



“AIDS-related parental loss: does the age when the trauma occurs matter?”

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Abstract

We use data from the Kagera Region of Northwestern Tanzania to investigate the long run impact of the timing of parental death on the education outcomes of orphans. Using double-hurdle model, we find that there is a statistically significant negative impact of the age at which a child loses his parent on his or her years of schooling, but this impact wears off with time – losing a parent in early childhood is particularly detrimental to schooling, with the six year olds suffering the most; children who lose their parents after the age of 12 experience no negative effects of orphanhood.

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Key Words: HIV-AIDS, orphans, education, timing of parental death, double-hurdle models

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**PRELIMINARY VERSION
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Introduction

“It is not because I am negligent that I find myself before you [two volunteer pharmacists] again” recounted Marthe Tepi, a 39 year-old mother of two, who has skipped her ARV therapy for the fourth time. “I have seen the benefit of these medicines but I am unfortunate [...] and always run short of money.” In an answer to a question about her five year-old ailing last child, she responded “I was hoping that by now I should have been well enough to look for money and carry out an HIV test for him but you can see that my own health has instead deteriorated. I have lost more than twenty kilograms since I last discontinued treatment.”

Fortunately for the hero of this story, aired by the freelance and feature writer on Cameroon Njei Moses Timah, the social services have overtaken the responsibility of paying for her medications and have prevented her two children from joining the annual pool of over 13 million children who are left orphans by AIDS. At least for as long as the mother’s treatment is being paid for. What does this opportunely postponed trauma of parental death mean for her two children? In particular, will her five year old have a better start in life if he can continue being under the mother’s care for even a couple of more years?

The purpose of this paper is to use data from the Kagera Region of Northwestern Tanzania to investigate the long run impact of the timing of parental death on the education outcomes. Apart from defining orphanhood as a continuous variable measured in years a child remains under parental care, we extend the standard specification by (1) breaking down the decision on investing into child’s human capital into two stages – a decision to send a child to school, followed by a decision regarding the level of education to be obtained; (2) by allowing the factors affecting the participation decision to be different from those affecting the level decision, at least in the strength of influence. After a brief overview of the key background papers, a description of the mechanisms through which the timing of death can impact the schooling choices of a child, and a description of the data, our analysis begins with a standard double-hurdle model.

Our results suggest that there is a statistically significant negative impact of the age at which a child loses his parent on his or her years of schooling, but this impact wears off with time – losing a parent in early childhood is particularly detrimental to schooling, with the six year olds suffering the most; children who lose their parents after the age of 12 experience no negative effects of orphanhood. We also find that wealth, household composition and educational background of both parents have an important effect on orphans’ educational outcomes, but that they differ significantly in their impact on the decision to send a child to school vs. the years of completed schooling.

Key Background Papers

This section briefly reviews a few papers from the literature on the impacts of orphanhood and family structure on the child/youth outcomes that directly inspire our study. The papers with a more tangential relationship are mentioned during the discussion of the theoretical and empirical frameworks and the presentation of results.

Beegle et al. (2007) is the most relevant to us paper from the literature on the health and/or education outcomes of children left orphans by AIDS. Controlling for a wide range of child and adult characteristics before orphanhood, the authors conclude that maternal orphanhood has an adverse permanent impact of two centimetres of final height attainment and one year of educational attainment. They also find that the welfare, measured in terms of consumption expenditure, of orphans is 8.5 percent lower compared to similar children whose mother survived till at least their 15th birthday. It is the first paper to provide evidence the short-run negative effects of orphanhood do indeed translate into long-run lower welfare.

Ainsworth et al. (2005) provide a tangential evidence on the importance of the timing of the parental death. They find that among orphans, younger maternal orphans are held back whereas older children are not found to be disadvantaged.

To understand the importance of the timing of the trauma and not just its existence, it is important to remember that the loss of a parent causes emotional distress, deprives the child of nurturing, guidance, and discipline. Gertler et al. (2003), for example, show that although bereaved households may be able to insure investments in children's human capital against the purely economic impact of parental loss, they cannot do so against behavioural factors related to the presence of a parent in the household. The trauma of bereavement, the authors argue, may make it difficult for children to concentrate on schoolwork, leading to temporary or permanent withdrawal from school. Children may lose the motivation to attend school and implement good health and nutritional practices. From the behavioural point of view, the impact may be non-linear. Infants and toddlers may be more flexible in adapting to the loss of the parent, whereas somewhat older children may be less prepared to cope with the emotional burden of parental death, unable to perform school tasks unassisted and be therefore more exposed to the negative effects of losing a parent whereas the detrimental impact on the adolescents may be lower.

Our conclusions from the aforementioned works are that the orphanhood has an important detrimental impact on the child's accumulation of human capital, at least in some countries, and that the effect of the timing of the bereavement trauma is worthy of further investigation. The model outlined in the next session describes how the timing of the disruption may affect the completed schooling.

Theoretical Framework

We propose an education output function with parents, other members of the household, child's health and household's income acting as inputs. Each of these inputs are characterised by different weights, with father and mother having a larger importance to the child's development than other household members. The father being mainly the income generating

source has a different weight than the mother, whose input consists of time and energy of childrearing work, rather than purely economic resource provided by the father.

Time allocation of child into playtime and school related activities also enters this education production function. It is a function of the child's degree of substitutability for the labor of adult members of the household. We assume that a child acts as a substitute for the labor of the adult of the same gender and that the degree of substitutability is an increasing function of the child's age, i.e. a teenage daughter is a better substitute for the mother's labor than a three years old.

AIDS affects the child through several channels. First, AIDS, being a long-term disease rather than an unexpected trauma of losing a parent, say, to an accident, acts as a decrease in the quality of the inputs into the skill formation prior to eliminating this input all together. This deterioration in quality depends on the progression of the disease and allows for the possibility of AIDS to directly affect the child's educational outcomes prior to the actual death of a parent when, for example, a mother is no longer available to check the child's school attendance or to provide help with school work. It would not be unreasonable to assume that an AIDS affected parent results in a bigger decrease of the overall quality of the inputs into the skill formation function than an AIDS affected relative residing in the same household.

Moreover, AIDS increases the opportunity costs of the child's time allocation into playtime and school related activities. Caring for the sick comes at the expense of school work or, very often, school attendance. We anticipate, however, this impact to be temporary and to be reversed once the AIDS victim dies for those children, whose labor cannot be substituted for the labor of the deceased adult (in case of high degree of substitutability, the child will be withdrawn from school permanently). Note, that since death eliminates an input into the skill formation, the overall effect will be negative but it's size will depend on the relative importance of this particular input.

As you can see, the age of the child at the time of the parental death enters the model twice: once, by determining the degree of substitutability between the child and the deceased adult; second time by determining the intensity of the psychological trauma at different stages of child development. This suggests clearly that losing a parent at different points of the child development is likely to have differential effects on the future outcomes. The exact nature of the differences, however, is hard to predict. As such, our work is explorative in nature.

Data, Sample and Variables

Data

The Kagera Region data have been collected through the Kagera Health and Development Survey (KHDS) by the World Bank and Muhimbili University College of Health Sciences. Institutional details on this survey, along with the sampling method and description of main indicators, are given in Beegle et al., 2006 and Beegle et al., 2007.

The surveys cover 915 households that were interviewed up to four times at 6-7 months intervals from 1991 to 1994. The data contain indicators of well-being, including consumption, expenditure, asset holdings, morbidity, health, nutrition and education. In 2004 the survey was repeated with the objective of re-interviewing all household members of the earlier rounds of the survey and who were alive at the last interview. That is, individual household members were tracked down to allow us to construct a panel data set of personal characteristics. Beegle et al. (2006) provide detail on the sample attrition due to a failure to track down all individuals because of migration or dissolution of households. The authors also discuss potential problems that may arise from such attrition.

Sample

We concentrate on a subsample of individuals whom we observe as children (before the age of 15) and whom we follow up as adults (above the age of 19). Given the emphasis of this study on the importance of the timing of the bereavement trauma, we concentrate on orphans.

This sets our work apart from the previous literature on orphans – rather than comparing orphans to non-orphans, we compare orphans to other orphans who have lost their parent at a different point in the development process. There is no downside to this approach, since the comparisons of orphans to non-orphans are plenty, including for the Kagera region that we are studying (add references). Moreover, concentrating on orphans allows us to circumvent the strong selectivity problem in the presence of prime-age mortality (AIDS is a sexual disease, hence adults “self-select” into risky behaviour on unobservables).¹

Variable Definitions

In this paper, an orphan is defined as a child that loses a parent before the age of 15. We anticipate that it is before this age that the bereavement trauma can generate a visible impact on child development. Of course, this choice of 15 years of age is arbitrary and we have experimented with other values (in particular, increasing the age from 15 to 18), but this does not have a significant impact on our results.

Our main variable of interest is the age at which a child became an orphan. As discussed in the section providing theoretical framework for this study, the death of the father may have a different effect than that of the mother. To evaluate the importance of this factor in practice, we need to control for the ages of becoming a paternal and a maternal orphan. Most children in the sample are, however, single orphans and we have many missing values either for the age of becoming a paternal or for the age of becoming a maternal orphan.

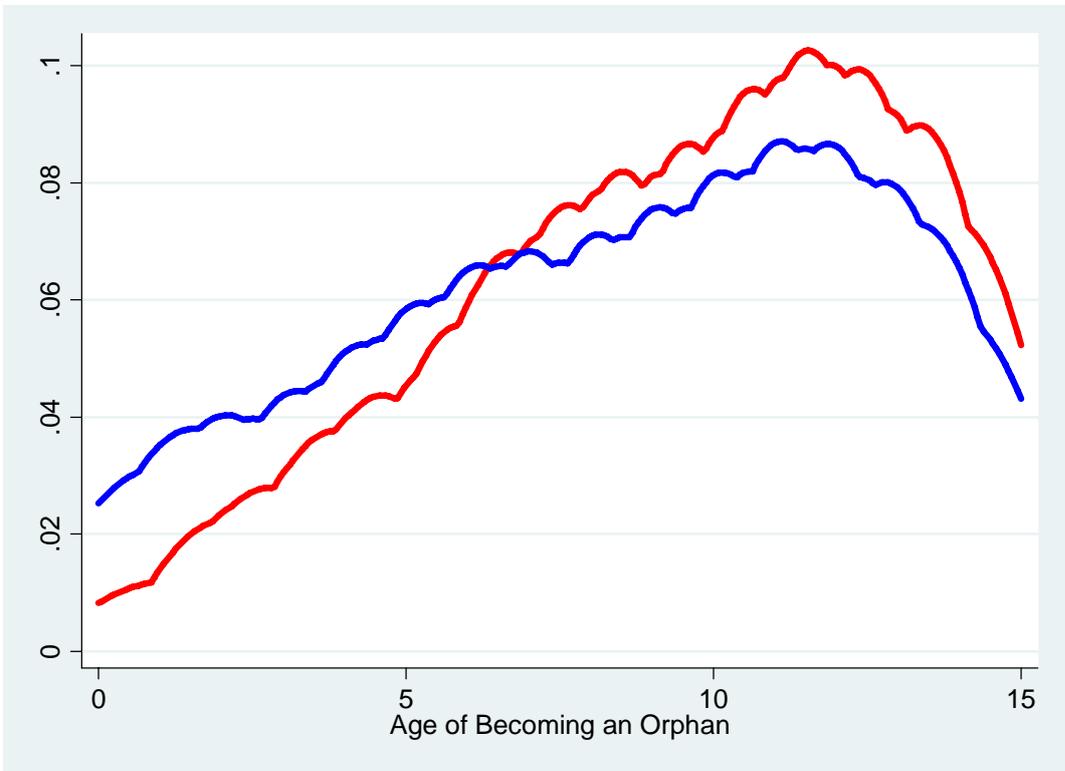
To circumvent this problem, we suggest to look at the age of becoming an orphan as an indicator for how long a child has been exposed to orphanhood. For example, a child who lost a parent at the age of two, has been exposed to orphanhood for $15-2=13$ years, whereas a child who lost a parent at the age of 10 has been exposed to orphanhood only for $15-10=5$ years. That is, the later a child loses his parent, the shorter is the exposure to orphanhood and the less is the anticipated impact on the educational attainment.

¹ Add references with detailed discussion of selectivity problem.

For single-orphaned individuals whose second parent, say, father does not die before the age of 15, the length of the exposure to paternal orphanhood is zero. Which, following the logic of the computations in the previous paragraph, allows us to replace the missing value with 15 (i.e. we truncate the age at 15 if the individual did not lose a parent during childhood).

To give the reader a sense of the main variables in our analysis, we provide a couple of distributional graphs. Graph 1 shows the distribution of the timing of parental death, divided by the gender of the deceased parent.

Graph 1:

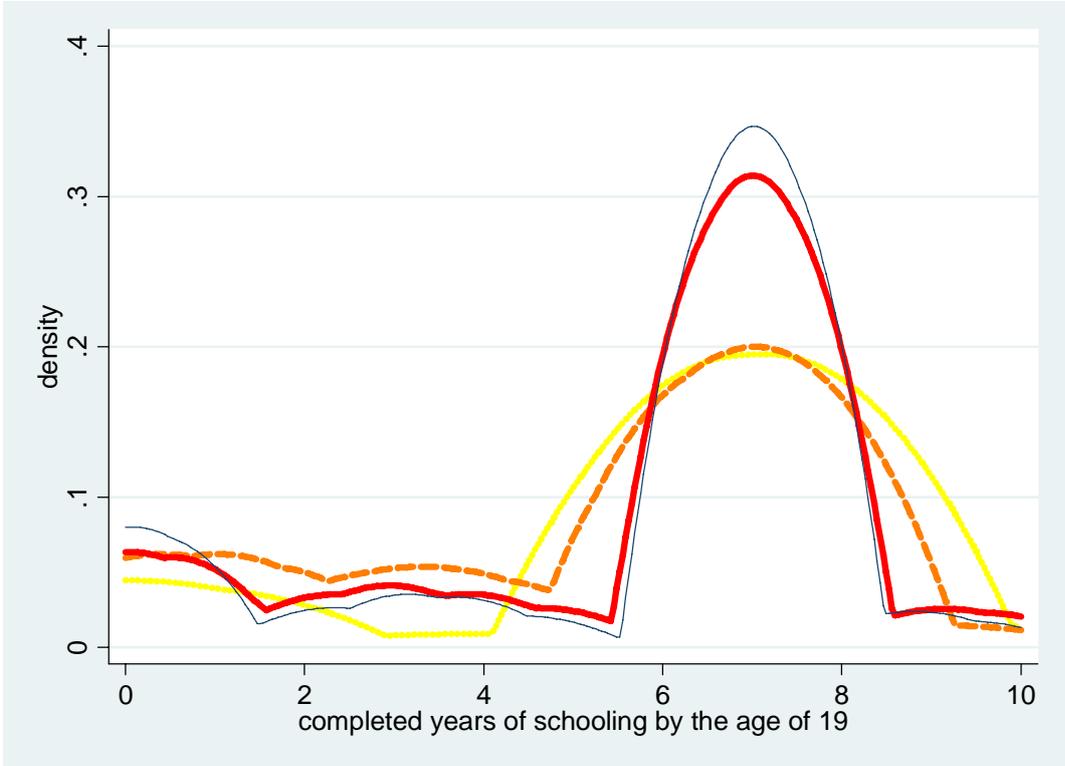


Red – maternal orphan, Blue – paternal orphan.

Graphs 2 and 3 show the distribution of the completed schooling, divided by the age group during which a child lost his/her parent. The main features of these graphs are (1) clustering of values around 7, the median educational attainment in the sample, and (2) a very high variability in educational attainment for the individuals who became orphans earlier in life.

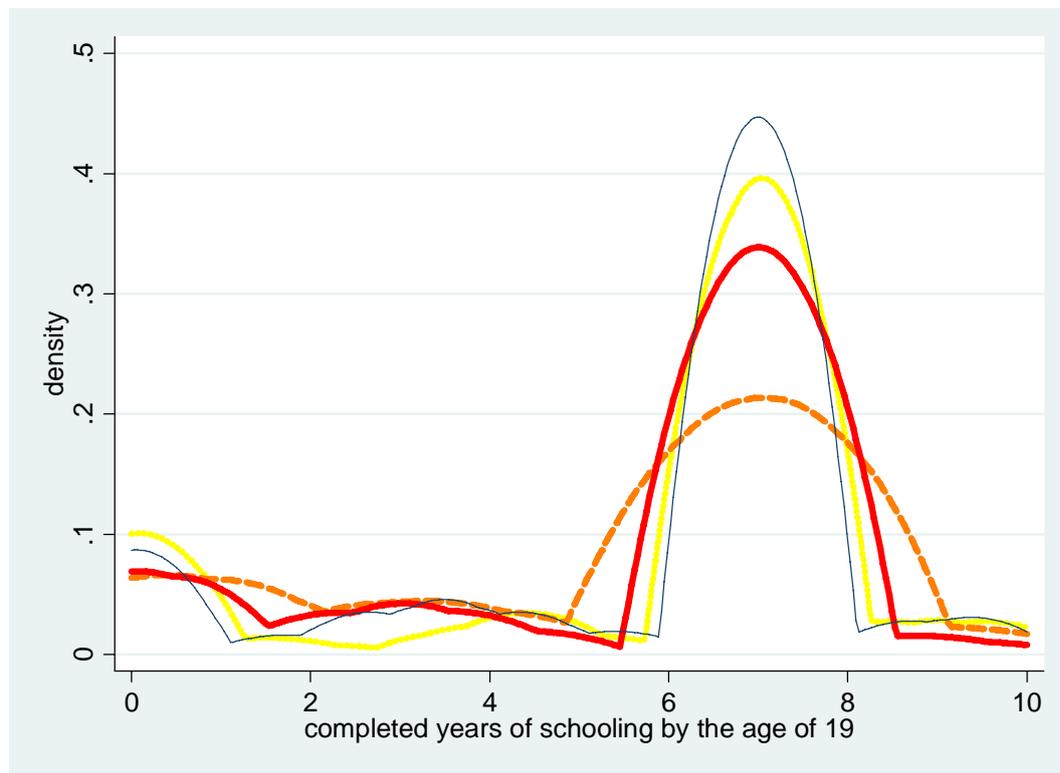
This may suggest a negative relationship between the age of becoming an orphan and the uncertainty for educational attainment and, hence, for future income.

Graph 2: Distribution of Completed Years of Schooling by Timing of Maternal Death



Yellow – lost mother before the age of 5; Orange – lost mother between the ages of 5 and 9; Red – lost mother between the ages of 10 and 14; Blue – no maternal death before the age of 15.

Graph 3: Distribution of Completed Schooling by Timing of Paternal Death



Yellow – lost father before the age of 5; Orange – lost father between the ages of 5 and 9; Red – lost father between the ages of 10 and 14; Blue – no paternal death before the age of 15.

Empirical Specification

The section on the theoretical framework systematized the channels through which parental death can affect education outcomes and showed how these effects may differ depending on the timing of the parental death. In the empirical work, however, we will not be able to identify the specific channels and, similar to other studies, resort to estimating the cumulative effect of parental death on education.

The basic specification can be summarized as follows:

$$\text{EDUCATIONAL ATTAINMENT} = f(\text{PARENTAL PRESENCE; PERSONAL CHARACTERISTICS; PARENTS' CHARACTERISTICS; HOUSEHOLD CHARACTERISTICS}) \quad (1)$$

Educational attainment is measured in terms of the years of education completed, counting each grade as a year. In most of the literature on parental death and child educational outcomes, which typically use data from the world's poorest countries with high illiteracy rates, zero observations commonly occur. To account for this feature, we treat investment in education as a two-step decision process. The first decision is whether or not to send a child to school (participation decision). Once the decision on participation is made, the second decision is the level of education to be obtained. Hence, the specification above can be better described as a system of two equations:

Step 1:

$$\text{SCHOOL ATTENDANCE} = f(\text{TIMING OF PARENTAL DEATH; PERSONAL CHARACTERISTICS; PARENTS' CHARACTERISTICS; HOUSEHOLD CHARACTERISTICS}) \quad (2)$$

Step 2:

$$\text{EDUCATIONAL ATTAINMENT} = f(\text{TIMING OF PARENTAL DEATH; PERSONAL CHARACTERISTICS; PARENTS' CHARACTERISTICS; HOUSEHOLD CHARACTERISTICS}) \quad (3)$$

The descriptions of the independent variables and their summary statistics are given in Tables 1 and 2. In equation (2), the dependent variable is a dummy that takes value of one when the years of completed schooling are strictly positive, and zero otherwise.

When decision making is done in two steps, the use of the ordinary least squares (OLS) results in potentially biased and inconsistent estimates. The Tobit model can be used to overcome this problem because of its capacity to measure the effects of orphanhood on the participation and level decisions. The disadvantage of this method, however, lies in its assumption that the same set of variables determines both decisions simultaneously (to our knowledge, none of the research papers in this area have used even this highly restrictive method to account for the possibility of not enrolling a child in formal education).

There are several ways in which the simultaneity assumption can be violated in practice. Family income, for example, may be important in whether to send a child to school but not in the level of education to be acquired by the child. More likely yet, the impact of orphanhood may affect both decisions, however, to a varying degree. Once again, short of direct theoretical predictions, the choice of determinants for each decision making stage and their relevant importance remains an empirical question.

Results

To satisfy assumptions of normality and homoscedasticity of error terms in the double-hurdle model, we used a natural log transformed dependent variable. Notice that we fit a quadratic model, to examine the possibility of a non-linear relationship between the timing of the bereavement trauma and educational outcomes. In other words, we believe that the orphanhood effect may change abruptly after reaching some unknown threshold level and finding this threshold level is part of our goal.

Table 3 presents our main results. Coefficients in columns “participation” provide the impact of the explanatory variables on the decision to send a child to school, whereas coefficients in the columns “level” provide the impact of the explanatory variables on the completed years of schooling.

There is a statistically significant negative impact of the age at which a child loses his parent on his or her years of schooling, but this impact wears off with time (as suggested by a negative linear and a positive quadratic terms). The competing quadratic and linear terms cancel out at the ratio of the linear over the quadratic term, i.e. approximately 12 in most specifications. The curve is at its minimum at half of this value, i.e. at the age of 6. To summarize, losing a parent in early childhood is particularly detrimental to schooling, with the six year olds suffering the most. Children who lose their parents after the age of 12 experience no negative effects of orphanhood. We believe that losing a parent a year prior to enrolling in

school (most children start attending school at the age of 7), postpones child's enrolment which translates into shorter overall schooling period. Since most children abandon their education after completing the seven years of primary schooling, losing a parent a year or two prior to completion does not result in permanent withdrawal from school. There are many sensible explanations that may result in the observed patterns. Among them is a higher expected value from the child completing the few remaining years of his or her education relative to the foregone earnings from earlier employment.

A closer look at the gender of the deceased parent suggests that observed patterns, for the most part, are driven by the timing of the paternal death. When we separate the sample by the gender of the orphan and the gender of the deceased parent, the impact on the schooling becomes statistically significant. We also notice a curious interaction of the effects. Whereas girls' education depends on the timing of the paternal death, boys' enrolment in school is affected by the timing of the maternal death. In both cases, losing a parent around the age of 9-10 ($0.924/(2*0.046)$ in the case of male orphans) is most detrimental.

An important auxiliary contribution of this paper is to document the differences in the impact of the explanatory variables on the decision to send a child to school and the impact on the completed years of schooling. For example, household's wealth is often reported to be decisive in the educational outcomes of orphans (add references). By comparing coefficients in the "participation" and "level" columns, we see that wealth is crucial for determining whether a child will be sent to school, but far less important in determining how many years of schooling he or she will complete. Whereas father's education is an important predictor of whether the child will be enrolled in formal schooling, it is mother's education that will determine how long the child will remain in school. Number of children in the household (our proxy for "competition for education") is also highly significant, especially for the decision to enrol a child in school. An orphan from a larger family has few chances of obtaining education and, even if, is more likely to leave school early.

In Table 4 we explore the impact of the timing of parental death on the completion of primary education. Once again, our findings suggest a strong negative, but decreasing in strength, effect of the age at which a child loses his or her parent on the completion of primary schooling. A negative coefficient on the linear term indicates an increased probability that a subject who has lost his parent early will withdraw from school prior to completing seven years of schooling. The effect is driven entirely by paternal orphans. A curious finding is a negative and, for the most part, significant coefficient on the variable indicating whether a household is lead by a female or a male. Children from women-headed households are more likely to complete at least seven years of schooling, which seems to be in sync with the literature suggesting the females have stronger preferences for education and, when in the bargaining position, will enforce their preferences (add references).

Parents education is an important determinant of whether a child will complete primary schooling (recall that the findings in Table 3 suggest that it is mother's education that is crucial for the years of completed schooling). A curious finding is that for maternal orphans the impact of mother's education is unimportant, whereas father's education is significant irrespective of his presence. This may be an indication that educated mothers contributed to their child's education through reinforcement of the value of education and, perhaps, assistance in school work.

To summarize, this paper provides empirical evidence on the importance of the timing of parental death, paying particular attention to approximating the threshold age at which the detrimental impact of orphanhood is nullified. We also illustrate how commonly used explanatory variables in the analyses of educational outcomes differ in magnitude and significance for the decisions to enrol a child in school and years of completed schooling.

Conclusions

Nearly all previous studies have assumed that the impact of orphanhood is independent of the timing of the bereavement trauma. Although these studies document an important finding that orphans fare worse than non-orphans, they fail to identify a leaner target group for the already limited financial resources aimed at helping HIV/AIDS victims. The key results of this study indicate that the negative impact of orphanhood is particularly strong for young children and is at its worst for the children close to the age of enrolment in formal schooling. Helping HIV/AIDS affected households with children of this age category may result in overall higher educational achievement of orphans. An additional policy implication of this study is the finding that it is mother's education that is decisive in the overall years of completed schooling. It is therefore important to ensure girls' education as the means of increasing future human capital.

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Table 1: List of explanatory variables

Variable	Description
Years of schooling	Child's years of schooling in 2004
Change in years of schooling	Change in years of child's schooling between baseline and 2004
Delay in schooling	Number of years by which child's school entry was postponed (with normal school entry at seven years)
No schooling	Child never started formal schooling by 2004
Primary schooling completed	Child completed at least seven years of primary schooling by 2004
Age at becoming orphan	Child's age at death of the first parent
Age at becoming paternal orphan	Child's age at death of father
Age at becoming maternal orphan	Child's age at death of mother
Father present at baseline	Dummy: father was alive and present in the household at baseline
Mother present at baseline	Dummy: mother was alive and present in the household at baseline
Father alive in 2004	Dummy: father was alive in 2004
Mother alive in 2004	Dummy: mother was alive in 2004
Father attended school	Dummy: father attended school
Mother attended school	Dummy: mother attended school
Male	Dummy: male child
Age	Child's age at baseline
Household size	Household size at baseline
No 0-15	Number of household members younger than 15 years at baseline
Male hh head	Dummy: at baseline, child lived in a household with male head
Hh head attended school	Dummy: at baseline, child lived in a household whose head had attended school
Wealth index	Value of wealth index at baseline: first principal component derived from different indicators capturing dwelling characteristics, dwelling infrastructure, main source of water, and the ownership of different assets
Baseline 1992	Baseline year is 1992
Baseline 1993	Baseline year is 1993

Table 2: Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Years of schooling	600	6.122	2.883	0	13
Change in years of schooling	596	4.763	2.940	0	13
Delay in schooling	524	1.971	1.529	0	9
No schooling	600	0.098	0.298	0	1
Primary schooling completed	600	0.735	0.442	0	1
Age at becoming orphan	600	8.720	3.937	0	15
Age at becoming paternal orphan	471	9.098	4.367	0	26
Age at becoming maternal orphan	389	11.234	4.687	0	26
Father present at baseline	600	0.308	0.462	0	1
Mother present at baseline	600	0.422	0.494	0	1
Father alive in 2004	600	0.215	0.411	0	1
Mother alive in 2004	600	0.352	0.478	0	1
Father attended school	600	0.855	0.352	0	1
Mother attended school	600	0.712	0.453	0	1
Male	600	0.495	0.500	0	1
Age	600	10.710	2.643	6	15
Household size	600	7.425	3.253	2	28
No 0-15	600	4.343	2.197	1	18
Male hh head	600	0.597	0.491	0	1
Hh head attended school	600	0.755	0.430	0	1
Wealth index	600	0.164	1.979	-1.857	10.228
Baseline 1992	600	0.568	0.496	0	1
Baseline 1993	600	0.095	0.293	0	1

Out of these 600 orphans, 442 were already orphans at baseline. 158 children became orphans by 2004.

Table 3: Log-Transformed Double-Hurdle Regressions

	all orphans a		all orphans b	
	Participation coef/se	Level coef/se	Participation coef/se	Level coef/se
age at becoming orphan	-0.155 (0.168)	-0.024** (0.011)		
squ age at becoming orphan	0.013 (0.010)	0.002** (0.001)		
father present at baseline	-0.260 (0.442)	-0.026 (0.038)	-0.115 (0.458)	-0.024 (0.038)
mother present at baseline	0.772* (0.407)	0.036 (0.033)	0.745* (0.438)	0.043 (0.034)
father alive in 2004	0.536 (0.437)	0.028 (0.039)	0.238 (0.722)	-0.037 (0.049)
mother alive in 2004	-0.152 (0.398)	0.036 (0.032)	-0.354 (0.536)	0.037 (0.039)
father attended school	0.887** (0.428)	0.073 (0.057)	0.907** (0.444)	0.075 (0.058)
mother attended school	0.969*** (0.347)	0.064** (0.032)	0.978*** (0.346)	0.066** (0.032)
male	0.227 (0.313)	-0.015 (0.026)	0.188 (0.319)	-0.016 (0.026)
age	0.108 (0.068)	-0.004 (0.005)	0.132* (0.071)	-0.003 (0.005)
household size	0.272** (0.135)	0.019* (0.010)	0.267** (0.132)	0.019* (0.010)
no 0-15	-0.514*** (0.183)	-0.031** (0.014)	-0.506*** (0.177)	-0.030** (0.014)
male hh head	-0.711 (0.441)	-0.079* (0.040)	-0.694 (0.444)	-0.078* (0.040)
hh head attended school	0.559 (0.398)	0.112*** (0.041)	0.496 (0.402)	0.109*** (0.041)
wealth index	0.698** (0.296)	0.022*** (0.006)	0.701** (0.294)	0.022*** (0.006)
age at becoming paternal orphan			-0.069 (0.153)	-0.025** (0.010)
squ age at becoming paternal orphan			0.005 (0.009)	0.002** (0.001)
age at becoming maternal orphan			-0.125 (0.274)	-0.015 (0.020)
squ age at becoming maternal orphan			0.007 (0.013)	0.001 (0.001)
Number of observations	600		600	
chi2		73.159		76.000
Log-Likelihood	-769.94		-770.67	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 3 (continued)

	paternal orphans a		paternal orphans b	
	Participation coef/se	Level coef/se	Participation coef/se	Level coef/se
age at becoming orphan	-0.138 (0.172)	-0.030*** (0.012)		
squ age at becoming orphan	0.009 (0.010)	0.002** (0.001)		
father present at baseline	0.286 (0.507)	-0.074 (0.058)	0.360 (0.522)	-0.082 (0.058)
mother present at baseline	0.545 (0.420)	0.068* (0.040)	0.534 (0.422)	0.070* (0.040)
father alive in 2004				
mother alive in 2004	-0.040 (0.393)	0.031 (0.034)	-0.026 (0.386)	0.033 (0.033)
father attended school	0.813* (0.456)	0.068 (0.070)	0.820* (0.468)	0.064 (0.069)
mother attended school	1.023*** (0.374)	0.091** (0.039)	1.042*** (0.373)	0.093** (0.039)
male	0.356 (0.337)	-0.038 (0.030)	0.331 (0.339)	-0.038 (0.030)
age	0.158** (0.075)	-0.007 (0.006)	0.169** (0.076)	-0.008 (0.006)
household size	0.377*** (0.141)	0.019 (0.013)	0.380*** (0.140)	0.018 (0.013)
no 0-15	-0.623*** (0.194)	-0.038** (0.016)	-0.625*** (0.191)	-0.038** (0.016)
male hh head	-0.791* (0.477)	-0.074 (0.049)	-0.781 (0.476)	-0.071 (0.049)
hh head attended school	0.331 (0.408)	0.116** (0.045)	0.302 (0.413)	0.115** (0.045)
wealth index	0.533** (0.242)	0.023*** (0.008)	0.530** (0.245)	0.024*** (0.008)
age at becoming paternal orphan			-0.064 (0.162)	-0.028** (0.012)
squ age at becoming paternal orphan			0.004 (0.010)	0.002** (0.001)
age at becoming maternal orphan				
squ age at becoming maternal orphan				
Number of observations	456		456	
chi2		65.105		69.130
Log-Likelihood	-589.65		-590.00	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 3 (continued)

	maternal orphans a		maternal orphans b	
	Participation coef/se	Level coef/se	Participation coef/se	Level coef/se
age at becoming orphan	-0.222 (0.271)	-0.029* (0.016)		
squ age at becoming orphan	0.020 (0.018)	0.002* (0.001)		
father present at baseline	-0.411 (0.662)	0.004 (0.048)	-0.202 (0.625)	-0.005 (0.048)
mother present at baseline	0.583 (0.745)	-0.028 (0.048)	0.586 (0.819)	-0.033 (0.048)
father alive in 2004	0.509 (0.456)	0.026 (0.043)	0.502 (0.429)	0.023 (0.041)
mother alive in 2004				
father attended school	1.466** (0.663)	-0.017 (0.053)	1.461** (0.665)	-0.024 (0.054)
mother attended school	1.222** (0.511)	0.006 (0.043)	1.223** (0.515)	0.010 (0.042)
male	-0.639 (0.457)	0.021 (0.035)	-0.673 (0.466)	0.020 (0.036)
age	0.159 (0.115)	-0.002 (0.006)	0.198* (0.118)	-0.003 (0.006)
household size	0.037 (0.210)	0.040*** (0.014)	0.016 (0.205)	0.040*** (0.014)
no 0-15	-0.283 (0.276)	-0.044** (0.021)	-0.253 (0.261)	-0.045** (0.020)
male hh head	-0.576 (0.691)	-0.093* (0.053)	-0.493 (0.706)	-0.091* (0.051)
hh head attended school	1.418** (0.567)	0.094* (0.057)	1.306** (0.545)	0.099* (0.058)
wealth index	0.694 (0.496)	0.024*** (0.007)	0.694 (0.494)	0.023*** (0.007)
age at becoming paternal orphan				
squ age at becoming paternal orphan				
age at becoming maternal orphan			-0.222 (0.482)	-0.017 (0.023)
squ age at becoming maternal orphan			0.014 (0.025)	0.001 (0.001)
Number of observations	325		325	
chi2		67.868		72.562
Log-Likelihood	-404.05		-404.82	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 3 (continued)

	male orphans a		male orphans b	
	Participation coef/se	Level coef/se	Participation coef/se	Level coef/se
age at becoming orphan	-0.252 (0.265)	-0.024* (0.013)		
squ age at becoming orphan	0.024 (0.015)	0.002* (0.001)		
father present at baseline	0.674 (0.722)	-0.049 (0.050)	1.084 (0.793)	-0.052 (0.047)
mother present at baseline	0.214 (0.520)	0.040 (0.041)	0.110 (0.601)	0.056 (0.043)
father alive in 2004	-0.040 (0.605)	0.059 (0.051)	0.104 (1.105)	-0.024 (0.063)
mother alive in 2004	0.985 (0.680)	0.005 (0.045)	0.005 (0.820)	0.023 (0.052)
father attended school	0.099 (0.715)	0.080 (0.078)	0.123 (0.784)	0.080 (0.077)
mother attended school	1.518** (0.596)	0.133*** (0.047)	1.559*** (0.599)	0.139*** (0.047)
male				
age	0.098 (0.097)	-0.001 (0.007)	0.184* (0.105)	0.000 (0.007)
household size	0.358 (0.248)	0.024* (0.015)	0.350 (0.242)	0.025* (0.014)
no 0-15	-0.617* (0.353)	-0.035** (0.018)	-0.583* (0.326)	-0.035** (0.017)
male hh head	-1.321* (0.801)	-0.077 (0.053)	-1.360* (0.815)	-0.074 (0.053)
hh head attended school	1.069* (0.637)	0.102* (0.056)	0.920 (0.693)	0.099* (0.056)
wealth index	0.588 (0.358)	0.023** (0.009)	0.634* (0.379)	0.022** (0.009)
age at becoming paternal orphan			0.112 (0.208)	-0.027** (0.013)
squ age at becoming paternal orphan			-0.004 (0.013)	0.002** (0.001)
age at becoming maternal orphan			-0.924** (0.452)	-0.013 (0.026)
squ age at becoming maternal orphan			0.046** (0.021)	0.000 (0.001)
Number of observations	297		297	
chi2		30.089		34.699
Log-Likelihood	-376.57		-375.49	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 3 (continued)

	female orphans a		female orphans b	
	Participation coef/se	Level coef/se	Participation coef/se	Level coef/se
age at becoming orphan	-0.193 (0.228)	-0.025 (0.018)		
squ age at becoming orphan	0.014 (0.014)	0.001 (0.001)		
father present at baseline	-1.366** (0.585)	0.015 (0.052)	-1.319** (0.606)	0.020 (0.054)
mother present at baseline	1.299** (0.550)	0.036 (0.049)	1.321** (0.569)	0.036 (0.051)
father alive in 2004	0.988 (0.773)	-0.003 (0.053)	0.425 (1.042)	-0.037 (0.072)
mother alive in 2004	-1.103** (0.521)	0.075* (0.044)	-1.299 (1.021)	0.056 (0.052)
father attended school	1.972*** (0.624)	0.051 (0.080)	2.198*** (0.678)	0.059 (0.080)
mother attended school	0.705 (0.500)	-0.008 (0.042)	0.688 (0.504)	-0.013 (0.044)
male				
age	0.157 (0.108)	-0.005 (0.006)	0.147 (0.111)	-0.004 (0.006)
household size	0.225 (0.192)	0.008 (0.014)	0.215 (0.196)	0.008 (0.014)
no 0-15	-0.462** (0.234)	-0.026 (0.020)	-0.423* (0.228)	-0.026 (0.020)
male hh head	-0.369 (0.599)	-0.087 (0.056)	-0.438 (0.659)	-0.086 (0.056)
hh head attended school	0.123 (0.632)	0.129** (0.054)	0.069 (0.674)	0.128** (0.053)
wealth index	0.800* (0.478)	0.023*** (0.008)	0.827 (0.523)	0.023*** (0.008)
age at becoming paternal orphan			-0.435* (0.230)	-0.024 (0.017)
squ age at becoming paternal orphan			0.024* (0.013)	0.001 (0.001)
age at becoming maternal orphan			0.274 (0.296)	-0.026 (0.027)
squ age at becoming maternal orphan			-0.010 (0.017)	0.001 (0.001)
Number of observations	303		303	
chi2		51.697		52.538
Log-Likelihood	-381.49		-380.06	

note: *** p<0.01, ** p<0.05, * p<0.1

Table 4: Probability of Completing Primary Schooling (7 years if formal education) by the Age of 19

	all orphans a	all orphans b	paternal orphans a	paternal orphans b	maternal orphans a	maternal orphans b	male orphans a	male orphans b	female orphans a	female orphans b
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
age at becoming orphan	-0.217** (0.109)		-0.253** (0.122)		-0.194 (0.163)		-0.232 (0.146)		-0.255* (0.154)	
squ age at becoming orphan	0.014** (0.006)		0.016** (0.007)		0.013 (0.010)		0.018** (0.008)		0.014 (0.009)	
father present at baseline	-0.232 (0.345)	-0.213 (0.343)	-0.264 (0.435)	-0.351 (0.436)	0.078 (0.449)	0.095 (0.441)	-0.158 (0.488)	-0.167 (0.478)	-0.259 (0.445)	-0.232 (0.461)
mother present at baseline	0.459 (0.314)	0.470 (0.321)	0.652* (0.349)	0.656* (0.345)	-0.016 (0.484)	-0.052 (0.501)	0.415 (0.406)	0.381 (0.420)	0.611 (0.437)	0.613 (0.450)
father alive in 2004	0.142 (0.342)	-0.389 (0.464)			-0.039 (0.393)	-0.024 (0.382)	0.361 (0.445)	-0.551 (0.636)	-0.116 (0.476)	-0.371 (0.649)
mother alive in 2004	0.229 (0.280)	0.155 (0.372)	0.211 (0.297)	0.230 (0.297)			0.362 (0.405)	0.200 (0.506)	0.052 (0.360)	-0.015 (0.520)
father attended school	0.834*** (0.319)	0.853*** (0.327)	0.690* (0.355)	0.671* (0.359)	0.812* (0.442)	0.776* (0.441)	0.556 (0.494)	0.533 (0.518)	1.073*** (0.390)	1.111*** (0.410)
mother attended school	0.732*** (0.241)	0.731*** (0.240)	1.002*** (0.281)	1.018*** (0.278)	0.393 (0.357)	0.391 (0.357)	1.095*** (0.345)	1.114*** (0.344)	0.392 (0.347)	0.387 (0.351)
male	-0.146 (0.215)	-0.164 (0.216)	-0.331 (0.242)	-0.337 (0.244)	-0.132 (0.294)	-0.139 (0.297)				
age	0.034 (0.044)	0.039 (0.044)	0.061 (0.055)	0.052 (0.056)	0.025 (0.063)	0.026 (0.060)	0.068 (0.063)	0.072 (0.066)	0.014 (0.063)	0.019 (0.063)
household size	0.186* (0.095)	0.186** (0.094)	0.189* (0.110)	0.185* (0.110)	0.284** (0.138)	0.291** (0.139)	0.214 (0.150)	0.213 (0.147)	0.136 (0.109)	0.134 (0.107)
no 0-15	-0.334*** (0.124)	-0.331*** (0.122)	-0.374*** (0.145)	-0.368** (0.144)	-0.372** (0.180)	-0.377** (0.181)	-0.413** (0.193)	-0.407** (0.190)	-0.236* (0.143)	-0.233* (0.141)
male hh head	-0.677* (0.353)	-0.678* (0.352)	-0.637* (0.385)	-0.611 (0.391)	-0.816* (0.469)	-0.819* (0.466)	-0.811 (0.535)	-0.846 (0.536)	-0.571 (0.443)	-0.555 (0.441)
hh head attended school	0.799***	0.777**	0.737**	0.732**	0.980**	0.965**	0.950**	0.928**	0.630	0.619

	all orphans a	all orphans b	paternal orphans a	paternal orphans b	maternal orphans a	maternal orphans b	male orphans a	male orphans b	female orphans a	female orphans b
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
wealth index	(0.308) 0.331*** (0.117)	(0.309) 0.332*** (0.115)	(0.341) 0.275** (0.117)	(0.345) 0.275** (0.118)	(0.415) 0.313** (0.143)	(0.413) 0.306** (0.144)	(0.443) 0.335 (0.205)	(0.453) 0.347* (0.196)	(0.386) 0.339*** (0.114)	(0.390) 0.332*** (0.115)
age at becoming paternal orphan		-0.197* (0.111)		-0.232* (0.120)				-0.226 (0.145)		-0.225 (0.170)
squ age at becoming paternal orphan		0.012** (0.006)		0.015** (0.007)				0.017* (0.009)		0.011 (0.009)
age at becoming maternal orphan		-0.115 (0.168)				-0.191 (0.212)		-0.102 (0.265)		-0.137 (0.213)
squ age at becoming maternal orphan		0.006 (0.009)				0.012 (0.012)		0.007 (0.013)		0.007 (0.011)
Number of observations	603	603	457	457	327	327	300	300	303	303
chi2	82.084	78.223	66.360	66.007	51.175	52.741	48.833	46.041	44.788	44.004
Log-Likelihood	-294.43	-294.64	-222.76	-223.02	-162.01	-162.34	-143.26	-142.82	-146.34	-146.44

note: *** p<0.01, ** p<0.05, * p<0.1