Mortality, Mobility and Schooling Outcomes among Orphans
Evidence from Malawi

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Abstract

This study investigates the impacts of parental death on children's survival risks and migration behaviors, as well as schooling outcomes, by using panel data from Malawi, which has the eighth-highest HIV infection rates in the world. A number of studies have analyzed the association between parental death and children's school enrollment, but very few have considered mortality and mobility of orphans.

Empirical results show that maternal orphans, as well as double orphans, tend to face higher survival risks and the lower schooling outcomes than paternal and non-orphans. This is especially so for boys. Similarly, maternal and double orphans tend to move to other households more frequently. Compared to adolescent orphans, the impact on younger orphans have is more muted, suggesting the possibility that free primary education policies may have mitigated shocks of parental death. These empirical results are robust to sample attrition due to mortality and mobility.

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1. Introduction

The unparalleled spread of HIV/AIDS in Sub-Saharan Africa poses severe socio-demographic challenges at the household, community, as well as at the national level. In particular, a tremendous increase in the number of orphans associated with a sharp rise in prime-age adult mortality has become a serious problem in the region. According to recent reports, there were more than 43.4 million orphans in Sub-Saharan Africa in 2003, 28 percent (12.3 million) of them became orphans as a result of losing at least one parent to AIDS (UNICEF [2004]). The report also predicts that the number of orphans losing both parents will increase threefold from 1990 to 2010.

As the prime-age adult mortality from AIDS has become one of the most serious concerns in Sub-Saharan Africa, many researchers and policy makers have started to pay more attention on the socio-economic impacts of orphanhood [1]. Reports on HIV/AIDS by international organizations and NGOs claim that orphans and other vulnerable children affected by HIV/AIDS, especially young female orphans, face increased risk of poverty, exploitation and abuse, malnutrition, and poorer access to health care and schooling (UNICEF 2004, UNAIDS 2006, Tadria 2004, World Bank 2002). Lack of investments in human capital and adverse conditions during childhood such as ill health and malnutrition are often associated with lower living standards in the future. Early intervention is critical so as to avoid the poverty trap.

In recent years, there has been a growing body of literature examining the association between parental death and human development outcomes of children measured by school attendance and health conditions. Studies based on cross-sectional data do not find consistent results (Lloyd and Blanc [1996], Ainsworth and Filmer [2002], Crampin et al [2003], Lindblade et al [2003], Chatterji et al [2005]), while recent studies using panel data find negative impacts of being an orphan on schooling outcomes (Case, Paxson and Ableidinger [2004], Deininger, Garcia and Subbarao [2003], Evans and Migel [2005], Beegle, De Weerdt and Dercon [2006], Case and Ardington [2006]). However, there are a few studies using panel household surveys

[1] In addition to orphans, many existing studies point out that vulnerable children tend to face negative shocks frequently. The definition of vulnerable children is broad. Generally, it includes children affected in some way by HIV/AIDS, for example, (1) children living in a community with a high prevalence of HIV/AIDS, (2) living with HIV infected family members and caring for siblings and chronically ill family members, and (3) living in financially stretched households that have absorbed other children affected by HIV.

and the coverage of countries is limited to Kenya, Uganda, South Africa and Kagera region in Tanzania. Moreover, few studies explicitly account for sample attrition, which is highly correlated with mortality and mobility behavior of orphans.

To fill in the gap of existing empirical studies, this study investigates the impacts of orphanhood and recent parental death on children's mortality, migration, and schooling outcomes using a household panel survey from Malawi. Malawi is one of the countries deeply affected by HIV/AIDS. According to a new report published by UNAIDS, Malawi has the nine-highest infection rate in the world (UNAIDS [2006]). Nevertheless, there is only a few quantitative studies examining the impact of orphanhood or parental death on children's outcomes in Malawi (Manohar [2006]).

This study contributes to the existing literature by providing empirical results regarding impacts of parental death on various children's welfare outcomes that are often overlooked in other studies. By utilizing panel data, we can examine the impacts in detail while controlling for initial conditions of children. Also, the panel data allow us to assess the impact of recent parental death on welfare outcomes among children who were non-orphans at the baseline period.

This study uses three empirical methodologies to explore different aspects of impacts. First, we analyze regression models with controls for various sets of household and child characteristics and for village fixed effects to investigate heterogeneous impacts of orphanhood across different types of households. Second, we employ household fixed effect models to test the differential effects of orphanhood on welfare outcomes among different types of orphans living in the same household. Third, using the non-orphaned children at the baseline as a sub-sample, we examine the impact of recent parental death on schooling outcomes.

Furthermore, this study delineates the effect of orphanhood and recent parental death on children's mortality and mobility behaviors as well as schooling investment. While a number of studies have examined the correlations between parental death and school enrollment, there are few studies focusing on the impacts of orphan status on mortality and migration of the children, which are also critical issues[2].

[2] Medical studies focus on the relationship between maternal death and child mortality in the context of mother-to-child transmission of HIV. However, few studies investigate economic effects, such as changes in household income and children's opportunity cost.

Considering mortality and mobility among orphans is critical because these factors are strongly associated with welfare outcomes of orphans. First, death is the worst case scenario facing orphans especially when orphans have higher mortality risks than nonorphans. Second, it is conceivable that orphans may move from one household to others more often than children living with biological parents. The frequency of such move from one household to others is thought to be detrimental to the child development.

Moreover, we need to consider mortality and mobility issues to take into account sample attritions of children since the panel data we use in this study do not track individuals that move to other households. Relatively high attrition rate in this data set makes it plausible that estimates are biased if attrition is nonrandom. This type of nonrandom attrition of sample is also a significant concern for other empirical studies using panel data (Fitzgerald, Gottschalk and Moffitt [1998], Alderman et al. [2000], Thomas, Frankenberg and Smith [2001], Maluccio [2004]).

The results show that parental death has significant negative impacts on mortality, mobility and schooling outcomes of children. In particular, mothers' death has a greater impact than fathers' death. For mortality and mobility of children, maternal and double orphans face higher probability of death and they tend to move from one household to others more frequently than non-orphans. These results suggest that losing their mothers has more negative impacts on a various aspects of children's well-being, to say nothing of the serious disadvantage for double-orphans. Similarly, our estimates show that maternal and double orphans are more likely to accumulate lower level of human capital compared to other children in the same households. Contrastingly, father's death does not affect human capital investment when their mother is alive. Neither being a paternal orphan nor recent father's death has significant impacts on children's schooling outcomes.

Free education policies of Malawian government seem to have mitigated negative shocks arising from parental death, at least partially. While adolescent orphans did not fare well in schooling outcomes, we find more muted impacts for younger school-aged children who enrolled in school after the introduction of universal free primary education in 1994. More interestingly, the impacts of orphanhood on schooling outcomes are significantly gender dependent: orphaned boys tend not to enroll relative to orphaned girls. Household wealth level significantly influences the severity of these impacts, at least for grade progression: the negative impact of being maternal orphans is much larger for those in poorer households than those in

wealthier ones. However, regarding double orphans, we did not find any differential impact of household wealth level, suggesting that negative impacts of orphanhood cannot be explained only by economic factor.

The rest of this paper is structured as follows. The next section provides succinct reviews of recent studies, recent trend in orphanhood and education systems in Malawi as a backdrop. Section 3 describes the data set used in this paper. Section 4 examines the effect of orphanhood on children's mortality. Section 5 examines the mobility of children, followed by the analysis of the impacts of parental death on schooling outcomes, such as enrollment and grade progression. Section 7 tackles the issue on attrition bias and compares coefficient estimates between attrition corrected and uncorrected estimates. Final section offers concluding remarks.

2. Motivation and Background

It is widely recognized that children face negative shocks on their welfare after their parental death, but the magnitude of such adverse impacts may be larger for deaths caused by HIV/AIDS than by other causes. There are a number of reasons why it may be so. From the biological aspect, AIDS orphans face higher mortality risks because of the high likelihood of transmission of HIV from the mother to the child. Furthermore, it is well known that children who have HIV infected mothers are less likely to receive adequate nutrition and good health care since the primary care giver is the mother with long-term illness.

Reduction in household income/assets and large expenditure on medical care arising from the death or morbidity of prime age adults put significant financial strain on households. Household income shock may reduce children's schooling because of liquidity constraint. In addition, illness or death of parents may change time allocation of the children: the demand for their time to engage in income earning activities and to care for ill person may increase substantially, leading to a reduction in their school time. Furthermore, orphans may suffer emotional trauma of seeing parental death or develop psychological problems such as depression, anger and fear for their future (Foster [2002], UNAIDS [2004]). To exacerbate the problem, AIDS orphans face twice as large negative impacts as non-AIDS orphans since most of them lose their remaining parent soon after the first parental death.

Traditionally, mutual cooperation systems, such as fostering children by kinship, extended family and communities, have functioned well as a way of risk coping mechanism in Sub-Saharan Africa. Extend families - in particular grandparents - have had a great responsibility as orphans' caregivers and, in fact, most of orphans have been cared for by them. Under these cultural norm and social security system, African orphans have been taken in and supported well in the past.

However, the recent drastic rise in a number of orphans and reduction in a number of prime-age adults because of the spread of HIV/AIDS may have weakened the societal capacity to care for orphans. Many households struggle with a heavy burden of fostering ever more orphans. Households that take in orphans may face severe resource constraints. For instance, in southern Africa, more than 20 percent of households with children are caring one or more orphans (UNICEF [2003]). Under these circumstances, households may invest less in human capital of children, especially of fostered children. It may well be the case that disparities in human capital investment exist between fostered orphans and biological children. If intrahousehold discrimination against orphans exists, even though the returns to schooling are not different between orphans and nonorphans, a policy intervention to redress the inequality in human capital investment can be effective[3]. By examining the impact of orphanhood on children's outcomes within a same household, this study also investigates whether such a traditional orphan-supporting network is still functioning well in Malawi.

Literature reviews

There have been a growing body of empirical studies examining the impacts of orphanhood on children's achievements in schools, but the results are mixed depending on data sources, estimation methodologies, and specifications. Most existing studies, especially early ones, compared the impacts between nonorphans and orphans at a single point in time, using cross-country data or descriptive studies using a data set with a small number of observations.

[3] While identification is difficult, it is plausible that orphans have lower returns to education than nonorphans. Parental death could affect the returns to schooling of orphans through deprivation and ill health in early childhood, time lost during the parents' illness and emotional suffering (Case, Paxson, and Ableidinger [2004]). This is a research issue to be tackled in future.

Although these studies could not show concrete evidence, recent empirical evidence based on household panel surveys provides causal relationships between parental death and children's welfare outcomes.

Four generalized findings emerge from the existing studies. First, without controls for the characteristics of household and children, being an orphan is negatively correlated with his/her schooling outcomes. Second, several studies using a panel survey found that being an orphan, especially losing mother, has a significant negative impact on child's schooling outcomes. Third, schooling outcomes for older children or adolescents are more likely to be negatively affected by parental death. Finally, contrary to common belief that girls are more vulnerable to shocks because of parental death/disease, the empirical evidence is mixed. Few studies found a significant anti-girl discrimination in welfare outcomes of orphans in this context.

A number of early studies use the Demographic and Health Survey (DHS) to examine the correlation between orphan status and school enrollment. Both Lloyd and Blanc [1996] and Ainsworth and Filmer [2006] found that the impact of orphanhood on school enrollment varies across countries even within the same part of Sub-Saharan Africa. Using merged DHS datasets for 17 countries in West Africa and East Africa, Bicego et al. [2003] found that being a double orphan significantly reduces school enrollment. They also found differential impacts of orphanhood by region: the impacts of paternal and double orphans were significant in West Africa, whereas maternal and double orphans were more disadvantaged in East Africa.

Likewise, Case, Paxson and Ableidinger [2004] found that orphans are less likely to enroll in school than nonorphans, with or without household fixed effects using 19 DHS surveys from 10 countries. Yamano, Shimamura and Sserunkuuma [2006] also found a significant negative impact of orphanhood on school enrolment in Uganda, with taking the same approach (household fixed effects). Even though most studies analyze the impacts of orphanhood using multiple regression analyses to control for various household and child characteristics, estimation results from cross-country exercises may be biased because they still suffer from omitted variables and endogeneity.

In recent years, a number of empirical evidence is based on panel regressions. A generalized finding from such studies is that orphanhood negatively impacts on schooling outcomes. Using a panel survey from South Africa, Case and Ardington [2006] concludes that maternal orphans are significantly less likely to be enrolled in school, tend to complete much

shorter years of schooling, and the household spends less money on education, whereas paternal death negatively affects educational outcomes of the children only through household wealth effects. Similarly, Evans and Miguel [2005] found a significant and negative impact of orphanhood on school participation using a unique five-year panel dataset from a high HIV prevalence district in rural Kenya. They found consistent evidence with Case and Ardington [2006] that maternal deaths have much larger negative impacts than paternal deaths. They also show that younger girls and children with lower test scores at the baseline are significantly less likely to participate in school after the death of parents, suggesting that households allocate their resources efficiently to children with higher expected returns to human capital. Using the same dataset as this study, Manohar [2006] examines the impact of orphanhood on school enrollment in Malawi, using probit models. His result shows that being an orphan has an insignificant impact on school enrollment in general, but the interaction of orphanhood dummy variable with grade level of children is significant and negative[4].

As an exception, Ainsworth, Beegle and Koda [2005], using panel data from Kagera region of northwestern Tanzania, did not find any significant negative impact of parental death on school attendance, although school entry was delayed for maternal orphans and children in poorer households with recent adult deaths. In terms of the prime-age adult mortality in the household, studies found the evidence that the adult death of household member decreases schooling outcomes of children (Yamano and Jayne [2005]), Yamauchi, Buthelezi and Velia [2006]).

Although empirical studies on schooling outcomes are mounting, few studies have examined the impacts of orphanhood on children's mortality and mobility, especially from the economic point of view. While epidemiological studies examine the relationship between AIDS related death and child mortality, most of them focus on the impact of mother-to-child transmission. Many of these studies show positive correlation of child mortality with mother's HIV status or maternal death[5]. Amelia et al. [2003] shows that mortality of children under 5 years old is much higher for those who have HIV positive mothers than for those who have HIV

[4] This study uses the same dataset, but estimation methodologies, model specifications and sample including the models are different. We examine the differential impacts of orphanhood by the type of orphanhood on both school enrollment and grade progression with utilizing household fixed effects. Also, our models restrict the sample of children who enrolled in school at baseline period (See section 6 for details).

[5] At the aggregated level, Adetunji [2000] found under 5 mortality rate increases when the HIV prevalence of countries reaches 5 percent or above.

negative mothers in Malawi. Masmas et al. [2004] found that motherless children have a higher mortality than children whose mothers are alive and the negative impact is large for children under 2 years of age when their mother died. Naiyingi et al. [2003] and Ng'weshemi et al. [2003] also found similar results. In Kenya, Hill et al. [2000] found positive correlation between child mortality and HIV prevalence at the provincial level. Watts et al. [2005] examines the relation between orphan status and child mortality by the type of orphanhood in Zimbabwe. They found that orphans have higher probability of death than non-orphans in general, but maternal orphans face the highest probability among orphans.

Watt et al. [2005] also analyzes the correlation between child mobility and orphanhood. They conclude that paternal orphans and double orphans are more likely to leave their household than non-orphans, but not maternal orphans. Using data from South Africa, Ford and Hosegood [2004] investigates the impact of parental death on the mobility pattern of children. They divide the impact of parental death by the cause of death and found that parental death increased mobility of children in general, but parental death by AIDS has no significant effect. With respect to econometric analysis using panel data, Yamano and Jayne [2004] found that older girls are more likely to leave the household after the death of a male head and younger children tend to leave the household after the death of a female head in Kenya, though they did not examine the impact of parental death directly.

In sum, for both mortality and mobility of children, few existing studies take an econometric approach using a panel survey. Also, only a few study focuses on the differential impact by the type of orphanhood.

Orphanhood Trend in Malawi

Malawi has experienced a rapid spread of AIDS epidemic and a large increase in the number of orphans similar to other African countries. According to the Malawi National AIDS Commission, the prevalence of HIV/AIDS among adults aged 15 to 49 years is estimated to be about 14.4 percent in 2003. This is the eighth-highest infection rate in the world. However, the prevalence rates vary by regions. The HIV prevalence rate in the Southern region is almost twice as high as in the Central and North regions (National AIDS Commission [2003]).

Table 1 shows the trends in prevalence of orphans by regions in the sample of this study. Although orphans are generally defined as children younger than 18 years old who have lost one or both parents, we also show the prevalence rate of the children between the age of 6 to 16 years old since this study focuses on educational outcomes of orphans. Compared with the situation in 2000, the proportion of orphans among children increased rapidly in 2004. The proportions of school-aged children (6-16) who had lost at least one parent were very high: approximately 20 percent in 2000 and 30 percent in 2004. Likewise, the percentage of orphans aged 18 years or younger also rose by 70 percent from 15 percent in 2000 to 25 percent in 2004. Comparing the result to the Malawi Population and Housing Census in 1998, the number of orphans have increased dramatically during last 10 years: only 7.51 percent of children aged 14 years or younger were orphans irrespective of orphan types (maternal, paternal and double) in 1998 (Benson [2002]).

The regional variation in prevalence of orphans mirrors the infection rate of HIV. The Southern region, which has the highest infection rate of HIV, has the highest proportion of orphans. The percentage of orphaned school-age children was 22 percent in 2000 and 35 percent in 2004. Compared to the national average, the prevalence of orphans was about 5 percentage points higher in the Southern region in 2004 and the disparity seems to be widening. One can argue that the high incidence of orphans in the Southern region is mainly caused by AIDS-related death.

To better understand the differential impacts by parental deaths, orphan status is divided into four categories in this study: non-orphans, maternal orphans, paternal orphans, and double orphans. A non-orphan is a child whose parents are alive regardless of whether they live with parents. A maternal orphan is defined as a child who lost only the mother. Similarly, a paternal orphan is a child whose father has died. A double orphan is defined as a child who lost both of the parents.

Among orphans in our sample, the majority of them are paternal orphans and the share of maternal orphans is low. A higher prevalence of paternal orphans is consistent with observations from other countries (Ainsworth and Filmer [2002], Case and Ardington [2006], Case, Paxson and Ableidinger [2004], Ainsworth, Beegle and Koda [2005], Gillespie [2005]). A high incident of paternal orphan is a reflection of a trend where fathers tend to die first, followed by mothers' death. This pattern may be explained by the typical infection route of HIV at initial stage of AIDS epidemic; men (husbands) were infected with HIV from contacts

outside of the households, and then they transmit infections to women (wives) within the household with a lag.

However, the pattern of orphanhood has been changing. According to a new orphan estimate, maternal orphans now outnumber paternal orphans in heavily HIV affected countries in southern Africa (UNICEF [2004]). UNICEF claims that the trend of orphan type reflects the recent trend in HIV infection where women are more vulnerable to HIV infection than men[6]. If so, this suggests that possibly in future, a large number of children will face maternal death, reversing the past trend of larger share of paternal orphans.

An even more serious problem is the recent increase in the number of double orphans. In the context of AIDS orphans, children tend to lose both parents in succession. In other words, there is a high possibility that current single orphans will become double orphans in a short period of time. In fact, the percentage of school-aged children who lost both parents almost doubled from 5.6 percent in 2000 to 10.6 percent in 2004 in our sample.

Demographic changes and household composition

The HIV/AIDS pandemic drastically changes demographic structure of a country, as well as a household. A representative example includes the excess mortality of prime-age adult. High mortality of prime-age adult seems to bring changes in household structure. Table 2 shows how household composition has changed between 1997 and 2004 in the sampled households. As the proportion of prime-age adults (20-49) among household members decreases (0.37 in 1997 to 0.28 in 2004), the child dependency ratio, which is defined as the number of children aged 18 or younger divided the number of adults aged 19-59, increased. As a result, the burden on elderly has increased. The share of grandparent-headed household increased from 5.9 percent in 1997 to 10.4 percent in 2004. The proportion of female-headed households also increased. These results - elderly women tend to shoulder greater burden on childcare - are consistent with the description of socio-demographic impacts of HIV/AIDS from various HIV/AIDS reports (UNAIDS [2006]).

[6] It is recognized that women are biologically, socio-culturally, and economically more vulnerable to HIV infection then men (see Tlou [2002] for the discussion in gender and HIV/AIDS).

However, the proportion of households containing only children and elderly did not increase, still hovering around 5 percent. This may be because the pattern of household composition became more diverse than in the past. Average household size increased from 1997 to 2004 and the percentage of nuclear family gradually decreased (36.7 percent in 1997 to 24.5 percent in 2004). In contrast, the share of three-generation family and the extended family living together in a same household increased.

Education system and trend in child schooling

Malawi has an 8-4-4 education system consisting of primary school, secondary school, and tertiary education, including university, technical training and teacher training collages. Primary school is 8 years of compulsory education from Standard 1 to 8. In general, children start formal education at primary school at the age of six and they are expected to complete primary education when they are 13 years old. Secondary education is 4 years from Form 1 to Form 4[7]. The first two years are spent preparing for the Malawi Junior Certificate Examination (JCE) at Form 2. Malawi has an exam-driven education system. Students have to pass certificate exams to graduate and proceed to higher education. Students who pass JCE may continue with the remaining two years to be eligible to take the Malawi School Certificate of Education (MSCE) to graduate[8]. The statutory schooling ages of secondary education are between 14 to 17 years, though only few children continue their studies at secondary school.

The most drastic change in the education system in Malawi was the introduction of universal free primary education (UPE) in October 1994, which led to a large increase in the primary school enrollment; the number of children enrolled in primary schools jumped from 1.9 million in 1993/94 to 2.9 million the following year.

Figure 1 illustrates the enrollment rate and current grade by child age in 2000 and 2004. The enrollment rates by age are defined as the percentage of children who are reported as

[7] Broadly speaking, there are three types of secondary schools in Malawi. Secondary Schools are schools for selective education. These are located in the district capitals and students who received higher test scores are qualified to enroll free of charge. Community Day Secondary Schools located in the village are open to all school-aged children, but students need to pay school fees. Private secondary schools tend to be even more expensive than the government-run Community Day Secondary Schools.
[8] The pass rate of the certificate examination at MSCE is low; around 16% in 1999.

currently "in school", regardless of their grade[9]. The UPE policy was successful in increasing the enrollment. The average enrollment rate between aged 6 and 16 increased gradually between two periods: 81 percent in 2000 to 88 percent in 2004 at the national level[10]. For each age, the enrollment rate in 2004 was higher than that in 2000, and the difference in enrollment rates between 2000 and 2004 increased with child age, meaning that older children are more likely to enroll in school during the period.

While the government succeeded in providing access to primary education, it is doubtful that UPE contributed significantly to the improvement in educational achievement. As in other African countries which introduced UPE policy, a rapid increase of enrollment may lead to several problems regarding the quality of education, such as a high grade repetition rate, low completion rate, and learning outcome. Indicators on grade progression provide evidence to support insignificant impacts on learning. In contrast to the stable growth of school enrollment, the grade progression during 4 years between 2000 and 2004 was almost the same as that in 1997-2000 (3 years), which suggests that grade progression rate was decreasing. The average grade level for each age was virtually unchanged between 2000 and 2004. Students remained at lower grade even though they were adolescents. Not only their grade fell short of the statutory grade, but also most of them stayed in primary education. Therefore, achieving universal primary education in Malawi is still a long way from being realized.

Schooling outcomes by orphan status

Table 3 shows a simple comparison of enrollment rates and the average grade progression by orphan status of children. Non-orphans are more likely to achieve higher

[9] Therefore, this enrollment rate is different from both the Gross Enrollment Rate and the Net Enrollment Rate. While the Gross Enrollment rate can exceed 100 percent because it is defined as the number of all children enrolled in school (including older children) for every 100 school age children, the enrollment rate we defined here cannot exceed 100 percent. At the same time, it is different from the Net Enrollment Rate, which represents the proportion of school-aged children currently enrolled in school, because the enrollment rate in this study does not take into account the grade attended.

[10] UPE also contributed to reducing the regional disparity in school enrollment. In Malawi, the enrollment rates varied greatly among regions in the past. The enrollment performance was the highest in the Northern region; 93 percent in both 2000 and 2004. While the Southern region achieved the lowest schooling outcomes, enrollment rate grew 12 percent points from 75 percent in 2000 to 87 percent in 2004.

educational outcomes than any types of orphans. School enrollment rates of orphans are 10 percent lower than that of non-orphans. Also, non-orphans are more likely to advance to higher grades than orphans.

Among orphans, double orphans are at the most disadvantaged both in terms of school enrollment and their grade progression, followed by maternal orphans. This suggests that losing mothers has larger negative impacts on schooling outcomes of children than losing fathers.

The disparities between orphans and non-orphans are severer for adolescent children. While more than 60 percent of non-orphaned children aged between 12 and 18 enroll in school, only 36 percent of double orphans are in school. Adolescent double orphans also achieve the lowest grade progression.

However, the findings in Table 3 are not a causal relationship, but only a bivariate correlation. Thus, this may be a pseudo association driven by other community and household characteristics, such as household standards of living and regional differences in school infrastructure. In order to examine the impact of orphanhood on schooling outcomes, we will employ multivariate regressions, controlling for household and community characteristics in Section 6.

3. Data

This study uses household level panel data from the Malawi Complementary Panel Survey (CPS) [11]. This survey was a complementary survey of the Malawi 1997-98 Integrated Household Survey (IHS), which was a comprehensive socio-economic survey of the living standards of households in all districts of Malawi.

The CPS is a sub-sample survey of the IHS. The sample selection procedure for the CPS paralleled that used for the IHS. At first, four strata were established for the CPS – Southern region rural, Central region rural, Northern region rural, and Urban (the four urban centers). Then, 16 Traditional Authorities (TA) were selected in the rural areas (7 in Southern rural, 6 in Central rural, and 3 in Northern rural). As the second stage, five of the enumeration areas (EAs) in each of these TAs were randomly selected. As the third stage, eight or nine

[11] This section draws heavily on an attached document in the data set "Malawi Complementary Panel Survey (CPS) Sample Design and Survey Methodology: an Overview".

households were selected in each EA, plus five replacement households were included only if an originally selected household could not be located. In the Urban area, the second-stage sample selection procedure was employed. EAs were randomly selected in each urban stratum, and then five households, plus five replacement households, were selected in each EA. The number of households selected in each stratum was roughly proportional to the population size of the strata, with some over sampling in the urban area.

The CPS is five round panel surveys conducted between January 2000 and July 2004[12]. The first round of the CPS was implemented in January and February 2000. The round 2 was conducted in October to December 2000. The round 3 resurveyed in the post-harvest period of the same cropping season (July to August 2001). The fourth round is implemented in the next post-harvest season, which was a poor harvest season, August and September 2002. The last round (round 5) was conducted in July 2004.

This study uses two-period panel data from the round 1 (2000) and round 5 (2004) of the CPS[13]. The sample households of the CPS round 1 were 758. Among them, almost three quarters were re-interviewed at round 5 (565 households). This study uses 503 households which include children aged 16 or under at the baseline (2000) for the analyses of child mortality and mobility. For analyses regarding schooling outcomes, we use only 431 households with school-aged children (6-18) in 2000.

Since this study examines welfare outcomes of children and the data do not track individuals who leave the households, we pay close attention to individual sample attrition as well as household sample attrition. Around 25 percent of children aged 18 years old or less are not included in 2004. The attrition rate of orphans, especially for double orphans, is much higher than that of non-orphans (see Appendix table 2 for details). The attrition rates of maternal and paternal orphans are around 40 percent and 50 percent for double orphans. This is partially because orphan status is associated with age, and age is also correlated with attrition. For children ages 12 to 18 years old, the attrition rates of orphans are similar to that of non-orphans, especially for girls.

[12] See Appendix Table 1 for the timing, sample size, and data availability of each survey.

[13] Although technically we can combine the IHS and each round of the CPS and make a longitudinal dataset from 1997 to 2004, the sample size of the full panel household drops to 337 because of sample attrition. In particular, the attrition in the forth round was particularly large; almost 35 percent of households interviewed at round one have disappeared. In addition, unfortunately, we cannot retrieve any information about orphan status of the children from the IHS. Therefore, in this study, we construct two-period panel data combining sample households at round 1 with round 5 of the CPS.

4. Orphan status and children's mortality

The following sections examine the effects of orphanhood on children's mortality, mobility, and schooling outcomes with emphasis on differential impacts caused by the sex of deceased parent. First, we examine whether orphans face higher mortality risks than non-orphans. We estimate equations of the following form for the determinants of children's mortality using probit models and liner regressions with community and household fixed effects.

$$\Pr ob(D_{ijt} = 1) = \alpha + \sum_{0=1}^{3} \beta_o \mathrm{I}(orphan_{ijt-1} = o) + \gamma \mathrm{I}(sex_{ijt} = boy) + \sum_{a} \lambda_a \mathrm{I}(age_{ijt} = a) + \mathbf{Z}_{ijt-1}\delta + \mathbf{X}_{jt-1}\theta + \mu_j + \varepsilon_{ijt}$$

where D_{ijt} is an indicator of mortality of child i in household j at time between t_0 and t, sex_{ijt-1} is the sex of the child, age_{ijt} is the age of the child, $\boldsymbol{Z}_{ijt-1}$ is a vector of other child characteristics such as birth order, $\boldsymbol{X}_{jt-1}$ is a vector of household characteristics at the base line, such as a variable of household economic welfare and the age, sex and education level of household heads, η_j is household fixed effects, and ε_{ijt} is an error term. $orphan_{ijt-1}$ is dummy variables indicating the orphan status (paternal, maternal and double orphans) at the baseline.

Although there are several pathways through which orphan status influences investments in children's human capital, this study highlights following two aspects of the impacts arising from parental death. First, we test whether income/wealth level of household has any effect on the subsequent human capital development of orphans. There are several reasons that household income/wealth level greatly influences human development outcomes of orphaned children. Households with lower income tend to invest less in education and health of children because of credit constraints. Furthermore, it is possible that children living in poor households are more likely to become orphans. In this case, lower human capital of orphans may be caused by the initial income constraint prior to being orphaned. In order to examine differential impacts of parental death on children's welfare by household economic status, first, we estimate probit models and community fixed effects models, which control for household wealth level and other observable household characteristics at the baseline survey.

Second, we examine whether intrahousheold discrimination against and among orphans exists. Historically, the role of the extended family and kinship has been an important social safety net in Malawi. This continues today especially with the spread of HIV/AIDS and the

subsequent increase in the number of orphans. The role played by the extended family has increased. As the result, a household could be a host for a large number of orphans from multiple families.

Even after controlling for household wealth level and other observable characteristics at the baseline, it is highly possible that unobservable household fixed effects (μ_j) are correlated with explanatory variables, especially with children's orphan status. Thus, we need to employ an estimation strategy with household fixed effects so as to mitigate estimation bias[14]. In doing so, we estimate liner regressions with heteroskedasticity robust standard errors. By utilizing household fixed effect models, we can assess intrahousehold discrimination in human capital investment between fostered orphans and biological children living in the same household.

The dependent variable is a dummy variable that is 1 if a child died between 2000 and 2004. Each model includes three dummy variables for orphan status in 2000: dummy variables for maternal, paternal and double orphans, which are equal to 1 if children lost their mother, father, and both parents, respectively. By distinguishing the type of orphanhood, we can test the differential impacts of parental death on human capital investment by the gender of deceased parent. For instance, being a maternal orphan and being a paternal orphan may result in different welfare outcomes. Furthermore, we can compare impacts on single orphans with those of double orphans. To control for household living standards, we create a dummy variable for poor households, which is equal to 1 if a household is in the lowest income quintile. We controls for age, age squared and male dummy for household heads and demographic composition of household. In order to control for age specific trends and gender differences, all specifications include age fixed effects (dummy variables for each age in year) and a dummy variable for boy.

Regression results show that the probability of death for orphans is much higher than that for nonorphans (Table 4). Columns 1 to 5 show the results of probit models. Column 1

[14] However, the empirical framework adopted in this study may not perfect. If orphans are strategically placed in better-off households, then the orphans in a household fixed-effect framework are compared to a non-random sample of non-orphans (Beegle, Weerdt and Dercon [2005]). The topic to consider is household strategies of placing orphans. Recent studies suggest employing child fixed effects models rather than household fixed effects (Evans and Miguel [2005]). However, the data using this study do not arrow child fixed effects model. Although propensity score matching is one of major methods to control for endogeneity and sample selection bias, we do not use this method since our interest is the differential impacts of parental death on children's welfare by gender of deceased parent, and the method needs a large number of observations to find adequate matching. For example, Gertler, Levine and Ames [2004] use the propensity score matching method.

uses all sampled children aged 16 years old or younger. The coefficient estimates on maternal, paternal and double orphans are all statistically significant and positive. Moreover, the coefficients for maternal and double orphans are larger than those for paternal orphans.

However, the results in Column 1 include the effect of non-AIDS parental death, in particular a maternal death that is the result of a complication of the pregnancy and delivery. Therefore, in Column 2, we exclude children less than 3 years old since there is little possibility that a mother having infants or young children dies from AIDS. It is impossible for HIV infected women who develop AIDS symptoms to give birth at the advanced stage of AIDS. In general, the average time from infection with HIV to death from AIDS is 9 years although it varies from 2 years to 12 years. An HIV infected person spends most of his/her remaining life as an asymptomatic carrier. After developing AIDS, most of them die within a few years. For children who are infected at birth, the HIV incubation period is much shorter because of immature immune systems. Most of them die before their fifth birthday. This means that children who are infected by prenatal mother-to-child transmission tend to die before their mother's death. In other words, most of deceased young children are non-orphans, even though their mothers will be dying of AIDS after few years. Since the aim of this study is to investigate the impacts of parental death on children's welfare through changing household income and intrahousehold resource allocation by the death and disease of household members, children less than 3 years are excluded.

The results are similar to the results based on the sample including children ages 3 years old or less. The impact of parental death seems not to differ between AIDS orphans and non-AIDS orphans. However, the coefficient on maternal orphans is larger in Column 1 than in Column 2, indicating that infants are more likely to be affected by maternal death because of lack of breastfeeding opportunities. Column 3 limits the sampled children aged between 3 and 10. The coefficient estimates on maternal and double orphans are larger than those in Column 2, indicating that younger orphans are more likely to face higher mortality risks than older ones. The models in Columns 4 and 5 estimate the same specification, but by the sex of children. The impacts of orphanhood on child mortality depend on the sex of children. We find no significant impacts for girls. Household living standards seem to be an important factor of mortality risks. As is expected, children living in a poorer household have a higher possibility of mortality. The liner regression model with community fixed effects shows similar results except for insignificant impact of being a maternal orphan (Column 6). However, we find no significant

evidence that orphan status has a negative influence on children's mortality from household fixed effects regression (Column 7).

These results, especially from probit models, suggest that younger boys who lost their mothers are most likely to face higher probability of death. Why is the impact of orphanhood on mortality for boys larger than for girls? It may be caused by biological difference in physical ability. In general, boys, especially in early ages, have a higher possibility of death because of their biological disadvantage. Therefore, they are more vulnerable to risks and environmental changes such as parental deaths.

5. Mobility of children

The next question we explore is whether children's migration (moving from a household to the other) is affected by orphanhood. We test the effect of orphanhood on children's mobility with similar explanatory variables used in the mortality equations. As with mortality of the children, mobility issues are associated with sample attritions. Although a sample attrition problem is generally a considerable issue for panel analysis in developing countries, taking account for nonrandom sample attrition of children is more critical for this study because orphans may have higher mobility and mortality, and the CPS panel surveys don't track household members who moved out from the original household.

For example, children who lost their parents may move out to join other households, and even orphans may themselves be seriously ill and do not survive for long. In that case, the impact of orphans who remain in original households in 2004 on educational outcomes may be overestimated. In worse scenario, if the survival risks of orphans are significantly higher than those of nonorphans, some orphans may need to deal with survival before even thinking about obtaining education. The mobility equation is specified as follows:

$$\Pr ob(M_{ijt} = 1) = \alpha + \sum_{0=1}^{3} \beta_o \mathrm{I}(orphan_{ijt-1} = o) + \gamma \mathrm{I}(sex_{ijt} = boy) + \sum_{a} \lambda_a \mathrm{I}(age_{ijt} = a) + \mathbf{Z}_{ijt-1}\delta + \mathbf{X}_{jt-1}\theta + \mu_j + \varepsilon_{ijt}$$

where M_{ijt} is an indicator whether child i moves out from a original household j between t_0 and t, and other notations are the same as the ones used in mortality equation.

The specifications and estimation strategy are similar to that of mortality analysis. We use children aged less than 16 years old as the sample. The dependent variable is equal to 1 if children moved out from original households between 2000 and 2004. As with the specifications to children's mortality, explanatory variables are types of orphan status in 2000 and various characteristics of household and children. To examine whether mobility trend is differentiated by the age, sex, and the birth order of children, we create interactions between boy and children aged 12 to 16, dummy variable for first-born child, and its interaction with the sex of children. The effect of living arrangement is also examined. We add a dummy variable if children live in grandparent-headed households, a dummy variable if children live in households headed by other relatives and their interactions with orphan status.

Table 5 presents the regression results on child mobility. First, we examine the determinants of children's mobility as a function of various household and child characteristics with community fixed effects (Column 1). The result indicates no significant impacts of orphan status on children's mobility. Girls and children living at female-headed households are more likely to move out from original households. Household wealth level has insignificant effect on child mobility.

Columns 2 to 5 employ regressions with household fixed effects. The results are different from community fixed effects models. The basic model (Column 2) which includes dummy variables for orphan status, boy and the age of children shows that maternal and double orphans are more likely to move out from original households than nonorphans, while being a paternal orphan does not affect the mobility of children. Boys are less likely to move out than girls. In particular, boys aged 12 years old or above in 2000 are less likely to move out from original households than girls of about the same age (Column 3). Similarly, the oldest child of the original household is likely to leave home because adolescents are generally more likely to leave their home; however, the first-born son tends to remain in his original household (Column 4). These results show that the probability of migration for girls increases with age, while elder boys are less likely to move out from households living in 2000.

The last column includes the interactions of orphan status with living arrangement. Children living in grandparent-headed or relative-headed households tend to leave for other households than children whose parent is the household head. However, the coefficient estimate of maternal orphans living in grandparent-headed or relative-headed households is significantly negative. It means that maternal orphans living with their grandparent or relatives

are more likely to remain in the same household after their mothers' deaths than other maternal orphans. These results may suggest that, while some reports point out that orphans tend to change foster family often, being fostered by their grandparent or relatives may reduce the risk of repeated changes in foster households. This result can explain the role of matrilineal kinship in fostering orphans.

In summary, our results suggest the following. First, while both maternal and double orphans are more likely to migrate than nonorphans, the impact of being double orphans on mobility is larger than that of maternal orphans. Being a paternal orphan has no significant impact on mobility. Second, girls, especially older ones, tend to leave original households than boys at the same age.

6. Impacts of orphan status on schooling outcomes

Next, we examine the effect of orphanhood on schooling outcomes using similar specifications employed in the analyses of mortality and mobility.

$$y_{ijt} = \alpha + \sum_{0=1}^{3} \beta_o \mathrm{I}(orphan_{ijt-1} = o) + \gamma \mathrm{I}(sex_{ijt} = boy) + \sum_{a} \lambda_a \mathrm{I}(age_{ijt} = a) + \mathbf{Z}_{ijt-1}\delta + \mathbf{X}_{jt-1}\theta + \mu_j + \varepsilon_{ijt}$$

where y_{ijt} is schooling outcomes. Other notations are the same as the mortality and mobility equations. We use two indicators of schooling outcomes: school enrollment (E_{ijt}) and grade progression ($P_{ijt} - P_{ijt-1}$). E_{ijt} is an indicator if a child i in the household j is in school at time t. P_{ijt}, P_{ijt-1} are the grade level of children i in the household j at time t and $t-1$, respectively.

In addition to the impact of orphan status in the previous period, we examine the impact of changes in orphan status on schooling outcomes. That is, we estimate the following equation.

$$\Delta y_{ij} = \alpha' + \Delta Death_{ij}\beta + \Delta\varepsilon_{ijt}$$

$\Delta Death_{ij}$ captures changes in orphan status, that is, a recent parental death. It represents an indicator that is equal to 1 if a mother/father died between *t*-1 and *t*. We also control for orphan

status in 2000 ($Orphan_{ijt\text{-}1}$), sex and ages of the children. Δy_{ij} shows grade progression and dropping out school.

We use the sample of children aged 6-18 who enrolled in school at the base line (2000). By doing so, we can check whether children has dropped out from school during the survey period by looking at their enrollment status in 2004. We include children who were not in school in 2004. In grade progression regressions, the range of value is 0 to 4 since the time range of two surveys is 4 years. For example, if a child started the first grade in 2000 and he/she was in the fifth grade in 2004, it is an ideal case. In this case, E_{ijt} is equal to 1 and $P_{ijt} - P_{ijt-1}$ is equal to 4 (fifth grade – first grade). If the child stayed in school in 2004, but did not advance to next grades, E_{ijt} is equal to one but $P_{ijt} - P_{ijt-1}$ is zero. In a case where the child dropped out from school in the third grade in 2003, E_{ijt} is zero and $P_{ijt} - P_{ijt-1}$ is equal to 2.

6.1. School enrollment

Table 6 lists the estimation results of school enrollment regressions. In all specifications, the sample is limited to children aged 6 to 18 who were in school in 2000. We also include a complete set of age indicators and a dummy variable for sex. The results from community fixed effect regressions show that being paternal and double orphans has a significant and negative effect on school enrollment (Columns 1 and 2). There is no significant gender discrimination at least in school enrollment. As expected, household standard of living and education of household heads are important determinants of children's enrollment. Children living in poor households are less likely to enroll in school probably because of a credit constraint. Also, households whose head has no education tend to provide fewer investments in children's education. In Column 2, we add the interactions between orphan status and the dummy variable if a household is in the lowest income quintile. The result suggests that the impact of orphanhood on school enrollment does not differ by household income levels.

In Columns 3 through 8, we employ household fixed effects regressions. The basic model (Column 3) shows that the impacts of being maternal and double orphans are significant and negative. The coefficient on paternal orphan becomes insignificant, but the sign is negative.

The impact of orphanhood on school enrollment is different by the age of children. To capture it, we include the interactions between orphan status and a dummy variable for children aged 12 years or above in the baseline (2000). In the context of Malawi's education, focusing on children aged 12 or above in 2000 is important, not only because adolescents tend to quit school due to direct and indirect costs, but also because they faced drastic change in education system. This generation, children born before 1988, reached a schooling-age before the introduction of free primary education system in 1994, therefore, there is a possibility that schooling decision may be different for children born after 1988. The coefficients on the interactions of maternal and double orphans with the dummy variable for ages 12 or above are significant and negative, and the coefficients on maternal and double orphans become insignificant. These results show that maternal and double orphans aged 12 years or above are less likely to enroll in schools.

The impact of orphanhood on school enrollment seems to differ by the sex of the children (Columns 5 and 6 for boys, 7 and 8 for girls). For boys, being maternal and double orphans have a negative impact on enrollment; however, there is no evidence that girls' school enrollment is affected by orphan status. In particular, the negative impacts of being maternal and double orphans are large for adolescent boys.

6.2. Grade progression

Table 7 presents the effect of orphan status on grade progression. The dependent variable is defined as the difference between current grade (or highest grade completed) in 2004 and the grade completed by 2000. The regressions use the same specifications as the school enrollment regressions.

The results are similar to those for school enrollment. We do not find any significant gender difference in grade progression. Educational level of household heads is positively correlated with grade progression of children.

Both community fixed effect models and household fixed effects models show that being a double orphan has a significant and negative impact on grade progression (Columns 1 to 4). Household living standards, sex and age of household heads are not significant determinants of grade progression. The impact of being maternal orphans on grade progression is

significantly different by the household income levels. Maternal orphans living in poor households are less likely to complete the current grade and proceed to the next.

Among double orphans, the impact seems to be different by sex of the children, though neither coefficients on orphan status for boys nor those for girls are statistically significant (Columns 5, 6). Double-orphaned boys are less likely to progress through school grades at the same speed as other children. While the magnitude of negative impact is similar by the age of children for double orphans, the age exerts large influences the magnitude of impact for maternal orphans (column 4). Maternal orphans aged 12 or older are less likely to advance to upper grades.

Overall, the results on grade progression are similar to those on school enrollment. The negative impact of being double orphans is large and robust. Without respect to the age of children, double orphans are more likely to have lower grade progression. However, in contrast to the negative effect of maternal orphans on school enrollment, the impact of being maternal orphans is insignificant for young children.

6.3. Impacts of parental death between 2000 and 2004 on schooling

Sub-sections 6.1 and 6.2 examined the impacts of orphan status in 2000 on schooling outcomes. The empirical results show that orphans, especially double orphans, face significant disadvantages with regard to human capital investment. In addition to the impact of orphan status at a baseline, we investigate the impact of recent parental death on children's schooling outcomes and results are shown in Table 8.

Based on the basic regressions in 6.1 and 6.2, we add the dummy variables for shocks of mother's/father's death, which are equal to 1 if a mother/father died between 2000 and 2004. All specifications include controls for age and sex of children and household fixed effects. Columns 1 to 4 shows the results of the impact on the probability of dropping out from school and the impact on grade progression are listed in Columns 5 to 8. Models in columns 1 and 5 include the dummy variables for orphan status in 2000. Other specifications (columns 2, 3, 4, 6, 7, 8) limit the sample children to children whose both parents were alive in 2000 (children who were non-orphans in 2000).

The results show a significant and negative impact of mother's death occurring between 2000 and 2004, both on the probability of dropping out from school and on grade progression between 2000 and 2004. In contrast, paternal death seems not to have any significant impacts. These results are fairly robust in all specifications.

In terms of school enrollment, both initial orphan status and recent parental death influence the decision whether children continue their education (column 1). Maternal and double orphans are less likely to stay in school. In addition, mother's death between 2000 and 2004 has a negative impact on school enrollment, in contrast to insignificant effect of father's death. In Column 2, we exclude children who were orphans in 2000 from the sample. The result based on restricted sample is similar to those in Column 1. There is a significant and negative impact of mother's death on enrollment. Also, the impact of parental death is different by the age of children. On the one hand, for children aged 6 to 11, parental death between 2000 and 2004 has no influence on school enrollment in 2004 (Column 3). On the other hand, school enrollment of children aged 12 to 18 is significantly affected by mother's death (Column 4).

The result of grade progression is similar to the result of school enrollment. Not only being a double orphan in 2000, but also recent mother's death reduces children's grade progression (Column 5). For children whose parents were alive in 2000, mother's death has a significant and negative impact on grade progression, but not father's death. With respect to differential impact of parental death by the age of children, the result of grade progression is totally opposite to that of school enrollment. Younger children face significant negative impact on grade progression, while grade progression of adolescents is not influenced by parental death. This may be because young children are more likely to continue their school because of universal free primary education policy, even when they lose their parent. In terms of grade progression, young children are more likely to face a negative impact from mother's death because older children with poorer achievement tend to drop out from school when they face parental death shock. Since high-achieving students are likely to remain in school even after their parental death, the average grade progress may increase.

7. Assessing the Attrition Bias

The results from the mortality and mobility equations suggest the possibility that the panel data have serious non-random attrition. Orphan status significantly correlates with mortality and mobility decisions of children (Sections 4 and 5). Because it is possible that the orphan status of children at the baseline (2000) contributes to sample attrition, there is a possibility that such sample attrition leads to selection biases. For example, if orphans tend to move out from original households or orphans face a higher probability of death, it may be possible that being an orphan has much more negative impacts on schooling outcomes than regression results showed in Section 6. Therefore, this section investigates the attrition bias and compares coefficient estimates between attrition corrected and uncorrected estimates[15].

To correct for attrition bias, we employ the inverse of probability weighting method (Wooldridge [2002]). First, we estimate the probability of being a stayer (non-attrition) using observable information. The dependent variable is one if a child remains in the original household (a child was in the household in 2000 and re-interviewed in 2004), and zero otherwise. We use initial orphan status, sex and age of children and various household characteristics, such as sex, age, education level of household heads, household living standards, demographic structure of a household, birth place of household head, a dummy variable for rural areas and regional dummy variables as explanatory variables. In addition, we include dummy variables for enumerators to control for the survey quality. Since we know enumerators' ID in round 2, we limit the sample to children who were in re-interviewed in round 2. Applying the probit estimation, we obtain predicted probability. Then, we re-estimate school enrollment and grade progression equations using the inverse probability weight as a weight.

Table 8 summarizes coefficient estimates on orphan status and parental death. The coefficients in Columns 1, 3, 5, 7, 9, 11 show uncorrected estimators. These regressions are the same specifications of the basic models with household fixed effects, but the results are not same because the number of observations is different. The regressions in Table 8 exclude children who were not re-interviewed in round 2 from the sample so as to compare attrition corrected estimators using enumerator dummy variables. Columns 2, 4, 6, 8, 10, 12 show attrition corrected estimators. The results clearly show that the magnitude and significance of

[15] By using household fixed effect models, we can avoid household level non-random attrition bias. This is one of advantages using panel data. Therefore, this study focuses on only individual level sample attrition bias.

coefficient estimates are almost same between attrition corrected and uncorrected estimators. That is, there is no significant estimation bias by sample attrition.

8. Conclusion

This study examined the impacts of orphanhood on mortality, migration and schooling outcomes of the children. As a whole, orphans tend to be more disadvantaged for schooling than non-orphans. First, we found that maternal and double orphans are more likely to face higher survival risks and they tend to move out from original households. This means that maternal death and paternal death have different implications for subsequence living arrangements and fostering patterns. Likewise, we found maternal and double orphans are more likely to have lower schooling outcomes than any other children. In contrast, being paternal orphans has no significant and negative impacts on schooling outcomes. This finding is consistent with other studies based on household panel data (Evans and Miguel [2005] for Kenya, Case and Ardington [2006] for South Africa, Beegle, De Weerdt and Deacon [2005] for Tanzania). This result suggests that investments in human capital are more affected by maternal death. Being a paternal orphan seems not to have significant impacts on human capital investments and mobility decision.

However, the magnitude of impacts of maternal and double orphanhood on schooling outcomes differs by characteristics of the children. First, older children losing their mothers are more likely to face negative impacts on school enrollment. This result suggests that school enrollment decision of younger children is less likely to be affected by orphan status because of the introduction of universal primary education policy in 1994[16].

We did not find any significant evidence of gender discrimination in schooling outcomes. However, the impacts of orphanhood and parental death on school outcomes are different by sex of the children. In contrast to reports made by international organizations which suggests that female orphans are discriminated against, our result shows that male

[16] Deininger, Garcia and Subbarao [2003] and Yamano, Shimamura and Sserunkuuma [2006] also suggest the possibility that orphans' school enrollment is improved by UPE in Uganda.

orphans are more likely to have lower schooling outcomes than non-orphans, but girls' schooling outcomes are not affected by orphan status.

Moreover, we found that large disparities in human capital investment exist between children who have lost both parents and children who have at least one living parent. On the one hand, double orphans are the most likely to face higher mortality risks and lower educational outcomes than any other children. On the other hand, for children losing one parent, the impacts of parental death on children's human capital investments are much less than has been suggested. The result is reasonable because, among foster children, orphans whose one biological parent is still alive may achieve better educational outcomes than those who both parents are died. From the economic aspect, foster households may receive financial supports from their biological parent. Moreover, it is reasonable to consider that biological parents have more incentive to monitor and encourage their children to stay in school and to study hard.

In sum, while maternal and double orphans, especially older children, are more likely to face adverse conditions, discrimination against orphans within a household is not severer than reported by NGOs and international organizations. This suggests that traditional fostering systems and universal free education system are functioning well in Malawi. Nevertheless, a rapid increase in the number of orphan is straining the current social safety net and the burden will only increase in future with the expected increase in double orphans, with grave consequences for their future welfare.

In order to improve the human capital investment, it is critical to control the spread of HIV/AIDS to stem the future flow of orphans, especially double orphans. Furthermore, more attention needs to be paid to improving the quality of education in Malawi. With the introduction of free primary education, the government of Malawi has succeeded in offering educational opportunities for disadvantaged children. However, the results show that the grade progress is still a significant problem. The government was able to overcome the tackle first hurdle. Now, it needs to seriously tackle the quality issues in the primary education.

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Table 1 Incidence of orphans in 2000 and 2004, by region

	Non orphans		Maternal orphans		Paternal orphans		Double orphans	
	2000	2004	2000	2004	2000	2004	2000	2004
Children under 18 years								
Southern	81.9	69.5	3.7	4.7	10.0	15.0	4.4	10.7
Central	87.9	79.8	1.7	2.2	7.2	11.4	3.2	6.6
Northern	83.3	77.2	2.4	4.3	8.6	9.6	5.7	8.9
All Malawi	84.6	75.0	2.7	3.6	8.7	12.7	4.1	8.7
School-age children (ages 6-16)								
Southern	77.9	64.4	4.8	5.4	11.2	17.7	6.1	12.5
Central	84.7	76.3	2.0	2.4	8.7	12.9	4.6	8.5
Northern	78.4	74.5	3.4	3.3	11.4	10.9	6.8	11.4
All Malawi	80.8	71.0	3.5	3.8	10.2	14.6	5.6	10.6

(Source) Own computation from the CPI in 2000 and 2004 (round 1 and 5)

Table 2 Trends in household composition

(percentage)

	1997	2000	2004
Household size	4.90	4.96	5.55
Number of children (aged 18 or younger)	2.72	2.78	3.08
The childhood dependency ratio[#]	1.51	1.58	1.75
Proportion of prime age adults (20-49)	0.37	0.33	0.28
Proportion of household (%)			
with children but no prime age adult (20-49)	10.8%	12.8%	12.7%
with only children and elderly (60 or over)	4.6%	6.0%	5.4%
Male-headed household	75.8%	76.3%	71.7%
Household patterns			
Nuclear family (head, spouse and child)	36.7%	44.1%	24.5%
Single parent household (head and child)	10.8%	10.8%	11.8%
Three generation family	16.9%	20.6%	24.3%
Grandparent(s)-Grandchild (no child)	5.9%	8.9%	10.4%

(Source)

Own computation from the HIS 1997, CPI in 2000 and 2004 (round 1 and 5)

(Note)

Defined as the number of children aged 18 or younger divided the number of adults aged 19-59

Figure 1 Enrollment rate and current grade by child age in 2000 and 2004

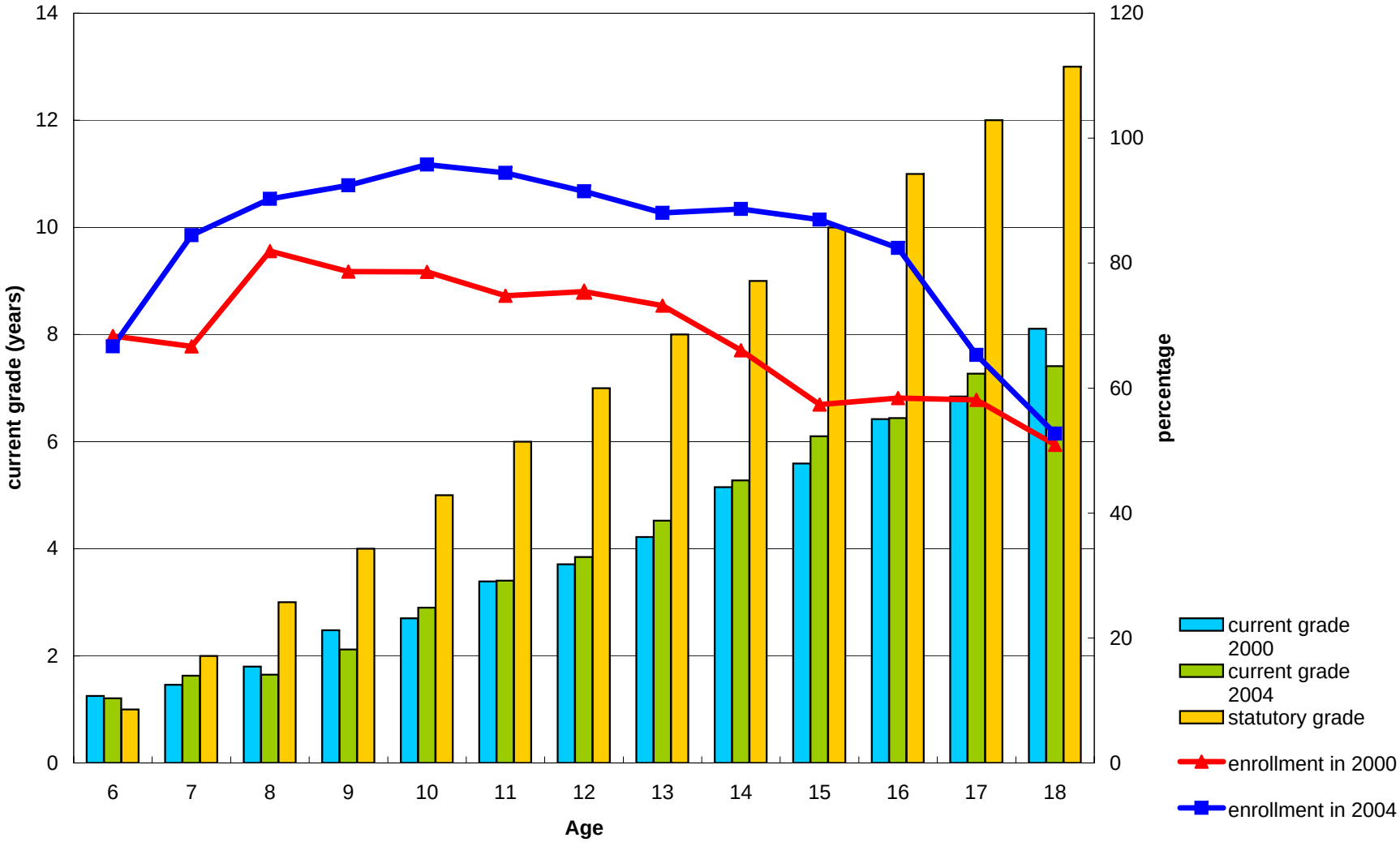

Table 3 Schooling outcomes by orphan status

	Enrollment rates in 2004 (%)		Grade progress, 2000 to 2004	
	Age 6 to 18	Age 12 to 18	Age 6 to 18	Age 12 to 18
Non-orphan	80.82	61.71	2.40	2.64
Maternal orphan	67.86	50.00	2.18	2.38
Paternal orphan	70.15	54.17	2.28	2.08
Double orphan	68.42	36.84	2.18	2.05

(Source) Own computation from the CPI in 2000 and 2004 (round 1 and 5)

Table 4 Impact of orphan status in 2000 on child mortality between 2000 and 2004 (age 3-16)

	Probit					Liner	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Age 0-16	Age 3-16	Age3-10	Age 3-16		Community	Household
	All	All	All	Boy	Girl	FE	FE
Orphan status in 2000							
Maternal orphan	0.82	0.84	1.21	1.04	0.69	0.06	0.06
	(2.15)**	(2.16)**	(2.61)***	(2.02)**	(1.24)	(1.41)	(1.14)
Paternal orphan	0.56	0.63	0.64	0.89	0.17	0.04	-0.01
	(2.24)**	(2.18)**	(1.86)*	(2.78)***	(0.33)	(1.75)*	(0.36)
Double orphan	0.95	1.09	1.28	1.33	0.82	0.07	0.08
	(2.75)***	(3.10)***	(2.92)***	(3.05)***	(1.11)	(1.79)*	(1.00)
Sex (boy=1)	0.25	0.15	0.17			0.01	0.02
	(1.50)	(0.74)	(0.75)			(0.65)	(1.63)
Poor	0.38	0.55	0.34	0.75	0.41	0.04	
	(2.18)**	(2.67)***	(1.32)	(2.70)***	(1.30)	(2.03)**	
Sex of head (Male=1)	0.29	0.34	0.21	0.45	0.38	0.01	
	(1.43)	(1.37)	(0.76)	(1.86)*	(0.92)	(1.09)	
Age of head	0.03	0.03	0.02	-0.04	0.33	0.00	
	(1.09)	(0.81)	(0.47)	(0.80)	(2.44)**	(0.97)	
Age of head (square)	-0.0003	-0.0002	-0.0002	0.0004	-0.0034	0.0000	
	(0.85)	(0.61)	(0.38)	(0.91)	(2.27)**	(0.68)	
Constant	-2.45	-3.94	-3.23	-1.93	-8.46	-0.07	-0.03
	(3.31)***	(3.90)***	(3.19)***	(1.68)*	(2.84)***	(1.12)	(1.01)
Observations	1192	966	745	490	286	1207	1237
Number of ea						48	
Number of rnd1qno							478
R-squared						0.04	0.04

For Probit models, robust z statistics in parentheses. For liner regressions, robust t statistics in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Unreported controlls include child ages (in year) and household composition (number of boys under 18, girls under 18, female adults 19-59, male and female elderly over 60).

Table 5 Determinants of moving-out from original households (Children aged 16 or younger)

	(1)	(2)	(3)	(4)	(5)
	Community FE	Household FE			
Maternal orphan	-0.03	0.15	0.15	0.15	0.49
	(0.42)	(2.12)**	(2.15)**	(2.18)**	(3.65)***
Paternal orphan	0.06	0.04	0.03	0.03	0.11
	(1.16)	(0.38)	(0.32)	(0.36)	(0.93)
Double orphan	0.09	0.25	0.25	0.25	0.23
	(1.13)	(2.49)**	(2.47)**	(2.49)**	(1.13)
Sex (boy=1)	-0.04	-0.04	0.00	0.00	-0.04
	(1.99)**	(1.86)*	(0.12)	(0.05)	(2.01)**
Boy*Age>=12			-0.14		
			(2.52)**		
First-born child				0.13	
				(3.10)***	
First-born child*Boy				-0.17	
				(3.21)***	
Live in grandparents' household					0.19
					(2.81)***
Maternal*Grandchild					-0.57
					(3.29)***
Paternal*Grandchild					-0.25
					(1.25)
Double*Grandchild					-0.11
					(0.43)
Live in relatives' household					0.39
					(3.50)***
Maternal*Relatives					-0.65
					(3.06)***
Paternal*Relatives					-0.20
					(0.74)
Doubld*Relatives					-0.25
					(0.88)
Poor	0.01				
	(0.25)				
Sex of head (Male=1)	-0.06				
	(1.97)**				
Head never attended school	-0.04				
	(1.29)				
Age of head	0.00				
	(0.14)				
Age of head (square)	0.00				
	(0.52)				
Constant	0.11	0.23	0.21	0.22	0.19
	(0.96)	(4.34)***	(3.83)***	(4.01)***	(3.73)***
Observations	1433	1471	1471	1471	1471
Number of ea	49				
Number of rnd1qno		508	508	508	508
R-squared	0.15	0.18	0.19	0.19	0.21

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Unreported controlls include child ages (in year) and household composition (number of boys under 18, girls under 18, female adults 19-59, male and female elderly over 60).

Table 6 Impacts of orphanhood on school enrollment (children age6-18 who enrolled in 2000)

	Community FE		Household FE					
	All		All		Boy		Girl	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Maternal orphan	-0.116	-0.137	-0.215	-0.006	-0.389	0.068	-0.079	-0.084
	(1.21)	(1.29)	(1.84)*	(0.05)	(1.83)*	(0.72)	(0.28)	(0.33)
Paternal orphan	-0.133	-0.142	-0.061	-0.053	-0.421	-0.338	0.063	-0.053
	(1.97)**	(2.12)**	(0.40)	(0.31)	(1.00)	(0.72)	(0.33)	(0.36)
Double orphan	-0.227	-0.267	-0.356	-0.133	-0.736	-0.379	-0.39	-0.188
	(2.58)**	(2.60)***	(2.30)**	(1.04)	(2.97)***	(1.93)*	(1.60)	(1.01)
Sex (boy=1)	0.011	0.014	0.015	0.012				
	(0.32)	(0.40)	(0.34)	(0.28)				
Maternal*Poor		0.105						
		(0.43)						
Paternal*Poor		0.093						
		(0.35)						
Double*Poor		0.189						
		(1.04)						
Maternal orphan*age>12				-0.459		-0.791		-0.231
				(2.33)**		(3.60)***		(0.47)
Paternal orphan*age>12				-0.042		-0.21		0.254
				(0.26)		(0.75)		(1.10)
Double orphan*age>12				-0.557		-0.591		-0.449
				(3.70)***		(3.19)***		(1.47)
Poor	-0.089	-0.116						
	(1.81)*	(2.23)**						
Sex of head (Male=1)	-0.028	-0.027						
	(0.62)	(0.60)						
Head never attended schoo	-0.094	-0.093						
	(2.13)**	(2.11)**						
Age of head	-0.014	-0.014						
	(2.04)**	(2.02)**						
Age of head (square)	0.00	0.00						
	(2.46)**	(2.40)**						
Constant	1.239	1.246	0.965	0.96	1.011	0.989	1.026	1.037
	(7.84)***	(7.72)***	(17.40)***	(18.04)***	(11.15)***	(11.10)***	(10.24)***	(10.51)***
Observations	667	667	683	683	379	379	304	304
Number of enumeration ar	46	46						
Number of household			346	346	249	249	208	208
R-squared	0.26	0.26	0.34	0.38	0.5	0.55	0.37	0.4

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Unreported controlls include child ages (in year) and household composition (number of boys under 18, girls under 18, female adults 19-59, male and female elderly over 60).

Table 7 Impacts of orphanhood on grade progression

	Community FE		Household FE			
	All		All		Boy	Girl
	(1)	(2)	(3)	(4)	(5)	(6)
Maternal orphan	-0.132	0.044	0.085	0.818	0.034	0.128
	(0.46)	(0.14)	(0.21)	(1.62)	(0.03)	(0.14)
Paternal orphan	-0.061	-0.175	-0.006	0.211	-0.233	0.504
	(0.30)	(0.83)	(0.02)	(0.51)	(0.31)	(0.75)
Double orphan	-0.676	-0.727	-1.451	-1.384	-2.213	-0.93
	(2.11)**	(1.96)*	(2.37)**	(1.96)*	(1.50)	(0.97)
Sex (boy=1)	-0.056	-0.067	-0.017	-0.025		
	(0.45)	(0.54)	(0.10)	(0.14)		
Maternal*Poor		-0.969				
		(1.97)**				
Paternal*Poor		0.879				
		(1.42)				
Double*Poor		0.188				
		(0.31)				
Maternal orphan*age>12				-1.415		
				(2.02)**		
Paternal orphan*age>12				-0.535		
				(1.24)		
Double orphan*age>12				-0.172		
				(0.27)		
Poor	0.139	0.096				
	(0.75)	(0.46)				
Sex of head (Male=1)	-0.128	-0.146				
	(0.84)	(0.95)				
Head never attended school	-0.314	-0.297				
	(1.99)**	(1.87)*				
Age of head	-0.008	-0.008				
	(0.28)	(0.27)				
Age of head (square)	0.00	0.00				
	(0.42)	(0.41)				
Constant	2.094	2.084	2.053	2.047	1.817	2.475
	(3.16)***	(3.17)***	(9.28)***	(9.22)***	(3.87)***	(6.81)***
Observations	664	664	680	680	377	303
Number of enumeration area	46	46				
Number of household			346	346	248	208
R-squared	0.06	0.07	0.1	0.11	0.22	0.27

Robust t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Unreported controlls include child ages (in year) and household composition (number of boys under 18, girls under 18, female adults 19-59, male and female elderly over 60).

Table 8 Impacts of parental death shock (between 2000 and 2004) on school outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	School Enrollment				Grade progression			
	age 6-18		age 6-11	age 12-18	age 6-18		age 6-11	age 12-18
Orphan status in 2000								
Maternal orphan	-0.248				-0.577			
	(1.84)*				(1.13)			
Paternal orphan	0.007				0.655			
	(0.05)				(1.42)			
Double orphan	-0.463				-1.466			
	(2.84)***				(2.26)**			
Parental death shock								
Mother's death (2000-2004)	-0.334	-0.378	-0.218	-0.625	-0.996	-1.28	-2.138	0.282
	(2.51)**	(2.02)**	-0.69	(2.54)**	(2.09)**	(1.92)*	(2.48)**	-0.32
Father's death (2000-2004)	-0.002	-0.044	0.123	0.023	0.958	1.145	0.3	-0.411
	(0.02)	(0.39)	-0.81	-0.09	(1.85)*	(1.38)	-0.23	-0.34
Sex (boy=1)	0.014	-0.005	0.048	-0.006	-0.014	-0.11	-0.172	0.177
	(0.32)	(0.10)	-0.76	-0.07	(0.08)	(0.56)	-0.63	-0.58
Constant	0.981	0.985	0.973	0.922	1.91	1.902	1.967	2.2
	(16.51)***	(17.14)***	(13.84)***	(7.72)***	(7.90)***	(6.67)***	(6.33)***	(3.98)***
Observations	683	572	255	317	680	569	255	314
Number of HH	346	304	163	190	346	304	163	189
R-squared	0.36	0.31	0.2	0.32	0.13	0.1	0.21	0.13

Robust t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions controll child ages (in year).

The sample children of the reggressions in colunms (2)-(4) and (6)-(8) are limited to children whose parents were alive in 2000.

Table 9 Attrition corrected coefficient estimates

	School Enrollment					
	Attrition uncorrected	Attrition corrected	Attrition uncorrected	Attrition corrected	Attrition uncorrected	Attrition corrected
	(1)	(2)	(3)	(4)	(5)	(6)
Maternal orphan	-0.177	-0.195	0	0.004		
	(1.47)	(1.57)	0.00	(0.03)		
Paternal orphan	-0.028	-0.009	-0.013	0.032		
	(0.18)	(0.06)	(0.07)	(0.17)		
Double orphan	-0.35	-0.368	-0.131	-0.152		
	(2.25)**	(2.54)**	(1.02)	(1.25)		
Mother's death (2000-2004)					-0.372	-0.36
					(1.98)**	(2.03)**
Father's death (2000-2004)					-0.051	-0.07
					(0.45)	(0.54)
Maternal orphan*age>12			-0.423	-0.437		
			(2.11)**	(2.08)**		
Paternal orphan*age>12			-0.065	-0.091		
			(0.39)	(0.51)		
Double orphan*age>12			-0.558	-0.529		
			(3.69)***	(3.18)***		
Observations	662	662	662	662	554	554

	Grade Progression					
	Attrition uncorrected	Attrition corrected	Attrition uncorrected	Attrition corrected	Attrition uncorrected	Attrition corrected
	(7)	(8)	(9)	(10)	(11)	(12)
Maternal orphan	0.19	0.126	0.839	0.872		
	(0.47)	(0.31)	(1.72)*	(1.77)*		
Paternal orphan	-0.041	-0.168	0.192	0.076		
	(0.11)	(0.45)	(0.47)	(0.18)		
Double orphan	-1.469	-1.429	-1.406	-1.317		
	(2.43)**	(2.45)**	(2.01)**	(1.97)**		
Mother's death (2000-2004)					-1.291	-1.214
					(1.93)*	(1.70)*
Father's death (2000-2004)					1.147	1.291
					(1.39)	(1.46)
Maternal orphan*age>12			-1.327	-1.417		
			(1.88)*	(2.04)**		
Paternal orphan*age>12			-0.536	-0.479		
			(1.24)	(1.10)		
Double orphan*age>12			-0.167	-0.248		
			(0.27)	(0.40)		
Observations	659	659	659	659	551	551

Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%
Unreported controlls include dummy variables for child ages (in years) and sex of the children. The models also include regression constants.
Coefficient estimates for attrition uncorrected regressions in this table are different from those in tables 6, 7 and 8 since the sample children are different.

Appendix Table 1

	Timing of survey	Sample size (households)	Data availability	
			Education of members	Orphan status
IHS	Nov.1997-Oct. 98	12960	Yes	No
CPS round1	Jan.-Feb. 2000	758	Yes	Yes
CPS round2	Oct.-Dec. 2000	667	Yes(new member only)	No
CPS round3	July-Aug. 2001	631	Yes	Yes
CPS round4	Aug.-Sep. 2002	499	No	Yes
CPS round5	July 2004	565	Yes	Yes

(Source) IHS and CPS

Appendix Table 2 Individual sample attrition

Children age 18 years old or younger

Oephan status in 2000	# of children in 2000	stayers in 2004	attritors in 2004	Attrition rates
Non-orphan	1403	1082	321	22.9%
Maternal-orphan	47	28	19	40.4%
Paternal orphan	122	74	48	39.3%
Double orphan	51	26	25	49.0%

Male

Oephan status in 2000	# of children in 2000	stayers in 2004	attritors in 2004	Attrition rates
Non-orphan	729	584	145	19.9%
Maternal-orphan	23	12	11	47.8%
Paternal orphan	62	39	23	37.1%
Double orphan	27	10	17	63.0%

Female

Oephan status in 2000	# of children in 2000	stayers in 2004	attritors in 2004	Attrition rates
Non-orphan	674	498	176	26.1%
Maternal-orphan	24	16	8	33.3%
Paternal orphan	60	35	25	41.7%
Double orphan	24	12	12	50.0%

Ages 12 -18

Oephan status in 2000	# of children in 2000	stayers in 2004	attritors in 2004	Attrition rates
Non-orphan	440	258	182	41.4%
Maternal-orphan	28	14	14	50.0%
Paternal orphan	55	25	30	54.5%
Double orphan	31	15	16	51.6%

Male(12-18)

Oephan status in 2000	# of children in 2000	stayers in 2004	attritors in 2004	Attrition rates
Non-orphan	231	159	72	31.2%
Maternal-orphan	14	7	7	50.0%
Paternal orphan	28	14	14	50.0%
Double orphan	15	8	7	46.7%

Female(12-18)

Oephan status in 2000	# of children in 2000	stayers in 2004	attritors in 2004	Attrition rates
Non-orphan	209	99	110	52.6%
Maternal-orphan	14	7	7	50.0%
Paternal orphan	27	11	16	59.3%
Double orphan	16	7	9	56.3%

(Source) CPS round 1 and 5
(Notes) Number of observations.