# The Dynamics of Educational Attainment for Orphaned Children in sub-Saharan Africa: Evidence from Malawi

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**Abstract**

This paper explores the factors that shape the dynamics of educational attainment for orphans in sub-Saharan Africa. One theoretical model, with the presumption that orphans may experience an immediate negative impact (grade repetition) associated with a parental death, predicts that there are three phases of orphans' educational progression: 1) orphans lag behind in their educational progression after a parental death, 2) yet continue to attend school at younger ages, 3) however, they are more likely to drop out of school at higher ages if they reside under discriminatory circumstances. Empirical analysis examines this prediction by employing a novel semi-parametric estimation methodology with consideration of the timing of losing one parent or both, and shows that in Malawi the patterns of educational progression, particularly for female maternal orphans, follow the predicted pattern. The estimation results further reveal that three factors: 1) liquidity constraints, 2) raised shadow wage, and 3) discriminatory circumstances within the household affect the dynamics of educational attainment for female maternal orphans, whereas fostering experience appears to mitigate the negative effects of parental deaths for the other types of orphans.

***JEL classification:*** **O12; O15; D13; J13**

***Keywords:*** **Orphans; Education; Economic household model; Malawi; sub-Saharan Africa**

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***Acknowledgements:*** I am grateful to Michael Carter for his guidance in writing up this paper. I am also grateful to the participants of a seminar presentation at the University of California-Davis, particularly Travis Lybbert, Steve Boucher, Thomas Barre, Quentin Stoeffler, and Wenbo Zou for their valuable comments. I also wish to thank Todd Benson of the International Food Policy Research Institute and Kathleen Beegle of the World Bank for their support in accessing the data set. This work was also partly assisted by the Japan Society for the Promotion of Science (Grant-in-Aid for Scientific Research C 22530248). Any remaining errors are the responsibility of the author.

## 1. Introduction

The immediate detrimental impact of losing a parent on a child is terrible, but the loss of a parent may also have a series of long-term consequences that prolong its negative impacts far into the future. A number of researchers, policy makers and practitioners have expressed considerable concern that parental deaths may lead to lower educational investment with the increasing number of orphans, and the destruction of human capital would contribute to poverty persisting over generations (World Bank 2002, UNAIDS/UNICEF/USAID 2004). The widespread HIV/AIDS pandemic in sub-Saharan Africa over the recent 20 years and resulting high adult mortality in the region have raised the concern of international society about the problem of orphans' educational outcomes. To address this problem, more care and effective support should be provided to households caring for children affected by HIV/AIDS (UNAIDS 2010, 2013).

The loss of a parent is highly likely to cause psychological trauma and may negatively affect orphans' school participation and academic performance. Socio-economic factors associated with the death of a parent could also adversely impact on the progress of orphans' educational attainment. Ainsworth et al. (2005) report three major factors. Firstly, a decline in family income after the death of a parent and the subsequent liquidity constraints may lead to lower educational investment in orphans. Secondly, a surge in opportunity costs of children's time after a parental death could also be a deterrent. Due to the parental death and even preceding sickness, the shadow wage of children might be raised and the increased opportunity costs could prevent orphans from spending sufficient time in educational activities either at school or at home. Thirdly, orphans' schooling might be less appreciated by caregivers within the household and their educational achievement could be lower than those who live with both biological parents.

It is critical to explore the causes of a deficit in educational attainment for orphaned children because our knowledge about what kinds of public interventions could effectively mitigate the adverse effects of parental deaths is limited. In particular, whether targeting the poor could also be an effective policy measure to ameliorate the problem of orphans' education is a fundamental research question (Ainsworth and Filmer 2006). For poverty alleviation, more specifically, cash transfer

programs have attracted particular attention (UNAIDS 2010).[1] Baird et al. (2011) compare the benefits of cash transfers conditional on school attendance with those of unconditional cash transfers, and find that the conditional cash transfers improve the targeted outcomes more effectively.[2] For the problem of educating orphans, if liquidity constraints alone explain orphans' disadvantageous educational outcomes, unconditional transfers could be effective. If, on the other hand, other factors are major obstacles, conditionality is required to solve the problem. This study thus, by presenting new evidence from Malawi, aims to contribute to policy-related debates over the effectiveness of public interventions for orphans.

Past studies have extensively examined associations between orphan status and school participation with cross-sectional data in various low-income countries, but the findings have been inconsistent. While some studies show negative associations between orphan status and school enrollment (Case et al. 2004, Yamano et al. 2006), the associations are not necessarily significantly negative in other studies, particularly among primary-school-age children (Ainsworth and Filmer 2002, Bennell 2005, Ainsworth and Filmer 2006). The minimal differences in school participation have often been attributed to the presence of strong family support networks in Africa, which are believed to absorb the adverse effects of parental deaths (Lloyd and Desai 1992, Lloyd and Blanc 1996, Foster 2000). In addition, two studies have revealed that by fostering the orphans of dead relatives, extended family members can improve the children's educational outcomes in Africa (Zimmerman 2003, Akresh 2007).

A series of studies has attempted to estimate the causal effects of adult mortality by utilizing longitudinal data. Yamano and Jayne (2005), for example, examine the impact of the death of working-age adults on school enrollment in Kenya and find a significant negative impact even before the death of working-age adults. Ainsworth, Beegle and Koda (2005) show that adult mortality and parental deaths delay school attendance and reduce hours spent in school in north-western Tanzania. Evans and Miguel (2007), in addition, find that the loss of a parent has an immediate adverse effect on the continuation of a child's schooling in Kenya. Furthermore, some studies have explored the long-term impact of orphanhood on educational attainment and find adverse effects associated with orphan status, which in the long-run result

in fewer years of educational investment in orphaned children (Beegle et al. 2006, Case and Ardington 2006, Beegle et al. 2010b). The findings on the adverse impacts of parental deaths, particularly mother's death, from the panel analyses are more pronounced, although panel analysis is also not free from bias (Beegle and De Weerdt 2008).

Despite the enormous efforts, however, how educational outcomes for orphaned children appear as they get older has not been well explored. More precisely, while the studies mentioned above have estimated the "net" effect of parental deaths, how factors associated with parental deaths including orphan status form orphans' educational attainment has not been examined yet.[3] This study thus investigates the factors that shape the long-term educational consequences of a parental death and estimate the effect of orphan status along with the *ceteris paribus* effects of the other factors associated with parental deaths on educational attainment by explicitly incorporating the timing of the parental death. My theoretical model focuses on household decisions regarding children's schooling, and explores how the evaluation of orphans' schooling and labor participation evolve over time and how the optimal level of educational investment, i.e., years of schooling, is determined. My empirical work then examines the theoretical prediction of the patterns of educational attainment for orphaned children by employing a recently developed semi-parametric estimation methodology.

The data set used for this study is the second Integrated Household Survey (IHS-2) in Malawi. The survey was carried out by the National Statistics Office (NSO) from March 2004 through March 2005 with technical assistance from the World Bank (GOM 2005b). The number of sampled households is 11,280 in 564 communities all across the country.[4] The survey contains 9,120 rural households in 492 communities, and 2,160 urban households in 72 communities. The IHS-2's sampling strategy adopted a two-stage procedure. Firstly, the number of sampled communities in each district was determined based on the 1998 Population Census, and those communities were randomly selected from a listing of all communities in each district. Then, in each selected community, 20 households are chosen randomly. The data set is cross-sectional, but contains a large-scale national representative sample, which allows us to examine differences in the trajectories of mean educational attainment

depending on the types of orphans, i.e., maternal, paternal and double orphans. This investigation is indispensable to comprehend the multifaceted relationship between the living arrangements of orphans and their educational outcomes.

The following section describes the circumstances of orphans and educational outcomes in Malawi. Section 3 presents theoretical models for investigating the factors that shape the dynamics of educational attainment for orphaned children. Then, Section 4 provides detailed explanations about the empirical models in relation to the theoretical prediction, and Section 5 presents the estimation results. Finally, Section 6 summarizes the findings of this study and conclusions to the discussions.

## 2. Orphans and Educational Outcomes in Malawi

### 2.1 Orphans in Malawi

Malawi is a sub-Saharan African country which has been greatly affected by the HIV/AIDS pandemic (Watkins 2004). The proportion of HIV/AIDS orphans has been very high, although the number of AIDS-related deaths appears to be reduced due to the recent efforts of disseminating antiretroviral treatment (UNAIDS 2013). Table 1 shows the proportion of orphaned school-age children, adolescents, and young adults in 2004-05. At age 7, 10.3 percent of female children and 11.5 percent of male children are orphans. The proportion of orphans becomes higher in the higher age groups, and by age 18 as much as 31.2 percent of female children and 31.4 percent of male children become orphans. Table 1 also shows the percentage of individuals who fall into the category of head or spouse status of the family. Among children aged 0 to 24, as much as 30.2 percent of females who have at least one deceased parent hold the head/spouse status, whereas 16.9 percent of females whose parents are alive are the head/spouse. Likewise, 11.1 percent of males who have at least one deceased parent are the head, while only 5.5 percent of males whose parents are alive are the head.[5] This suggests that on average orphans become independent earlier than non-orphans.

Table 2 shows the proportion of maternal, paternal and double orphans, and also the duration of orphanhood. Regardless of age and gender, the proportion of paternal orphans is higher than that of maternal and double orphans, which is a common observation in sub-Saharan Africa. With respect to the duration of

orphanhood, there is no significant difference between maternal and paternal orphans, which implies that paternal and maternal orphans lose their parents at around the same age. The duration of double orphanhood is shorter than the average duration of paternal and maternal orphans. This is because the duration of double orphanhood is measured by the duration as a two-parent orphan.[6] This study utilizes information about the age at which they lost their mother and/or father to explore the dynamics of educational attainment for orphaned children.

### 2.2 Living Arrangements of Orphans

The death of one parent or both significantly impacts households in which children reside and the living arrangements of orphans vary substantially. To investigate factors associated with the living arrangements of orphans, the characteristics of households living with and without orphans are compared. Fostering children, either orphans or non-orphans, is widely practiced in sub-Saharan Africa and the functions of the extended family system in the region are well documented (Foster 2000). This study focuses on the living arrangement of orphaned children aged 0 to 18. Among all sampled households, 7,559 (67%) households reside with children aged 0 to 18 and 3,606 (32%) households reside with two-parent children only. The latter group is used as a reference group. Table 3 then compares households living with orphans to the reference group. For single orphans, in addition, whether they still live with the remaining parent is considered.

The comparison exhibits that there are significant differences in a variety of aspects (Table 3). Firstly, household demographic characteristics are significantly different depending on the presence of orphans within the household. Orphans reside in households with fewer working age adults, implying that fostering decisions of orphans might be motivated by an incentive to cope with family labor scarcity. Simultaneously, orphans reside in households with fewer young children, but with more school-age children, which suggest that a fostering motive could also be for educational investment. Serra (2009) presumes that purposive fostering may benefit both households that foster in children from other households and foster out children to other households, and shows the conditions under which seemingly conflicting motives, i.e., demand for labor force and schooling investment, could coexist. There appear to be mixed motives for fostering decisions in Malawi.

Next, it is often documented that orphans are more likely to be cared for by grandparents (Beegle et al. 2010a), which explains the higher fractions of elderly within the households and higher age of the household head. Households with higher education levels are more likely to live with orphans, implying that better educated households are more likely to foster orphans. Another striking fact is that double orphans reside in households whose consumption expenditures are significantly higher, implying that better off households are more likely to foster orphans and thus fostering experience may have potential for improving orphans' educational outcomes. In contrast, if paternal orphans still live with the remaining mother, their levels of consumption expenditure are significantly lower. This suggests that the loss of a father may lead to a decline in their income, whereas paternal orphans as well are more likely to be fostered by wealthier households. In Burkina Faso, Akresh (2009) finds that households flexibly adjust their size in response to income volatility by sending out own children to other households and also by receiving children from other households. The findings of this study in Malawi are consistent with the circumstances that past studies have conjectured.

### 2.3 Education System in Malawi and Educational Outcomes of Orphans

The education system in Malawi is 8-4-4; 8 years of primary education followed by 4 years of secondary education and 4 years of university education. Since 1994, there have been no tuition fees for primary education, nevertheless, households still have school-related expenses such as uniforms, shoes and books, which represent a significant expense for poor families and are arguably a deterrent for enrollment in primary education (Al-Samarrai and Zaman 2007). Secondary schools are not free, and they are often located far from students' villages, incurring additional expenses such as transportation, food and lodging. One can expect, therefore, that far fewer children attend secondary school. Another issue is grade repetition. Due to poor academic performance, a considerable number of children repeat grade levels every year even when they attend primary school, which in turn tends to result in lower educational attainment in their entire lifetime.

This study compares the educational outcomes of orphans to those of children living with both biological parents. Figure 1 illustrates school attendance ratios by age. While no significant difference can be seen for primary-school-age children,

female orphans compared to children living with both parents are less likely to attend school at higher ages. Differences between orphans and children with both parents are much smaller among males. Figure 2 illustrates educational attainment, which is measured by the highest grade level attained. It appears that maternal female orphans complete fewer years of education at higher ages indicating that female orphaned children who lost their mother have slower educational progression. The interpretation, however, has to be made with caution. Eighteen year-old female orphans, for example, range from those who became orphans very recently to those who lost their parent even before entering primary school. Figures 1 and 2, nonetheless, do not take into account the timing of parental deaths.

In Figures 1 and 2, other factors associated with parental deaths are also not considered. As described in the preceding sub-section, orphans are more likely to be fostered by better off households in Malawi, and thus their educational outcomes might be improved by more abundant resources available in the foster family. Therefore, the difference in the educational outcomes shown in Figures 1 and 2 does not necessarily indicate the effect of orphan status per se. To examine the effect of orphan status on school attendance in past studies, household fixed-effects models were utilized (Case et al. 2004, Yamano et al. 2006). However, no suitable estimation methodology for the analysis of the dynamics of educational attainment for orphaned children has been proposed. In the following sections, by making use of a semi-parametric methodology, this study will devise a novel empirical approach and examine how much of the difference shown in Figure 2 can be attributed to the consequences of orphan status in conjunction with the effects of other factors associated with parental deaths.

## 3. Theory of Educational Investment

### 3.1 One-Child Model

The basic theoretical framework of child schooling with human capital accumulation is a one-child model in which a household maximizes utility by choosing the optimal level of consumption $c_t$ (per capita) and child's schooling $S_t$ in each period. The child schooling decision $S_t$ takes the value of one if the child attends school in period $t$ and zero otherwise.[7] Human capital is accumulated accordingly and

measured by the highest grade successfully completed $H_t$ by period $t$ . The initial level of human capital $H_{t_0}$ is assumed to be given exogenously and the household's utility function $u(c_t, S_t)$ is assumed concave and additive.[8] Under these assumptions, the optimization problem for the household is expressed as

$$\max\left\{\sum_{t=t_0}^{T}\beta^{t-t_0}u(c_t, S_t)\right\} \quad (*)$$

subject to

$$A_{t+1} = (1+r)(A_t + y_t - lc_t - \overline{p_t}S_t) \ldots \text{(Asset dynamics: } \lambda_1^t) \quad (1a)$$

$$H_{t+1} = H_t + S_t \ \ldots \text{(Human capital accumulation: } \lambda_2^t) \quad (2a)$$

$$y_t = (1-S_t)w_t + \overline{R_t} \ldots \text{(Income stream: } \lambda_3^t) \quad (3a)$$

$$S_t(1-S_t) = 0 \ \ldots \text{(Discrete choice of schooling: } \lambda_4^t) \quad (4a)$$

where $t = t_0, t_0+1, \cdots T$ and age at $t_0$ is given exogenously and increases by increments of one in each period $\beta$ is the discount factor and $r$ is the interest rate. $A_t$ is household assets at the beginning of period $t$, and the initial level of asset $A_{t_0}$ is assumed to be given exogenously. In this model, when the child goes to school, the household incurs educational cost $\overline{p_t}$, otherwise the household can earn wage $w_t$ if they allow the child to work. $w_t$ is an increasing function of human capital accumulation $H_t$ $(\partial w_t / \partial H_t > 0)$ and assumed to have diminishing returns $(\partial^2 w_t / \partial^2 H_t < 0)$. $\overline{R_t}$ is an exogenous income stream from other household members and thus $y_t$ is the total income of the household in period $t$. Lastly, $l$ represents the household size and the $\lambda$s are the Lagrange multipliers for each constraint.

Note that the model is non-stochastic and can be solved with some more specific conditions. Here, to solve this maximization program, the condition $A_{T+1} = \overline{A}$ is imposed, where $\overline{A}$ is the target level of the asset immediately after the last period $T$. Also, liquidity constraints are assumed to be never binding.[9] The solution of this model is characterized by the optimal schooling year $t^*$ and the optimal level of human capital accumulation $H^*$. The optimal schooling decision is that the child goes to school up to period $t^*$, and after $t^*$ the child works until the last period $T$. Thus $H^*$ can be interpreted as the lifetime educational attainment of the child.

To investigate how the optimal level of educational investment is determined, the FOC with respect to $S_t$ is considered,

$$\lambda_3^t(\overline{p_t}+w_t)+\lambda_4^t(2S_t-1)=\partial u/\partial S_t+\lambda_2^t \tag{5a}$$

This optimality condition equates the costs and benefits of the educational investment in period $t$. The left-hand side represents the costs of child schooling. The first term indicates the direct educational cost the household must incur if the child attends school, and the second term is the opportunity cost. The third term denotes a value that adjusts the discrete choice of schooling decisions. The right-hand side, in contrast, represents the benefit from schooling in period $t$. The first term can be interpreted as a contemporaneous utility gain of sending the child to school in period $t$, and the second term captures the marginal future utility gain from the schooling decision in period $t$.

The FOC tells us that as long as the benefits exceed the costs, sending the child to school is the optimal choice, which means that up to period $t^*$ the direct educational cost $\overline{p_t}$ is paid in each period and the opportunity cost $w_t$ is incurred because households expect these costs to be outweighed by higher benefits in the future. After period $t^*$, however, the costs become larger than the future benefits. As a result, the child can work and earn the labor income $w_t$ $(H^*)$ until the last period $T$. If the child receives more education than the optimal choice $t^*$, the wage rate becomes higher but educational costs have to be paid for longer periods and the duration of earning income becomes shorter. Therefore, this alternative plan does not maximize the sequence of family utility and cannot be the optimal educational investment. A tradeoff exists between the costs of educational investment and its returns, and the optimal choice is determined by balancing this tradeoff.

### 3.2 Two-Child Model

The one-child model can be extended to incorporate the case in which there are two children in the household, which allows us to investigate sibling effects on the other child's educational outcomes. The theoretical schooling model with two children (Child 1 and Child 2) assumes a household maximizes family utility each period beginning in period $t_0$ and ending at the last period $T_1$ (the time when one of the children leaves the family) by choosing the optimal level of consumption $c_t$ (per

capita) and child $i$'s ($i$= 1, 2) schooling decision $S_{it}$ in each period. The model can be expressed as

$$\max\left\{\sum_{t=t_0}^{T_1}\beta^{t-t_0}\,u(c_t,\ S_{1t},\ S_{2t})\right\} \qquad (**)$$

subject to

$$A_{t+1} = (1+r)(A_t + y_t - lc_t - \overline{p_{1t}}S_{1t} - \overline{p_{2t}}\,S_{2t})\ldots\text{(Asset accumulation: } \lambda_1^t) \qquad (1b)$$

$$H_{i(t+1)} = H_{it} + S_{it}\ \ldots\text{(Human capital accumulation: } \lambda_{2i}^t) \qquad (2b)$$

$$y_t = (1-S_{1t})w_{1t} + (1-S_{2t})w_{2t} + \overline{R_t}\ \ldots\text{ (Income stream: } \lambda_3^t) \qquad (3b)$$

$$S_{it}(1-S_{it}) = 0\ldots\text{ (Discrete choice of schooling: } \lambda_{4i}^t) \qquad (4b)$$

where $t = t_0, t_0+1, \cdots, T_1$. In this model, the initial level of human capital ($H_{1t_0}$ and $H_{2t_0}$) is given exogenously for each child. Since the utility function is assumed to be additive[10], the FOC with respect to $S_{it}$ is

$$\lambda_3^t(\overline{p_{it}} + w_{it}) + \lambda_{4i}^t(2S_{it}-1) = \partial u/\partial S_{it} + \lambda_{2i}^t \qquad (5b)$$

The first best choice is made by considering the costs and benefits of educational investment for each child. If the term $\partial u/\partial S_{it}$ is negligible and liquidity constraints are not binding, then the schooling decision for one child is independent from the decision for the other child. However, the presence of the term $\partial u/\partial S_{it}$ eliminates the separability and yields an association of schooling decisions between the two children through the marginal utility of wealth. Under the assumption of binding liquidity constraints, in addition, one child might be able to assist with the other's schooling by earning additional income or, alternatively, one child might exploit family resources and adversely affect the other's school attendance. Note that this model assumes that the second child will stay in the family longer after the last period $T_1$, and therefore $\lambda_{42}^{T1} > 0$ whereas $\lambda_{41}^{T1} = 0$.[11]

### 3.3 Orphan vs. Non-orphan

Based on the theoretical model constructed above, how parental deaths influence schooling decisions are discussed with respect to: 1) slower educational progression and 2) environmental changes due to parental deaths. Firstly, the effect of slower educational progression is examined. Orphans may experience an

immediate negative impact after a parental death and are more likely to repeat grade levels. As a result, the process of human capital accumulation could be interrupted and their educational progress may lag behind, i.e.,$H_{t_0}^{(orphan)} < H_{t_0}^{(non-orphan)}$. This delay in educational progression, in turn, appears to influence children's schooling decisions. In order to further investigate the effect of the delay, the FOC with respect to $H_{t+1}$ is considered.

$$\lambda_{2i}^{t} = \lambda_{2i}^{t+1} + \lambda_{3}^{t+1}(1 - S_{i(t+1)})\frac{\partial w_{i(t+1)}}{\partial H_{i(t+1)}} \tag{6}$$

Equation (6) explains how the utility-maximizing household evaluates the marginal future gain from the schooling decision in period $t$. The household sums up the marginal gains of educational investment backward from the last period T up to time $t$ to calculate the marginal future gain $\lambda_2^t$, and thus the value of $\lambda_2^t$ relies on the characteristics of the wage function $w(H_t)$. When the child fails to proceed to the next grade level at the end of period $t-1$, $\partial w / \partial H$ remains unchanged in period $t$, which is larger compared to the case of successful completion because the wage function is assumed to exhibit diminishing returns. Therefore, the household will choose to enroll the child in more years of school. When the cost side is examined, a key finding is that delaying human capital accumulation reduces the opportunity cost which, in turn, also allows children to stay in school longer.[12] In sum, under the assumption of a diminishing returns wage function, slower educational progression leads to more time spent in school but does not result in completing a higher level than that with no delay because the child is repeating grade levels.

Next, environmental changes resulting from parental deaths are discussed. After being orphaned, the child may live with the remaining parent; otherwise s/he will be fostered by another household. If both parents pass away, s/he must be fostered by another household. As can be seen in Section 2.2, fostering experience involves dramatic changes in the characteristics of the households where orphans reside.[13] This study focuses on the following two factors within the household. Firstly, if the host family obtains a lower utility level by sending orphans to school, i.e., $\partial u / \partial S_t^{(\text{orphan})} < \partial u / \partial S_t^{(\text{non-orphan})}$, the optimal level of educational investment in orphans is lower than in non-orphans. Secondly, if the host family expects to benefit from income earned by an orphan for a shorter amount of time or if they expect that orphans become independent earlier than non-orphans,

i.e., $T^{(orphan)} < T^{(non-orphan)}$, the optimal schooling years for orphans should also be less.

Under the discriminatory circumstances, environmental changes negatively affect orphans' educational outcomes, whereas slower educational progression leads to longer duration of school attendance. Some possible patterns are illustrated in Figure 3. The theoretical model predicts Pattern 1, in which orphans can catch up with non-orphans when the positive effect of slower educational progression expels the adverse effect of the discriminatory environmental changes. When the adverse effect exceeds the positive effect, the theoretical model predicts that Pattern 2 is most likely and expects that orphans continue to attend school up to a certain age. Yet, orphans above such an age are more likely to drop out of school causing the gap in the educational attainment between orphans and non-orphans to widen as children become older. Lastly, if orphans are heavily discriminated against, the model predicts Pattern 3 implying that orphans never have a chance to go back to school after a parental death. These hypothetical patterns of educational progression are empirically tested in the following two sections.

## 4. Empirical Models

This section considers empirical models suitable for testing the theoretical predictions drawn from the discussions in the previous section. Firstly, an empirical model for educational attainment measured by the highest grade level attended is considered. A conventional approach is to utilize a linear regression model with the dependent variable of years of educational attainment (Taubman 1989). Yet, this model requires, for example, an assumption that current input measures can be proxy for the whole history of inputs (Todd and Wolpin 2003), which appears to be very strong. Below, this assumption is relaxed by introducing the non-linear function of the age of children as part of the explanatory variables. More precisely, the following semi-parametric models are employed.[14] Firstly, an equation of educational attainment for non-orphans is considered.

$$H_i^0(a_i, X_i) = f_0(a_i) + \sum_a \delta_a \cdot 1\,(a_i = a) + X_i \beta, \tag{7}$$

where $a_i$ is the age of child $i$ and $X_i$ is a vector of other individual and household characteristics. $f_0$ is a non-linear function of age, which is to be estimated along

with $\beta$ coefficients in the linear form. $\delta_a$ coefficients represent age cohort fixed effects, whereas $1(\cdot)$ is the indicator function.

Next, for single orphans, suppose that child $i$ was a non-orphan up to age $j_i$ and lost one parent at age $j_i+1$. Then, for practical purposes, the following four groups are constructed: the first group experienced a parental death after 14 years old ($c=1$), the second group became a single orphan at age 11 up to 14 ($c=2$), the third group became a single orphan at age 8 up to 10 ($c=3$), and the fourth group comprises those who lost one parent at age 7 or below ($c=4$). For each group, the equation for educational attainment can be expressed as

$$H_i^c(a_i, X_i, j_i \mid c) = f_0(j_i) + f_c(a_i - j_i) + \Delta_c + \sum_a \delta_a \cdot 1(a_i = a) + X_i\beta, \tag{8}$$

where $f_c$ is a non-linear function of age for single orphans, which is to be estimated with $\beta$ coefficients in the linear form, and $\Delta_c$ represents fixed effects for each group.

For double orphans, $j_i$ denotes the age after which child $i$ became a single orphan, and furthermore let $k_i$ be the age after which s/he $i$ lost the remaining parent and $\widetilde{f}_d$ be a non-linear function of age for double orphans. Then, we have the following equations:

$$H_i^{c,d}(a_i, X_i, j_i, Ki \mid c,d) = f_0(j_i) + f_c(k_i - j_i) + \Delta_c + \widetilde{f}_d(a_i - k_i) + \widetilde{\Delta}_d + \sum_a \delta_a \cdot 1(a_i = a) + X_i\beta, \tag{9}$$

where $\widetilde{\Delta}_d$ represents fixed effects for the following groups; the first group lost the remaining parent after 14 years old ($d=1$), the second group became a double orphan at age 11 up to 14 ($d=2$), the third group did at age 8 up to 10 ($d=3$), and the fourth group lost both parents before age 8 ($d=4$).

Let us further define a set of dummy variables $D_i$ that denotes the history of orphan status comprising $D_i^0$, $D_i^c$ , $\widetilde{D}_i^c$ and $\widetilde{D}_i^d$ ($1 \leqq c \leqq 4$ and $1 \leqq d \leqq 4$). $D_i^0$ takes the value of one if child $i$ is a non-orphan and zero otherwise. $D_i^c$ is a dummy variable that takes the value of one if single orphan $i$ belongs to the $c_{th}$ group and zero otherwise. $\widetilde{D}_i^c$ and $\widetilde{D}_i^d$ are dummy variables that take the value of one if double orphan $i$ belongs to the $c_{th}$ group and the $d_{th}$ group respectively, and zero otherwise. By using these dummy variables, the empirical model can be expressed as

$$H_i(a_i, X_i, j_i, k_i, D_i) = D_i^0 \cdot f_0(a_i) + \sum_{c=1}^{4} D_i^c \cdot (f_0(j_i) + f_c(a_i - j_i) + \Delta_c)$$
$$+ \sum_{d=1}^{4} \sum_{c=d}^{4} \widetilde{D}_i^c \cdot \widetilde{D}_i^d \cdot (f_0(j_i) + f_c(k_i - j_i) + \Delta_c + \widetilde{f}_d(a_i - k_i) + \widetilde{\Delta}_d) + \sum_a \delta_a \cdot 1(a_i = a) + X_i\beta + \varepsilon_i, \quad (10)$$

where $\varepsilon_i$ is an error term.

In the linear part of the regression model, other child characteristics and household characteristics including factors associated with parental deaths are controlled for. Firstly, two dummy variables for living arrangements are included to capture the differentials in the conditions for non-orphans living separately from their biological parents.[15] Next, the ratios of older siblings up to 20 years old to household size are also utilized to capture birth-order effects. Schooling of earlier-born children may be preferred by parents and/or siblings may compete for limited resources that tend to be directed toward older siblings. By contrast, the presence of older siblings, implying an abundant labor force within the household, could be helpful for younger siblings to attend school and to study at home. In addition, one sibling could quit schooling earlier and work to earn supplemental income to assist another sibling attending school, particularly in a poor family. Thus, the birth-order effects on educational outcomes can be either positive or negative (Behrman and Taubman 1986, Emerson and Portela 2008).

Household characteristics include categorical variables representing the age of the household head, which capture the characteristics of caregivers such as knowledge and experience. The highest grade levels attained by female and male adult members (older than 20 years old) are also included. The higher levels of education achieved by adult household members might improve the capability of perceiving the benefit from children's education, and positively contribute to children's educational attainment. Moreover, the size of household and the ratios of working-age female and male adults to household size are included to capture household demographics that appear to have some influence on the valuation of children's labor participation. Furthermore, the level of per capita household consumption expenditure, as a proxy for family income or a measure of wealth, is controlled for. To control for unobserved heterogeneity due to regional-level characteristics, district dummy variables are included.

## 5. Estimation Results

### 5.1 Predicted Values of Educational Attainment

For data analysis, the information on children aged 7 to 18 is utilized. The sample is made up of 7,977 female and 7,879 male children, and the average age is 11.9 for both females and males. In Table 4, the information about orphan status and summary statistics of other explanatory variables used in the following regression analysis are shown. Figure 4 summarizes the estimation results by illustrating the predicted values of mean educational attainment for children with the history of orphan status $D$ evaluated at the mean values of other covariates $X$, i.e., $\hat{H}(a, \overline{X}, D)$, in comparison with non-orphans living with both biological parents. The trajectories of mean educational attainment for children who became orphans before age 15 are illustrated in Figure 4.

Let us begin with the estimation results for maternal orphans. The estimation results for female maternal orphans reveal that, by fixing the other covariates equal to the mean values among all female children, maternal orphan status after around age 10 tends to result in a decline in the mean educational attainment and end up with a large deficit in the mean educational attainment at higher ages (statistically significant at the 5 percent level). This indicates that female maternal orphans reside under discriminatory circumstances within the household. The trajectory of mean educational attainment for male maternal orphans who became orphans during age 11 through 14 is similar to that of female maternal orphans who became orphans during age 11 to 14. Yet, those for male maternal orphans who became orphans before age 11 show no delay in their educational progression, implying that they do not face any discriminatory circumstances within the household.

Next, the estimation results for paternal orphans are examined. The gaps in the mean educational attainment between paternal orphans and non-orphans living with both parents are much smaller than those of maternal orphans, which is consistent with the evidence that Beegle et al. (2010b) find in Tanzania. The estimation results of this study, however, suggest that being a paternal orphan at younger ages leads to slower educational progression, particularly for male orphans. It appears that their educational progression becomes slightly slower after they lose their father.

Lastly, the estimation results for double orphans are investigated. Double orphans experience compounded consequences caused by the parental deaths. Becoming a double orphan after age 10 exhibits contrastive consequences by gender. While the loss of both parents at higher ages tends to result in a large deficit in the mean educational attainment for female double orphans, no significant decline can be seen for male double orphans. Losing both parents at younger ages leads to slower educational progression, yet double orphans seem to keep up with two-parent children up to age 18 with slower educational progression, suggesting that there is no disadvantageous factor within the household and the institution of fostering could function as a mitigation mechanism against adult mortality.

There are two major issues relating to these estimation results. Firstly, the empirical models control for only contemporaneous inputs in the linear part, and thus the estimation results of the non-linear functions of age might be biased if historical inputs were correlated with the history of orphan status. The analysis in Section 2.2 reveals that orphans are more likely to be fostered by wealthier households, which implies that the income level of their original households might be lower when they were non-orphans. In the estimation, such children are regarded as non-orphans from wealthier households even prior to their orphanhood, although they in reality might live in much poorer households. This creates a downward bias to an estimated non-linear function of age for non-orphans. Thus, this study may underestimate the negative impacts of orphan status. Secondly, biases are also caused by unobserved individual characteristics (Cameron and Heckman 1998, 2001). For this problem, Evans and Miguel (2007) show that, in evaluating the impacts of parental death on school participation in Tanzania, inability to control for individual fixed effects using cross-sectional data would cause biases toward zero. For these two reasons, the estimation results for the adverse effects of orphan status should be regarded as conservative estimates.

**5.2 Factors Associated with Parental Deaths**

The *ceteris paribus* effects of the other factors associated with parental deaths on educational attainment are shown in Table 5. The ratio of older female siblings and ratio of female adults are positively associated with the educational attainment of female children (significant at the 5 percent level and at the 10 percent level,

respectively), implying that higher availability of women's labor in the household would assist female children to attend school and complete higher educational achievement. The coefficients on the categorical variables for the age of household head indicate that, compared to female children living in households with a head of age 30 to 39, educational attainment for female children living in households with a head of age below 30 is significantly lower (significant at the 10 percent level). In contrast, educational attainment for both female and male children residing in households with a head of age above 60 is significantly higher (significant at the 1 percent level), suggesting that living with an elder household head positively influences children's educational achievement.

The highest levels of education female and male adult family members achieved are consistently and positively correlated with educational attainment of children regardless of gender (significant at the 1 percent level), which suggests that better educated households appreciate children's schooling more and their utility gain from sending their offspring to school is higher than that of poorly educated households. Moreover, both household size and the level of total consumption expenditure per capita are also positively correlated with educational attainment (significant at the 1 percent level). Larger household size implies higher availability of family labor and higher level of consumption expenditure per capita indicates more abundant financial resources and lower probabilities of facing liquidity constraints. These findings together with the investigation into the living arrangements of orphaned children in Section 2.2 suggest that the institution of fostering, through the effects of mitigating the problems of labor scarcity and also income decreases due to parental deaths, appears to ameliorate educational investment in orphans.

## 6. Conclusion

This paper explores the factors that shape the dynamics of educational attainment for orphans in sub-Saharan Africa. A dynamic household model, in which a series of decisions regarding children's schooling and labor participation are made sequentially, could generate a world with three predicted phases of orphans' educational progression: 1) orphans lag behind in their educational progression after a parental death, 2) yet continue to attend school at younger ages, 3)

however, they are more likely to drop out of school at higher ages if they reside under discriminately circumstances. Empirical analysis in this study examines this prediction by employing a novel semi-parametric estimation methodology with consideration of the timing of losing one parent or both, and shows that in Malawi the patterns of educational progression, particularly for female maternal orphans, follow the predicted pattern.

The findings of disadvantageous educational outcomes among female maternal orphans echo those of Evans and Miguel (2007) in Kenya and Beegle et al. (2010b) in Tanzania, but this study further reveals the mechanism by which orphans disadvantageous educational outcomes appear as they grow up. The estimation results reveal that three factors: 1) liquidity constraints, 2) raised shadow wage, and 3) discriminatory circumstances within the household in fact affect the dynamics of educational attainment for female maternal orphans, whereas fostering experience appears to mitigate the negative effects of parental deaths for the other types of orphans.[16] Based on these findings, I claim that in order to solve the educational investment problem for female maternal orphans effectively, conditional cash transfers for the targeted group are preferable, while unconditional cash transfers would improve educational investment for all poor children.[17]

Furthermore, one can argue that in the African extended family system, child-fostering decisions are simultaneously made with decisions on various children's activities, including school attendance. It appears that, while some orphans are fostered in response to labor demand for household domestic chores and/or income generating activities such as farming, other orphans are fostered for various other reasons including for the purpose of educational investment. Mixed motives for child fostering can coexist (Serra 2009) and appear to prevail in Malawi. Another important argument is related to the capacity of the extended family network. A rapid increase in the number of orphans in the region has raised concern that current extended family networks may not be sustainable because of the growing burden of taking care of orphans (Foster 2000). This study does not show clear evidence that the extended family system has reached its limit, although continuous monitoring is required.

Finally, let me mention the progress toward achieving the goal of universal primary education. In Malawi, even without the orphan's education problem, the goal

of universal primary education is very far from being achieved. Although, as this study demonstrates, urgent care and support particularly for female maternal orphans is indispensable, providing effective measures to accomplish Education for All is still a crucial challenge. Toward this goal, this study finds that income is undoubtedly a major obstacle, but other factors such as family labor scarcity and low levels of education among care givers as well disturb children from achieving sufficient levels of educational attainment. Since poor educational attainment maintains the poverty structure over the generations, effective support to improve educational attainment for all children by paying particular attention to female maternal orphans would contribute to the accumulation of human capital and enhance the capability of fighting against poverty over the next generations. Along with this process, we also expect that improving educational attainment for all children would prevent further expansion of the HIV/AIDS pandemic (UNAIDS 2013).

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**Table 1: Orphaned children, adolescents, and young adults in Malawi**

| Age | Female | | | | | | Male | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Non-orphans | | | Orphans | | | Non-orphans | | | Orphans | | |
| | No. | % | % of head / spouse | No. | % | % of head / spouse | No. | % | % of head / spouse | No. | % | % of head / spouse |
| 7 | 743 | (89.7) | 0.0 | 85 | (10.3) | 0.0 | 741 | (88.5) | 0.0 | 96 | (11.5) | 0.0 |
| 8 | 715 | (85.2) | 0.0 | 124 | (14.8) | 0.0 | 719 | (86.2) | 0.0 | 115 | (13.8) | 0.0 |
| 9 | 641 | (86.9) | 0.0 | 97 | (13.1) | 0.0 | 638 | (85.9) | 0.0 | 105 | (14.1) | 0.0 |
| 10 | 615 | (83.1) | 0.0 | 125 | (16.9) | 0.0 | 637 | (86.3) | 0.0 | 101 | (13.7) | 0.0 |
| 11 | 691 | (83.4) | 0.0 | 138 | (16.6) | 0.0 | 613 | (82.5) | 0.0 | 130 | (17.5) | 0.0 |
| 12 | 555 | (80.6) | 0.0 | 134 | (19.4) | 0.0 | 498 | (80.3) | 0.0 | 122 | (19.7) | 0.0 |
| 13 | 542 | (77.0) | 0.0 | 162 | (23.0) | 0.0 | 508 | (76.9) | 0.0 | 153 | (23.1) | 0.0 |
| 14 | 476 | (76.9) | 0.0 | 143 | (23.1) | 0.0 | 444 | (73.8) | 0.0 | 158 | (26.2) | 0.0 |
| 15 | 378 | (71.1) | 0.0 | 154 | (28.9) | 1.3 | 445 | (73.0) | 0.0 | 165 | (27.0) | 0.6 |
| 16 | 381 | (72.8) | 2.6 | 142 | (27.2) | 3.5 | 403 | (72.7) | 0.2 | 151 | (27.3) | 1.3 |
| 17 | 364 | (73.4) | 9.1 | 132 | (26.6) | 10.6 | 342 | (72.3) | 0.0 | 131 | (27.7) | 2.3* |
| 18 | 337 | (68.8) | 23.1 | 153 | (31.2) | 24.8 | 352 | (68.6) | 2.3 | 161 | (31.4) | 0.6 |
| 19 | 405 | (71.8) | 42.0 | 159 | (28.2) | 45.9 | 329 | (68.5) | 2.1 | 151 | (31.5) | 6.0* |
| 20 | 379 | (66.7) | 53.6 | 189 | (33.3) | 60.8* | 295 | (68.4) | 8.5 | 136 | (31.6) | 9.6 |
| 21 | 388 | (66.9) | 60.6 | 192 | (33.1) | 69.3** | 318 | (66.7) | 16.4 | 159 | (33.3) | 18.9 |
| 22 | 347 | (64.3) | 67.4 | 193 | (35.7) | 80.3*** | 287 | (66.3) | 31.4 | 146 | (33.7) | 39.0 |
| 23 | 340 | (63.3) | 75.9 | 197 | (36.7) | 76.6 | 295 | (62.9) | 41.7 | 174 | (37.1) | 48.3 |
| 24 | 308 | (67.4) | 76.3 | 149 | (32.6) | 81.2 | 263 | (64.6) | 53.6 | 144 | (35.4) | 54.2 |
| ALL | 8605 | (76.3) | 16.9 | 2668 | (23.7) | 30.2*** | 8127 | (76.5) | 5.5 | 2498 | (23.5) | 11.1*** |

Note: 'Orphans' are defined as children who have at least one deceased parent before age 18 (UNAIDS/UNICEF/USAID 2004).

Statistical test results (standard errors are cluster-adjusted at the district level) are shown for the differences between non-orphaned and orphaned individuals; * significant at 10%; ** significant at 5%; *** significant at 1%.

**Table 2: Orphan status and duration of orphanhood**

| Age | No. of | Maternal orphan | | | Paternal orphan | | | Double orphan | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Children | % | duration (years) | | % | duration (years) | | % | duration (years)[(a)] | |
| | | | mean | s.d. | | mean | s.d. | | mean | s.d. |
| ***Female*** | | | | | | | | | | |
| 7 | 823 | 2.2 | 2.56 | (1.58) | 6.2 | 2.55 | (1.79) | 1.7 | 1.86 | (1.17) |
| 8 | 836 | 3.9 | 2.94 | (1.60) | 8.6 | 3.14 | (2.05) | 2.3 | 3.47 | (2.59) |
| 9 | 730 | 2.5 | 3.89 | (2.35) | 7.9 | 2.98 | (2.25) | 2.5 | 2.44 | (1.62) |
| 10 | 737 | 4.2 | 2.74 | (2.54) | 9.6 | 3.96 | (2.52) | 3.1 | 2.96 | (2.31) |
| 11 | 825 | 4.4 | 3.47 | (2.65) | 9.0 | 4.18 | (2.72) | 3.2 | 3.77 | (2.78) |
| 12 | 688 | 3.5 | 4.21 | (3.31) | 11.6 | 4.51 | (3.01) | 4.4 | 2.93 | (2.20) |
| 13 | 694 | 5.6 | 4.41 | (3.48) | 12.7 | 4.60 | (3.32) | 4.9 | 3.35 | (2.65) |
| 14 | 613 | 4.2 | 4.31 | (3.72) | 13.4 | 4.40 | (3.03) | 5.5 | 3.62 | (2.63) |
| 15 | 531 | 5.5 | 5.79 | (4.39) | 14.7 | 5.45 | (4.27) | 8.7 | 4.61 | (3.17) |
| 16 | 520 | 5.2 | 6.15 | (4.31) | 13.7 | 5.28 | (3.57) | 8.3 | 4.63 | (3.21) |
| 17 | 493 | 5.5 | 4.78 | (4.50) | 13.0 | 6.08 | (4.55) | 8.3 | 5.15 | (3.44) |
| 18 | 487 | 6.8 | 6.91 | (5.89) | 15.8 | 6.19 | (4.49) | 8.6 | 5.07 | (4.36) |
| All | 7977 | 4.3 | 4.40 | (3.83) | 10.9 | 4.52 | (3.45) | 4.6 | 3.95 | (3.11) |
| ***Male*** | | | | | | | | | | |
| 7 | 827 | 2.5 | 2.52 | (1.44) | 7.1 | 3.02 | (1.76) | 1.8 | 1.93 | (1.79) |
| 8 | 828 | 3.0 | 2.56 | (1.92) | 7.9 | 3.42 | (1.96) | 3.0 | 2.56 | (1.73) |
| 9 | 739 | 4.3 | 2.56 | (2.34) | 7.7 | 3.84 | (2.34) | 2.0 | 4.00 | (2.20) |
| 10 | 737 | 3.5 | 3.42 | (2.12) | 7.7 | 4.02 | (2.59) | 2.4 | 3.33 | (2.40) |
| 11 | 736 | 3.8 | 3.79 | (2.44) | 9.8 | 4.11 | (2.99) | 3.9 | 2.72 | (2.12) |
| 12 | 612 | 5.1 | 4.03 | (3.03) | 10.3 | 4.76 | (3.21) | 3.9 | 3.21 | (2.02) |
| 13 | 659 | 4.6 | 5.37 | (3.59) | 14.3 | 3.88 | (2.82) | 4.4 | 3.31 | (2.84) |
| 14 | 598 | 6.0 | 4.53 | (3.34) | 13.2 | 5.01 | (3.75) | 6.7 | 4.60 | (2.99) |
| 15 | 607 | 7.4 | 5.20 | (4.06) | 12.4 | 5.04 | (3.43) | 7.2 | 4.95 | (3.09) |
| 16 | 551 | 4.9 | 5.33 | (4.13) | 15.6 | 5.59 | (3.91) | 6.7 | 4.03 | (3.28) |
| 17 | 472 | 4.4 | 5.86 | (4.82) | 16.9 | 5.94 | (4.24) | 6.4 | 4.10 | (3.14) |
| 18 | 513 | 6.4 | 5.94 | (4.37) | 16.4 | 5.44 | (4.65) | 8.6 | 5.07 | (3.49) |
| All | 7879 | 4.5 | 4.34 | (3.51) | 11.1 | 4.59 | (3.44) | 4.4 | 3.89 | (2.92) |

Note: Sample is individuals with information on orphan status and education.
(a) Duration as a double orphan.

**Table 3: Comparison of household characteristics with/without orphans (aged 0 to 18)**

| | Household with two-parent children only | Household with maternal orphans | | Household with paternal orphans | | Household with double orphans |
|---|---|---|---|---|---|---|
| | | together with father | separately from father | together with mother | separately from mother | |
| Household size | 5.85 | 6.28** | 5.67* | 5.43*** | 5.74 | 5.87 |
| Ratio of female 0-5 | 0.11 | 0.09** | 0.07*** | 0.07*** | 0.06*** | 0.06*** |
| Ratio of male 0-5 | 0.11 | 0.06*** | 0.07*** | 0.07*** | 0.06*** | 0.06*** |
| Ratio of female 6-18 | 0.18 | 0.21** | 0.24*** | 0.24*** | 0.24*** | 0.25*** |
| Ratio of male 6-18 | 0.18 | 0.24*** | 0.23*** | 0.25*** | 0.23*** | 0.23*** |
| Ratio of female 19-59 | 0.20 | 0.12*** | 0.15*** | 0.24*** | 0.15*** | 0.16*** |
| Ratio of male 19-59 | 0.20 | 0.25*** | 0.13*** | 0.08*** | 0.14*** | 0.14*** |
| Ratio of female 60 and above | 0.01 | 0.01 | 0.07*** | 0.03*** | 0.07*** | 0.07*** |
| Ratio of male 60 and above | 0.02 | 0.02 | 0.03*** | 0.01* | 0.04*** | 0.03*** |
| Age of the head | 41.7 | 45.8*** | 48.5*** | 44.9*** | 49.5*** | 47.9*** |
| Female education (Highest grade) | 3.19 | 3.58 | 3.10 | 3.52** | 3.67*** | 3.65*** |
| Male education (Highest grade) | 5.24 | 5.89 | 5.59* | 5.66*** | 6.14*** | 5.83*** |
| Total expenditure (MK) | 112526 | 135701* | 112522 | 99953** | 131519*** | 136312*** |
| Total expenditure per capita (MK) | 26754 | 28961 | 26259 | 25279 | 29735** | 29684** |
| No of households | 3606 | 87 | 407 | 623 | 427 | 516 |

Note: Ratios are to the household size. The *t*-tests compare households living with orphans to households living with two-parent children only; * significant at 10%; ** significant at 5%; *** significant at 1%.

**Table 4: Summary statistics of explanatory variables**

| Explanatory Variables | *Female aged 7 to 18 (n 7977)* | | | | *Male aged 7 to 18 (n 7879)* | | | |
|---|---|---|---|---|---|---|---|---|
| | mean | s.d. | min | max | mean | s.d. | min | max |
| ***Measure of past educational progression***[(a)] | 0.450 | (0.306) | 0 | 1 | 0.414 | (0.295) | 0 | 1 |
| ***Orphan Status*** | | | | | | | | |
| ***Maternal orphan*** | | | | | | | | |
| Orphaned at 15 or above (=1) | 0.003 | (0.054) | 0 | 1 | 0.003 | (0.050) | 0 | 1 |
| Orphaned at 11-14 (=1) | 0.009 | (0.095) | 0 | 1 | 0.010 | (0.097) | 0 | 1 |
| Orphaned at 8-10 (=1) | 0.014 | (0.116) | 0 | 1 | 0.015 | (0.120) | 0 | 1 |
| Orphaned at 7 or below (=1) | 0.027 | (0.162) | 0 | 1 | 0.027 | (0.162) | 0 | 1 |
| ***Paternal orphan*** | | | | | | | | |
| Orphaned at 15 or above (=1) | 0.005 | (0.070) | 0 | 1 | 0.006 | (0.079) | 0 | 1 |
| Orphaned at 11-14 (=1) | 0.024 | (0.152) | 0 | 1 | 0.024 | (0.152) | 0 | 1 |
| Orphaned at 8-10 (=1) | 0.029 | (0.169) | 0 | 1 | 0.030 | (0.172) | 0 | 1 |
| Orphaned at 7 or below (=1) | 0.067 | (0.250) | 0 | 1 | 0.066 | (0.249) | 0 | 1 |
| ***Double orphan*** | | | | | | | | |
| Orphaned at 15 or above (=1) | 0.003 | (0.055) | 0 | 1 | 0.003 | (0.058) | 0 | 1 |
| Orphaned at 11-14 (=1) | 0.013 | (0.113) | 0 | 1 | 0.011 | (0.106) | 0 | 1 |
| Orphaned at 8-10 (=1) | 0.014 | (0.119) | 0 | 1 | 0.013 | (0.113) | 0 | 1 |
| Orphaned at 7 or below (=1) | 0.016 | (0.126) | 0 | 1 | 0.017 | (0.128) | 0 | 1 |
| ***Living Arrangement*** | | | | | | | | |
| Non-orphan living away from mother (=1) | 0.139 | (0.346) | 0 | 1 | 0.124 | (0.330) | 0 | 1 |
| Non-orphan living away from father (=1) | 0.232 | (0.422) | 0 | 1 | 0.208 | (0.406) | 0 | 1 |
| ***Other Child Characteristics*** | | | | | | | | |
| Age | 11.88 | (3.36) | 7 | 18 | 11.93 | (3.41) | 7 | 18 |
| Ratio of older female siblings (up to 20)[(b)] | 0.090 | (0.119) | 0 | 0.800 | 0.091 | (0.120) | 0 | 0.750 |
| Ratio of older male siblings (up to 20)[(b)] | 0.081 | (0.113) | 0 | 0.667 | 0.082 | (0.112) | 0 | 0.600 |
| ***Household Characteristics*** | | | | | | | | |
| Age of the household head | 45.32 | (13.67) | 14 | 104 | 46.22 | (13.46) | 14 | 98 |
| Highest education among female adults (above 20) | 3.283 | (3.487) | 0 | 17 | 3.079 | (3.422) | 0 | 17 |
| Highest education among male adults (above 20) | 5.473 | (3.555) | 0 | 17 | 5.383 | (3.591) | 0 | 17 |
| Ratio of female adults (above 20)[(b)] | 0.192 | (0.097) | 0 | 1 | 0.194 | (0.095) | 0 | 1 |
| Ratio of male adults (above 20)[(b)] | 0.160 | (0.111) | 0 | 1 | 0.158 | (0.105) | 0 | 1 |
| Log (household size) | 1.787 | (0.394) | 0 | 3.296 | 1.812 | (0.374) | 0 | 3.296 |
| Log (total expenditure per capita) | 9.913 | (0.629) | 6.870 | 12.94 | 9.892 | (0.613) | 6.870 | 12.94 |

Note: Sample is individuals with information on orphan status and education.
(a) Measure is defined as (Highest grade attended by the preceding year) / (age at the time of last school attendance - 5)).
(b) Ratios are to household size.

**Table 5: Highest grade levels attended (children aged 7 to 18)**

| *Dependent Variable* | Female | Male |
|---|---|---|
| Highest grade attended | (A) | (B) |
| ***Orphan Status and Living Arrangement*** | | |
| **Maternal orphan** | | |
| Orphaned at 15 or above (=1) | −2.364 | 0.972 |
| | (1.483) | (0.679) |
| Orphaned at 11-14 (=1) | 0.231 | 0.179 |
| | (0.481) | (0.688) |
| Orphaned at 8-10 (=1) | 0.937** | −0.175 |
| | (0.331) | (0.320) |
| Orphaned at 7 or below (=1) | 0.351 | 0.211 |
| | (0.204) | (0.227) |
| **Paternal orphan** | | |
| Orphaned at 15 or above (=1) | 0.425 | 1.852*** |
| | (0.805) | (0.526) |
| Orphaned at 11-14 (=1) | −0.291 | 0.336 |
| | (0.346) | (0.570) |
| Orphaned at 8-10 (=1) | 0.225 | 0.476 |
| | (0.247) | (0.256) |
| Orphaned at 7 or below (=1) | −0.064 | 0.281 |
| | (0.142) | (0.178) |
| **Double orphan** | | |
| Orphaned at 15 or above | 3.237** | 1.081 |
| | (1.043) | (1.279) |
| Orphaned at 11-14 (=1) | 0.486 | −0.461 |
| | (0.526) | (0.521) |
| Orphaned at 8-10 (=1) | 0.133 | −0.132 |
| | (0.701) | (0.421) |
| Orphaned at 7 or below (=1) | 0.235 | 0.379 |
| | (0.277) | (0.270) |
| **Non-orphan** | | |
| Non-orphan living away from mother (=1) | 0.212 | −0.048 |
| | (0.142) | (0.140) |
| Non-orphan living away from father (=1) | 0.038 | 0.111 |
| | (0.129) | (0.131) |

| | | |
|---|---|---|
| ***Other Child Characteristics*** | | |
| Age dummies | Included | Included |
| Ratio of older female siblings (up to 20) to household size | 0.548** | 0.285 |
| | (0.182) | (0.181) |
| Ratio of older male siblings (up to 20) to household size | 0.300 | 0.046 |
| | (0.169) | (0.164) |
| ***Household Characteristics*** | | |
| Age of the household head (below 30) (=1) | 0.186* | −0.115 |
| | (0.082) | (0.084) |
| Age of the household head (40-49) (=1) | 0.079 | 0.048 |
| | (0.052) | (0.051) |
| Age of the household head (50-59) (=1) | 0.098 | 0.035 |
| | (0.059) | (0.058) |
| Age of the household head (above 60) (=1) | 0.362*** | 0.225*** |
| | (0.066) | (0.066) |
| Highest education among female adults (above 20) | 0.119*** | 0.089*** |
| | (0.007) | (0.007) |
| Highest education among male adults (above 20) | 0.076*** | 0.094*** |
| | (0.006) | (0.006) |
| Ratio of female adults (above 20) to household size | 0.561* | 0.220 |
| | (0.256) | (0.256) |
| Ratio of male adults (above 20) to household size | 0.200 | 0.251 |
| | (0.232) | (0.247) |
| Log (household size) | 0.421*** | 0.236*** |
| | (0.069) | (0.070) |
| Log (total expenditure per capita) | 0.068*** | 0.554*** |
| | (0.036) | (0.037) |
| Constant | −6.884*** | −5.377*** |
| | (0.439) | (0.448) |
| Regional dummies | Included | Included |
| Observations | 7977 | 7879 |
| R-sq. | 0.626 | 0.623 |

Note: Standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Computations are executed by using the 'mgcv' package of R software (version 1.8-3).
The estimation results of non-linear parts are illustrated in Figure 4.

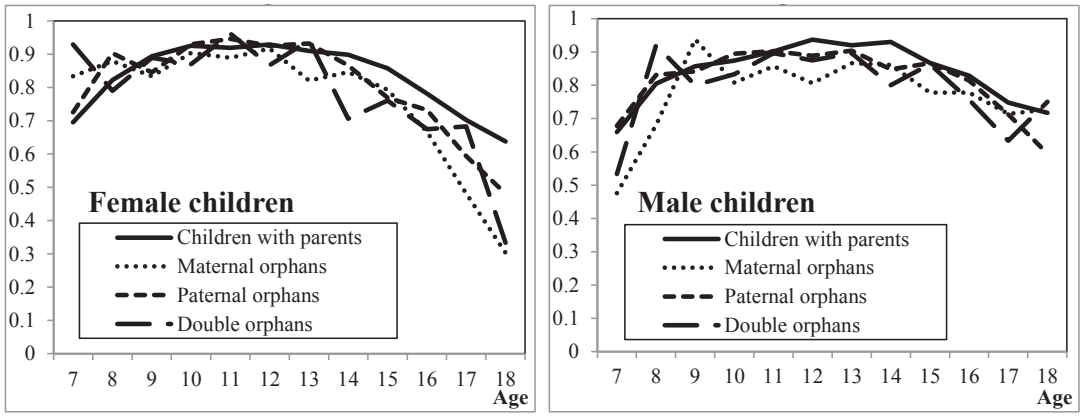



Figure 1: School attendance ratio for maternal orphans

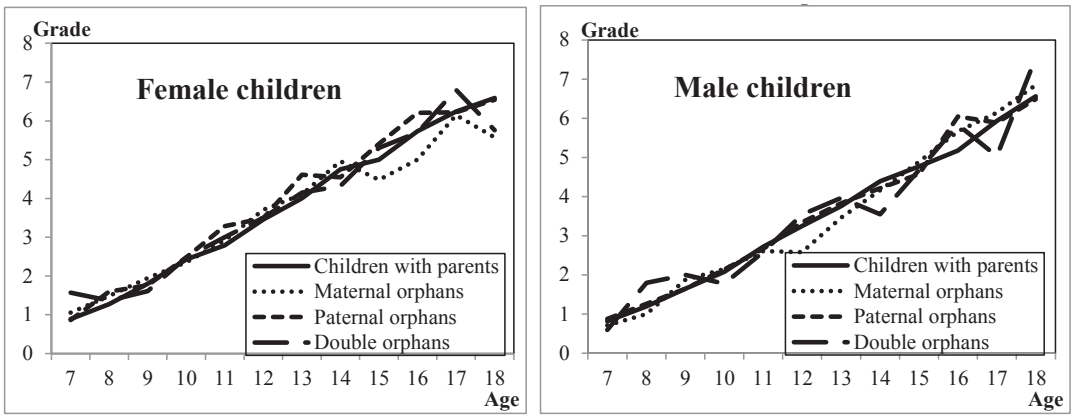



Figure 2: Highest grade level attended for maternal orphans

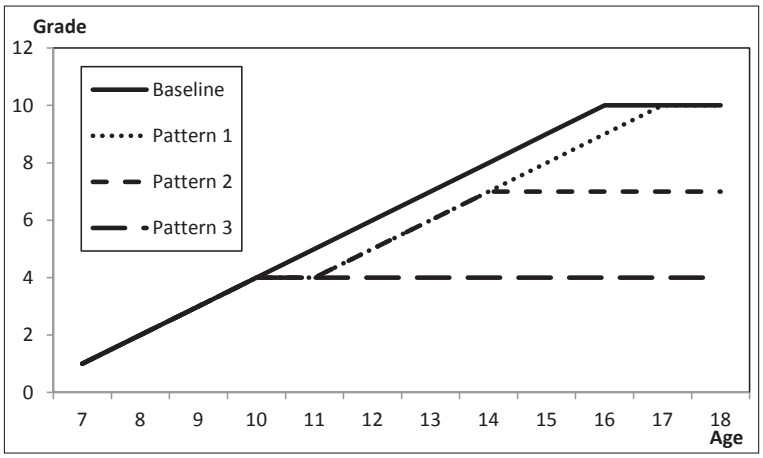
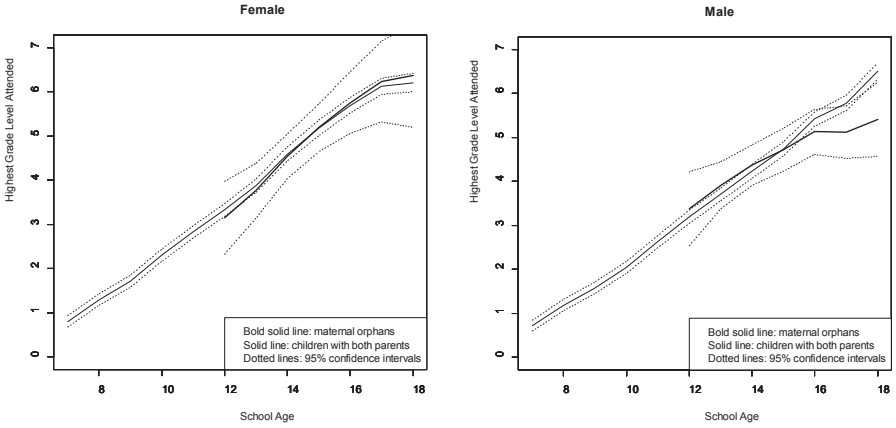
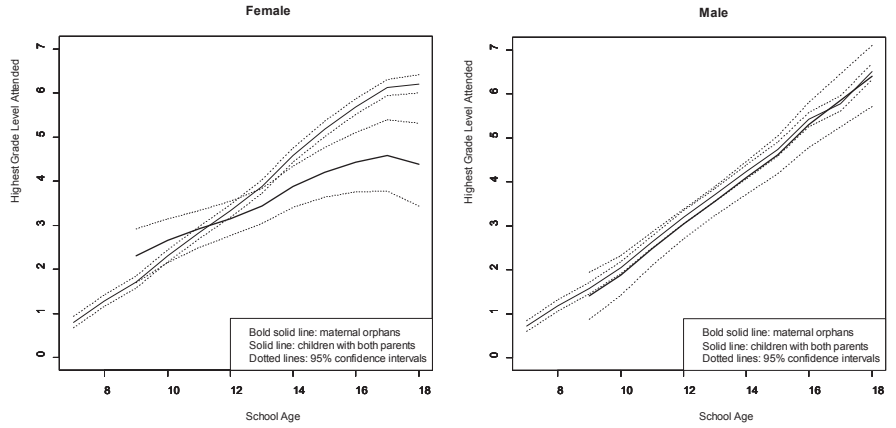



Figure 3: Patterns of educational progression for orphans – theoretical prediction

(1) Orphaned at age 11-14




(2) Orphaned at age 8-10




(3) Orphaned at age 7 or below

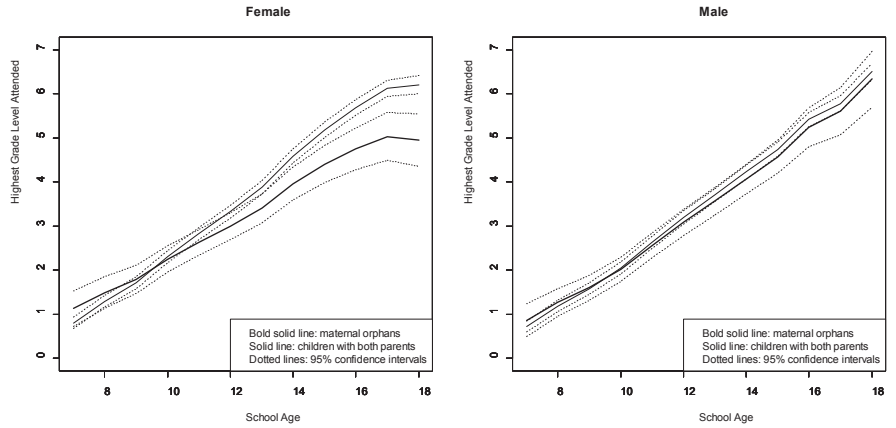
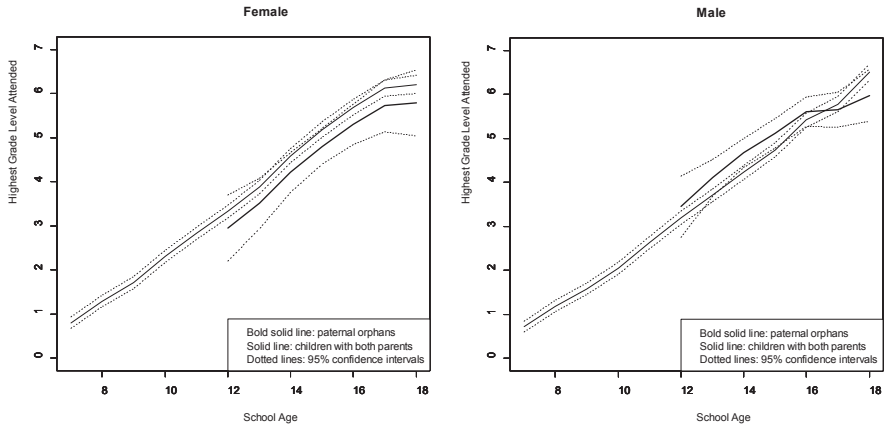
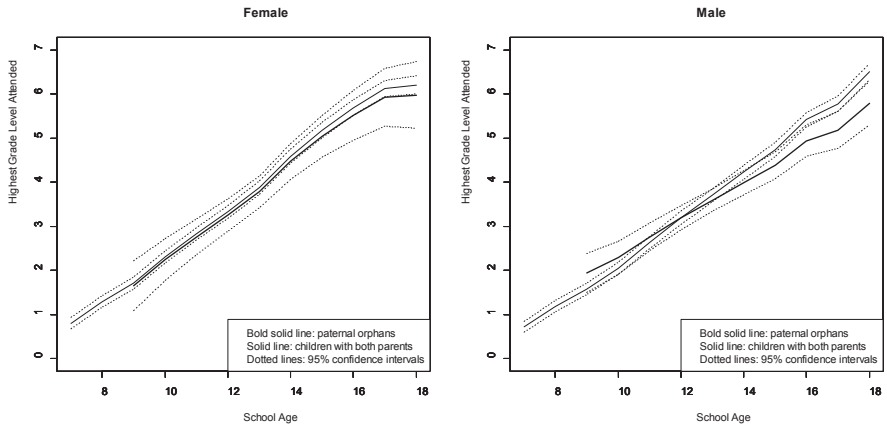



**Figure 4A: Predicted educational attainment (highest grade attended evaluated at the mean values) among maternal orphans (7-18)**

(1) **Orphaned at age 11-14**




(2) **Orphaned at age 8-10**




(3) **Orphaned at age 7 or below**

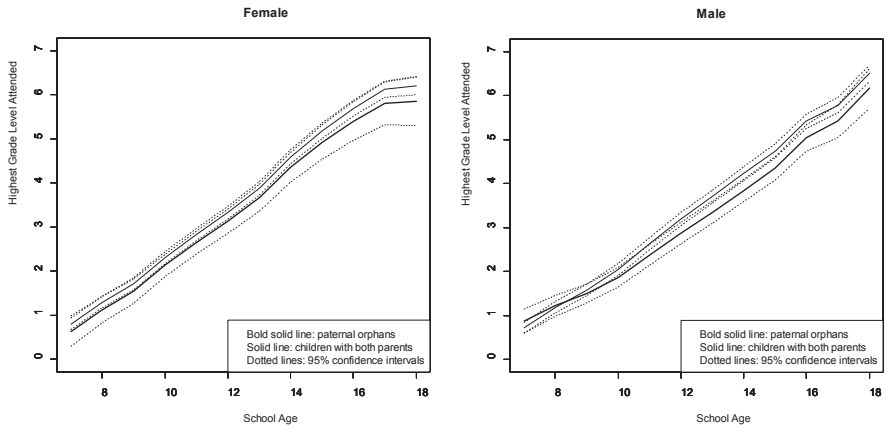
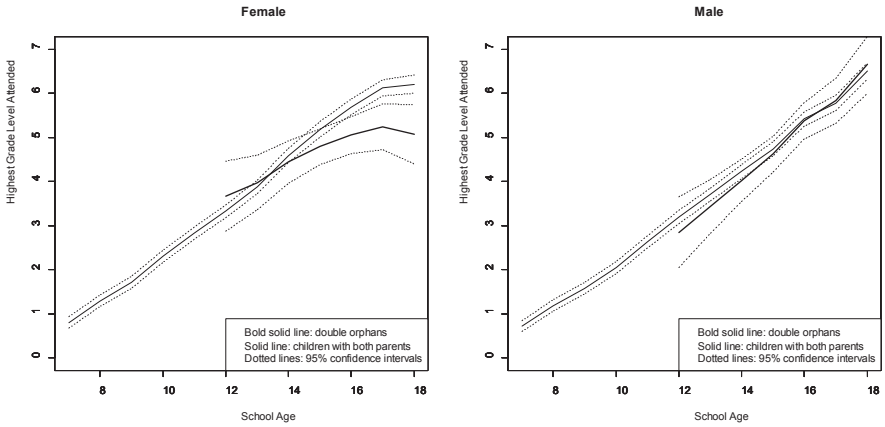
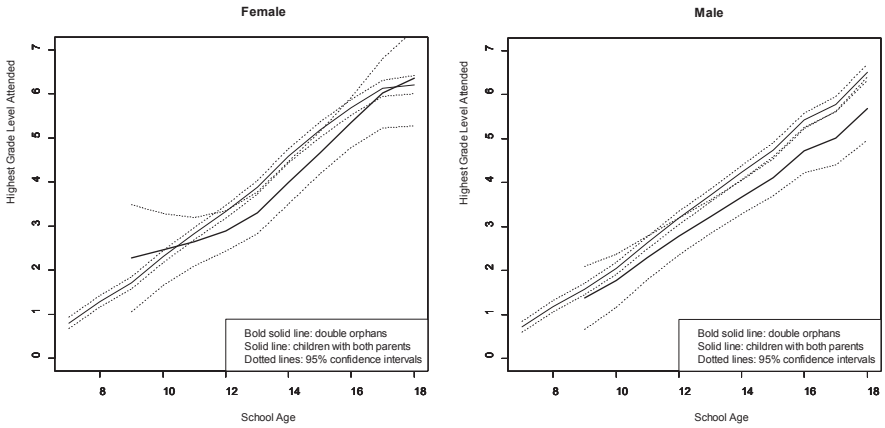



**Figure 4B: Predicted educational attainment (highest grade attended evaluated at the mean values) among paternal orphans (7-18)**

(1) Orphaned at age 11-14




(2) Orphaned at age 8-10




(3) Orphaned at age 7 or below

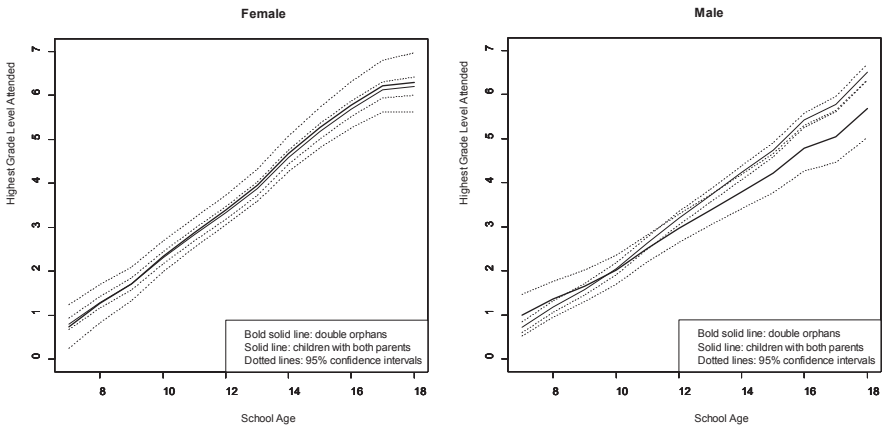



**Figure 4C: Predicted educational attainment (highest grade attended evaluated at the mean values) among double orphans (7-18))**

## Notes

1 While a series of past studies has found that cash transfers conditional on school attendance contribute to the improvement of educational outcomes (Schultz 2004, de Janvry et al. 2006, Filmer and Schady 2011), another line of studies has demonstrated that unconditional cash transfers also decrease child labor and improve school outcomes (Case, Hosegood, and Lund 2005, Edmonds 2006, Edmonds and Schady 2012).

2 Baird et al. (2011), on the other hand, find that unconditional cash transfers have some positive impacts on other welfare measures.

3 In Malawi, Sharma (2006) by utilizing panel data from 2000 to 2004 compares school enrollment between orphans and non-orphans with a control of the past educational attainment at the first round of surveys and shows that orphans are more likely to drop out of school as the grade levels increase. His study, nonetheless, due to the small sample size, fails to disaggregate this tendency by gender and by orphan type, and also does not incorporate the timing of becoming an orphan into his analysis.

4 The word "community" in this paper refers to the enumeration area (EA), which is the primary sampling unit used for the IHS-2 and 1998 Population Census.

5 These differences are more evident when we compare double orphans with children living with both biological parents.

6 The total period during which double orphans live as an orphan (either single or double) is longer than the duration of single orphans.

7 This model is based on the schooling model in Jacoby (1994), but this model explicitly incorporates the utility gain from child's schooling. Also, schooling decisions are discrete and the time horizon is finite.

8 $u(c_t, S_t) = u(c_t) + u(S_t)$

9 Even under perfect credit market conditions, the introduction of the term $\partial u/\partial S_t$ breaks the separability between household consumption and schooling decisions. With the term $\partial u/\partial S_t$, schooling decisions become an explicit function of the marginal utility of wealth ($\lambda_3^t = \lambda_1^t(1+r)$). Liquidity constraints will also lead us to the same conclusion.

10 $u(c_t, S_{1t}, S_{2t}) = u(c_t) + u(S_{1t}) + u(S_{2t})$

11 This model can also be easily extended to a model with multiple children.

12 If it is assumed that the wage function is increasing in age and/or the direct costs of schooling increases as the child gets older, the grade repetition negatively affects the schooling decisions.

13 Changes in the demography of the households and the valuation of children's labor participation can be captured by $w$ because $w$ represents both wage in the external labor market and also shadow wage of children's time. Changes in the wealth level and the probability of facing liquidity constraint can be captured by $\overline{R}$. While a parental death may cause a rise in the shadow wage and a decline in income, which could negatively affect the schooling decisions, fostering experience in a wealthier family could improve the conditions for educational investment.

14 Computations are executed by using the 'mgcv' package of R software (version 1.8-3).

15 One is for non-orphans living separately from their biological father and the other is for non-orphans living separately from their biological mother.

16 There is no clear evidence for maternal orphans that they are fostered by better-off households (Table 3).

17 In addition, unconditional cash transfers might be able to improve other welfare measures such as health outcomes.