position of women is stronger and in households with more (grand)daughters. The stronger position of the mother and the fact that household tasks can be divided among the daughters might reduce the opportunities of a grandmother to contribute to the household.

Although the interaction analysis shows that certain conditions weaken the grandmother effect, no indications of negative grandmother effects were found. Both among the Dogon in Mali and among children living under the most difficult circumstances in our data, the grandmother effect remained significantly positive. Hence we are led to the conclusion that, at least for educational participation of children, presence of a grandmother in the household is a positive resource under a broad range of circumstances within the sub-Saharan African context.

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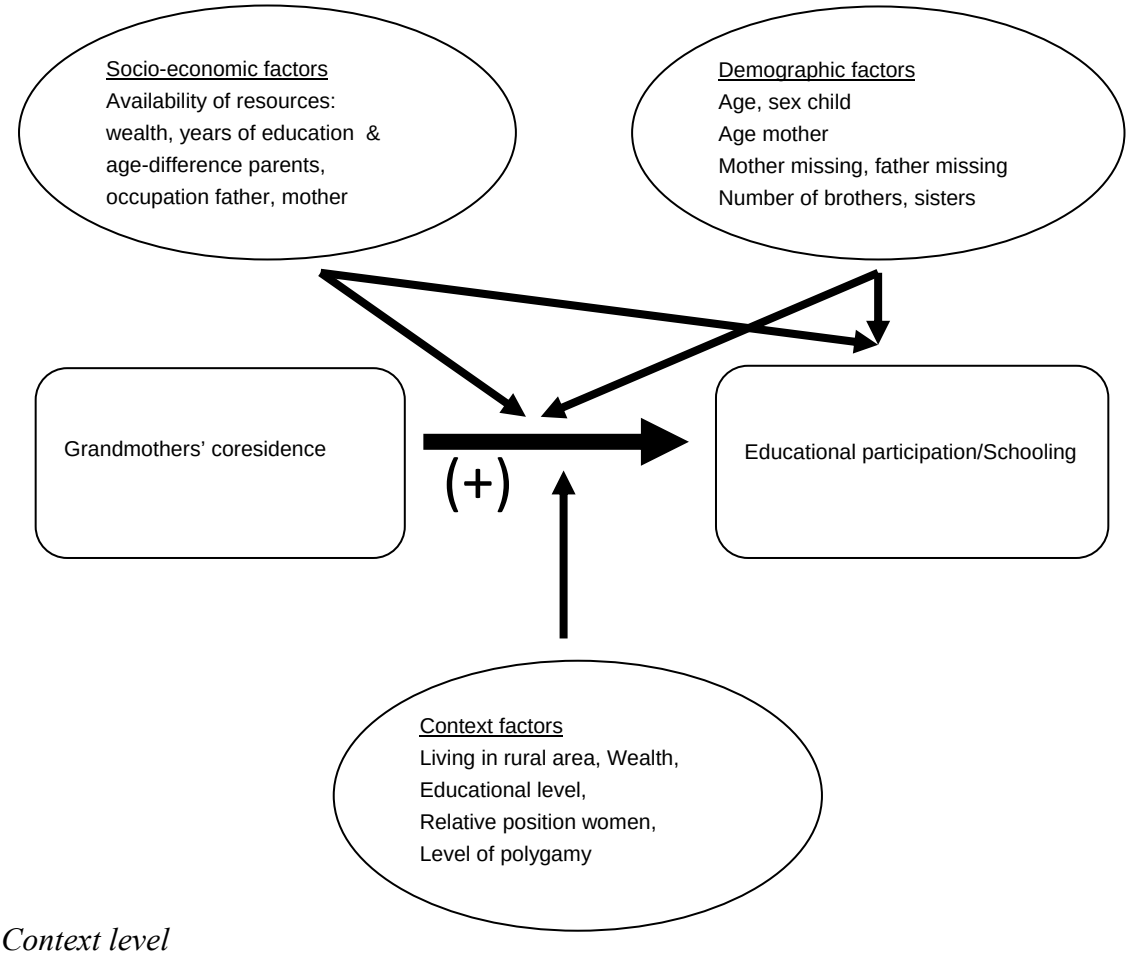
Figure 1 Conceptual model of relationship between grandmothers' coresidence and their grandchildren's schooling in sub-Saharan Africa

Household level



Context level

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

Variables	%, mean	Min	Max	SD
School attendance (dependent variable)	73.0%	0	1	0.44
Demographic factors at household level				
Grandmother present	16.8%	0	1	0.37
Sex is girl	49.0%	0	1	0.50
Age child	10.7	7	15	2.54
Age mother	38.0	15	96	6.91
Birth order	3.31	1	18	1.94
Number of Sisters	1.92	0	10	1.66
Number of Brothers	2.04	0	10	1.74
Mother missing	29.9%	0	1	0.46
Father missing	40.6%	0	1	0.49
Socio-economic factors at household level				
International Wealth Index (IWI, 0-100)	25.82	0	100	22.37
Education father (years)	3.99	0	16	3.53
Education mother (years)	2.93	0	16	3.23
Occupation Father: Ref=*Farm*	19.5%	0	1	0.31
Lower non-farm	9.3%	0	1	0.22
Upper non-farm	3,0%	0	1	0.13
Mother employed	57,6%	0	1	0.41
Relative position women (age mother-age father):				
Agedif 1 (reference category: ≤-6 years)	33.4%	0	1	0.47
Agedif 2 (-6-0 years)	17.8%	0	1	0.38
Agedif 3 (>0 years)	1,7%	0	1	0.13
Socio-economic/cultural factors at context level				
Living in rural area	71.5%	0	1	0.45
International Wealth Index (IWI, district, 0-100)	25.86	0.99	88.72	16.69
Relative position women (age difference parents, district)	-8.9	-16.7	0.04	2.68
Educational level (years, cluster)	2.84	0	12.5	1.25
Polygamy (district)	28.8%	0	1	0.20

Source: DHS (1998-2012).

Table 2 Coefficients of multilevel binary logistic regression models with the log odds of being in school as dependent variable (odds ratios between brackets)

	Model 1	Model 2
Demographic factors at household level	B (exp (B))	B (exp (B))
Grandmother present	0.219*** (1.24)	0.157*** (1.17)
Age child	0.040*** (1.04)	0.040*** (1.04)
Sex is girl	-0.220*** (0.80)	-0.219*** (0.80)
Age mother	0.039*** (1.04)	0.037*** (1.04)
Birth order child	-0.026*** (0.97)	-0.026*** (0.97)
Number of sisters	-0.002 (0.99)	-0.001 (0.99)
Number of brothers	-0.031*** (0.96)	-0.029*** (0.97)
Mother missing	-0.652*** (0.52)	-0.647*** (0.52)
Father missing	-0.507*** (0.60)	-0.508*** (0.60)
Socio-economic factors at household level		
International Wealth Index (IWI)	0.025*** (1.02)	0.025*** (1.02)
Education father (years)	0.077*** (1.08)	0.076*** (1.07)
Education mother (years)	0.086*** (1.08)	0.086*** (1.09)
Occupation father (ref.=farm):		
Lower non-farm	0.104*** (1.10)	0.088*** (1.09)
Upper non-farm	0.230*** (1.25)	0.224*** (1.25)
Mother employed	0.124*** (1.13)	0.123*** (1.13)
Relative position women (ref. ≤ -6 years):		
Age difference parents -6-0 years	-0.004 (0.99)	-0.001 (0.99)
Age difference parents >0 years	-0.067** (0.93)	-0.092*** (0.91)
Socio-economic/Cultural factors at context level		
Living in rural area	0.120** (1.12)	0.107* (1.11)
International Wealth Index (district)	0.016*** (1.01)	0.015*** (1.01)
Age difference (district)	0.073*** (1.07)	0.072*** (1.07)
Educational level (cluster)	0.130*** (1.13)	0.131*** (1.14)
Polygamy (district)	0.041 (1.04)	0.050 (1.05)
Interactions with grandmother present		
Grandmother * Sex is girl		0.117*** (1.12)
Grandmother * Number of sisters		-0.021*** (0.97)
Grandmother * Mother missing		0.286*** (1.33)
Grandmother * Occupation father (lower non-farm)		-0.156** (0.85)
Grandmother * Educational level (cluster)		0.026*** (1.02)
Grandmother * Age difference parents >0 years		-0.286*** (0.75)
Grandmother * IWI (district)		0.005*** (1.01)
Grandmother * Living in rural area		0.169*** (1.18)

***P<0.01, **P<0.05, *P<0.1. The use of country dummies to control for country specific circumstances did not change the results.

(n=763.615 of which 128.043 is living with a grandmother and 557.318 is attending school)

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	99.3
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	97.2
Madagascar	2004, 2009	97.8, 98.8
Malawi	2000, 2004, 2010	99.0, 97.8, 98.1
Mali	2001, 2006	97.9, 98.8
Mauritania	2001	98.4
Mozambique	2003, 2011	80.6, 99.8
Namibia	2000, 2006	96.9, 97.8
Niger	2006	98.0
Nigeria	2003, 2008	98.6, 98.3
Rwanda	2000, 2005, 2010	99.7, 99.7, 99.8
Senegal	2005, 2011	98.5, 98.4
Sierra Leone	2008	97.6
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