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Anne Case
Christina Paxson
Joseph Ableidinger

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ABSTRACT

We examine the impact of orphanage on the living arrangements and school enrollment of children in Sub-Saharan Africa, using data from 19 Demographic and Health Surveys (DHS) conducted in 10 countries between 1992 and 2000. We find that orphans in Africa on average live in poorer households than non-orphans, and are significantly less likely than non-orphans to be enrolled in school. However, orphans' lower school enrollment is not explained by their poverty: orphans are equally less likely to be enrolled in school relative both to non-orphans as a group and to the non-orphans with whom they live. Consistent with the predictions of *Hamilton's Rule*, we find that outcomes for orphans depend largely on the degree of relatedness of the orphan to the household head. Children living in households headed by non-parental relatives fare systematically worse than those living with parental heads, and those living in households headed by nonrelatives fare worse still. Much of the gap between the schooling of orphans and non-orphans is explained by the greater tendency of orphans to live with more distant relatives or unrelated caregivers.

Anne Case
345 Wallace Hall
Princeton University
Princeton NJ 08544
(609) 258-2177
and NBER
accase@princeton.edu

Christina Paxson
316 Wallace Hall
Princeton University
Princeton NJ 08544
(609) 258-6474
and NBER
cpaxson@princeton.edu

Joseph Ableidinger
Center for Health and Wellbeing
Wallace Hall
Princeton University
Princeton NJ 08544

1. Introduction

More than 15 percent of adults in Sub-Saharan Africa are infected with HIV, and prevalence rates are as high as 25 percent in many Southern African countries (UNAIDS/WHO 2000). Death of prime aged adults has led to pronounced concentrations of orphans in Uganda, Malawi, Mozambique, Zambia and Zimbabwe, where nearly 15 percent of all children under the age of 15 have lost one or both parents. In this paper, we examine the impact of orphanage on the living arrangements and school enrollment of children in Sub-Saharan Africa, using data from 19 Demographic and Health Surveys (DHS) conducted in 10 countries between 1992 and 2000.

Some researchers argue that orphans are not at any particular disadvantage over equally poor non-orphans (Foster and Shakespeare 1995). In many countries in sub-Saharan Africa, kinship fostering of orphans and non-orphans is common, and is often seen as a way of reallocating resources based on need, ability, and prospective benefit (Isiugo-Abanihe 1985). Kamali et al (1996) argue that orphans in South-West Uganda are "generally well looked after" within the community and by extended family (page 509). Lundberg and Over (2000) point to the role played by the network of family and friends, suggesting that wealth within such networks is used as a form of insurance in times of crisis. Lloyd and Blanc (1996) argue that schooling investments in all children depend primarily on the collective pool of kin-resources and individual children's academic promise, and less on their biological parents' financial positions or vital status. In this view, adult death adversely affects resources available to all children in a kinship—non-orphans as well as orphans— but there are no additional effects on investments in orphans. This is one of the points made in a new publication on AIDS and education from the World Bank (2002), which calls the relationship between orphanage and school enrollment

"unclear" and notes that in low enrollment countries both orphans and non-orphans face schooling constraints (page 18).

An alternative view is that children who are cared for by adults other than their parents are disadvantaged, even holding resources fixed. Research by Bishai et al (2001) argues that biological relatedness is an important predictor of the quality of care offered to children by different providers. Foster parents may not have the same altruistic ties to the children, and may be less likely to realize financial gains from investments made in orphans, leading to weaker incentives to invest in such children. African children who continue to live with a surviving parent may be absorbed into households in which other adults control the available resources, or may gain a step-parent who does not have the same incentives as the biological parent they lost. The death of a mother may leave children especially vulnerable, even among those who continue to live with their father and who experience no reduction in income. Household expenditure on child-related goods—in particular, on healthy foods—is lower when a child's biological mother is absent (Case et al 2000). Moreover, mothers are generally the gate-keepers for their children's health investments (Case and Paxson 2001).

Understanding the risks that orphans face is important for policy. If extended families do provide adequate insurance, then government policies need not target orphans specifically. Households could be singled out for help on the basis of other indicators (income poverty, for example).[1] On the other hand if, holding all else equal, orphans are at risk for lower investments, then governments may be well advised to target orphans specifically when designing policies to

[1]Urassa et al (1997) and Lundberg and Over (2000) argue against targeting based on orphanage. Urassa et al state that in rural Tanzania many non-orphans live in poorer households than do orphans. Lundberg and Over argue that "indiscriminate provision of assistance [to orphans] is both fiscally irresponsible and socially inefficient" (page 13).

improve such outcomes as school enrollment. A related issue is whether the effects of orphanage differ across boys and girls. There is a presumption in much of the literature that female orphans are at a disadvantage. A recent report from the World Bank states that "girls are more likely than boys to be retained at home for domestic work when household income drops due to AIDS deaths or to care for sick relatives" (p. 21).[2] Another report states that "one of the more unfortunate responses to a prime-age-adult death in poorer households is that of removing the children (especially girls) from schools (UNAIDS, 2002, pp. 48-49.) To the extent that female orphans are at a disadvantage, it could be because adult deaths reduce household resources, and girls in poorer households are generally less likely to attend school than boys. Or, it could be that foster parents discriminate against girl orphans relative to boys. Understanding whether and why girls are disadvantaged is an important policy concern.

In the sections that follow, we present evidence that orphans in Africa on average live in poorer households than non-orphans, and are significantly less likely than non-orphans to be enrolled in school. However, orphans' lower school enrollment is not explained by their poverty: orphans are equally less likely to be enrolled in school relative both to non-orphans as a group and to the non-orphans with whom they live. Furthermore, we find no evidence that female orphans are systematically disadvantaged. Consistent with the predictions of *Hamilton's Rule*, we find that outcomes for orphans depend largely on the degree of relatedness of the orphan to the household head. Children living in households headed by non-parental relatives fare systematically worse than those living with parental heads, and those living in households headed by non-relatives fare

[2]However, this report is internally inconsistent in its stance on the effects of orphanage on the school enrollment of girls versus boys, and states elsewhere that "in most cases, the gender gap among double orphans is similar to the gender gap among children living with their parents" (p. 18).

worse still. Much of the gap between the schooling of orphans and non-orphans is explained by the greater tendency of orphans to live with more distant relatives or unrelated caregivers.

2. Rates of orphanage and living arrangements

Data and definitions

We use information for children, aged 14 and under, collected in 19 Demographic and Health Surveys (DHS). The surveys collected data on household living arrangements, housing quality and durable goods ownership, years of completed education and current enrollment status for all children in the household, and the vital status of their parents. The sample in each country-year is typically a stratified random sample of all non-institutional households, which allows us to assess the prevalence of orphanage in non-institution based populations.[3] Because the survey misses children who live in orphanages or on the street, the rates of orphanage we compute are likely to be too low. There are no reliable national estimates of the numbers of children who live in institutions or are homeless.

The surveys ask a responsible adult to list each household member, and to indicate the vital status of each child's parents (living, deceased or unknown). There is no information on the cause of parental death, so AIDS orphans cannot be separated from others. If a parent is noted to be living, the interviewer finds out whether the parent lives in the household. If so, his or her household identification number is noted, so the child's record can be linked to that of the parent.

We divide children into four mutually exclusive categories for our analysis. "Non-orphans" are children with two living parents. "Maternal orphans" are children whose mothers are

[3]In some country-years, sections of countries were excluded due to civil unrest or excessive violence. The DHS website provides details: http://www.measuredhs.com/

deceased *and whose fathers are known to be living*. Similarly, "paternal orphans" are those whose fathers are deceased and whose mothers are known to be living. Defining "double orphans" is complicated by the fact that some children have parents whose vital status is unknown to the respondent: 1.16% of children have mothers in this category and 1.94% have fathers in this category. We define "double orphans" as children for whom either both parents are deceased, or one parent is deceased and the other parent has unknown vital status, or both parents have unknown vital status. We experimented with alternative definitions of double orphans, for example counting children as double orphans only if both parents are known to be deceased, with little effect on our results. We prefer the broader definition of double orphans because, if both parents have unknown vital status, or if one parent is deceased and the other has unknown vital status, it is unlikely that these parents (even if alive) exert any influence on their children's care. We have chosen these mutually exclusive categories to allow easier identification of the impact of the death of one parent, and to separate this from the impact of the loss of both parents.[4]

Rates of orphanage

The countries we use are mapped in Figure 1. Altogether, these 10 countries account for approximately 27% of the children living in Sub-Saharan Africa, and 50% of the AIDS orphans.[5] Seven of the 10 countries—Uganda, Kenya, Tanzania, Malwai, Mozambique, Zambia and Zimbabwe—are in the "AIDS belt" that extends from Eastern into Southern Africa. All of these

[4]Children with one living parent and another parent whose vital status is unknown are not classified as orphans or non-orphans: 0.86% of children fall into this category.

[5]The fraction of AIDS orphans living in the 10 countries is based on data from the UNAIDS (2000), which provides a measure of "cumulative orphans" for each country. "Cumulative orphans" are defined as the estimated number of children who lost their mother or both parents to AIDS by age 15, from the epidemic's onset through to the end of 1999.

countries have orphan rates in excess of 9 percent, with Uganda (2000), Zambia (1996) and Zimbabwe (1999) in excess of 12

percent. In the countries we analyze where the fraction of orphans is lowest—the West African countries of Niger and Ghana—the adult AIDS rates are relatively low.[6]

Figure 2 shows orphan rates, by the age of the child, in each of the survey years we examine. A common characteristics across all countries is that orphan rates increase with age, so that school-age children are at higher risk of orphanage than younger children. In Mozambique (1997), Uganda (2000), Zambia (1996), and Zimbabwe (1999), a quarter or more of 14-year-olds had lost one or both parents. Interpretation of the graphs requires care, since they necessarily confound age and cohort effects. In countries in which AIDS rates are climbing, orphan rates among older children may be higher in 10 years than the rates shown on the graphs.

Countries differ in how orphan rates have changed over time. For example, although estimates of orphanage in Uganda are quite high in both 1995 and 2000, the estimated rates have remained stable. Uganda may have reached a saturation point in the spread of the disease. However, these results are also consistent with reports on the success of Ugandan prevention programs and the diminution of HIV prevalence rates there.[7] Ghana, Niger and Tanzania have also maintained steady orphan rates, while in Kenya, Malawi and, especially, Zambia and Zimbabwe, the fraction of children of each age who are orphans grew over the 1990's.

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[6]Nigeria has a high rate of AIDS and orphanage, and conducted a DHS in 1999 that contains information on the vital status of children's parents. We do not use this survey because the quality of these data appears to be low. Relative to surveys from other countries, there are substantially more children in the Nigerian DHS with both parents of "unknown" vital status. The data collection for this survey was not supervised by Macro International, which conducted the other surveys, and we are concerned that the same protocols may not have been used by the data collectors as in other countries.

[7]See www.unaids.org/fact_sheets/files/Africa_Eng.html for discussion.

Table 1 shows statistics on the fractions of children who are maternal, paternal, and double orphans. A (non-population weighted) average over the country-years analyzed here indicates that 2.4 percent of children aged 14 or younger are maternal orphans and more than twice that percentage (5.7) are paternal orphans.[8] Roughly 2 percent of children surveyed have lost both parents (either deceased or vital status unknown), and 10 percent of children have lost one or both parents. The fractions of children who are maternal, paternal, or double orphans at each age, for the most recent year of data available, can be seen in Figure 3. In some countries, in particular, Kenya, Namibia, Tanzania, Uganda, Zambia and Zimbabwe, the fractions of children who have lost a father are markedly larger than those who have lost a mother. In other countries, including the two West African countries in which HIV/AIDS rates are thought to be lower (Ghana and Niger), the differential loss of fathers is small.

Living arrangements

Children who lose a parent through death often experience additional changes in the set of adults who provide them with care. Many maternal and paternal orphans are "virtual" double orphans, who lost the care of both parents when one died. Traditions of patrilineage may dictate that paternal orphans remain with paternal relatives rather than with their mothers; remarriage and migration among widows and widowers may also result in separation of children from their surviving parents (see Foster 1996, Ntozi and Nakayiwa 1999, and Monk 2000).

[8]Throughout the paper we will treat the results for each country-year as one observation, and for this reason we do not population-weight our cross-country summary statistics. However, our results are robust to population weighting. (The statistics reported for each country-year taken individually have been population weighted, to make them nationally representative.)

Table 2 provides evidence on the importance of "virtual" double orphans. Columns 1 and 2 show the fraction of non-orphans and maternal orphans who live with their fathers, and columns 3 and 4 show the fraction of non-orphans and paternal orphans who live with their mothers. In all of the country-years examined, paternal orphans (who by definition have mothers who are alive) are less likely to live with their mothers than are non-orphans. In many countries these differences are large and have become more pronounced in later years. In Tanzania, for example, 73.5 percent of children whose fathers were dead lived with their mothers in 1992, a statistic that drops to 63.4 percent by 1999. At the same time, the fraction of non-orphans living with their mothers remained constant, at 84 percent. The relative differences in living arrangements between orphans and non-orphans are even larger for children who have lost a mother (columns 3 and 4). For example, in Zambia, in 1996, only 40 percent of maternal orphans lived with their fathers, compared with 74 percent of non-orphans. These differences have become larger with time. In Malawi, 52 percent of maternal orphans lived with their fathers in 1992; only 27 percent of maternal orphans lived with their fathers by 2000. In Tanzania, the fraction of maternal orphans who lived with their fathers declines from 56 percent in 1992 to 37 percent in 1999.

In most of the country-years we analyze, orphans live in household with smaller numbers of members (see Appendix Table 1).[9] However, the gap in household size is always less than one member, indicating either that adult deaths strike larger households or that, when an adult dies, households gain new adult members or are absorbed into other households. The fraction of members who are children is also not systematically larger for orphan households, which is consistent with adult deaths striking households with fewer children per adult, or with a

[9]We restrict attention in Appendix Table 1 to children aged 6-14, since the following analyses of school enrollment are based on this sample.

reshuffling of household members after a death occurs. In all countries, orphans are more likely to live in households with a higher fraction of elderly members, and with less well educated heads. In addition, orphans are more likely to live in households headed by women. These patterns are consistent with evidence highlighting the role of grandparents, and often grandmothers, in the care of orphans (Hunter 1990, Ntozi 1997).

In the next section, we present a model of household resource allocation that allows us to analyze the effects of household living arrangements and income on the school enrollment of orphans and non-orphans.

3. Household resource allocation

A model of equal intra-household allocation

To begin, we define a household *h* as consisting of N_h adults and n_h children. Children within households need not be siblings—and in fact 30% of the households in our sample contain children who do *not* all share the same relationship to the household head.[10] We work with a simple model in which there are no household economies of scale in consumption and a child is assumed to require resources of β (where β<1) to achieve the same living standard as an adult with resources of 1. Resources are allocated to equalize welfare across all household members. Let y_h denote total income per adult, equal to the sum of all adult's earnings plus net transfers from other households in their extended family, divided by the number of household adults. Expenditure on each adult (C^A) and child (C^C) equals:

[10]Children who share the same relationship to the household head are not necessarily full siblings—for example, two children who are grandchildren of the head could be cousins. For this reason, 30% is a lower bound on the fraction of households that contain groups of children who are not full siblings.

$$C^A = \frac{y_h}{1+\beta n_h/N_h}, \qquad C^C = \frac{\beta y_h}{1+\beta n_h/N_h}. \tag{1}$$

Expenditures on children include both current consumption as well as investments made in children's health and education, and in the empirical work that follows we will focus only on education.[11]

How does the death of an adult affect the living standards of household members? Assume that each household begins with N_h^I initial adult members, a fraction s_h of whom survive, so that $N_h = s_h N_h^I$. Each initial adult has b_h children, f_h of whom are fostered to other households to live, so that the number of children living in a household is $(b_h - f_h)N^I$. The ratio of children to adults in the household equals $(b_h - f_h)/s_h$. Substituting into (1), the living standard of each child in the household can be expressed as:

$$C_h^C = \frac{\beta y_h}{1+\beta(b_h - f_h)/s_h}.$$

In what follows, it will be useful to work with the logarithm of expenditure per child. Taking logarithms and applying a first-order Taylor expansion to $\ln(1+\beta\frac{b-f}{s})$, and suppressing the household subscript, the logarithm of expenditure per child can be expressed as:

$$\ln C^C = \ln\beta + \ln y - \beta\frac{(b-f)}{s}. \tag{2}$$

We summarize the routes through which changes in the survival probability affect the living standards of children as follows:

$$\varepsilon_{C,s} = \varepsilon_{y,s} + \frac{\beta(b-f)}{s}[1 - \varepsilon_{b-f,s}], \tag{3}$$

[11]These expenditure functions can be derived from an additively separable utility function of the form:

$$U_h = v(C_h^A) + n_h\beta v(C_h^C/\beta).$$

where $\varepsilon_{C,s}$ is the elasticity of child expenditure with respect to adult survival, $\varepsilon_{y,s}$ is the elasticity of average adult income with respect to adult survival, and $\varepsilon_{b-f,s}$ is the elasticity of the birth rate net of foster-care out-placements with respect to adult survival. The term $\varepsilon_{y,s}$ will be positive if adult deaths are concentrated among adults whose earnings are higher than the household average, and if the households that experience deaths do not receive transfers to fully compensate for changes in earnings per adult. The term $\varepsilon_{b-f,s}$ will be positive if birth rates net of fosterage are higher in households with higher adult survival. A sufficient condition for lower survival to depress living standards is that the elasticity of earnings with respect to adult survival is positive, and the elasticity of the birth rate net of foster care out-placements with respect to the survival rate is less than 1.[12]

This conclusion applies only to the living standards of individuals who remain in the household, and does not address the effects of sending children–presumably orphans—to live elsewhere. All else equal, households to which orphans are sent will experience an increase in the ratio of children to adults. Unless there is an offsetting increase in transfers to or reductions in birthrates in the foster household, the living standards of the members of the child's new household will decline. The model is silent as to how an adult death affects the living standards of children who change households. Orphans could be placed in households that are wealthier or poorer than their households of origin.

Several important points come out of this model. First, adult deaths will not necessarily result in declines in investments in children. The effect of a death on living standards depends on

[12]Although we have not modeled this possibility, the death of an adult may result in new adult members moving into the household, reducing the ratio of children to adults and changing income per adult. We have also not modeled the effects of medical care and funeral costs that result from the illness and death, which all else equal would reduce household resources and living standards.

whether the deceased adult was a high earner within his or her household, whether transfers increase in response to the death, whether the household responds by placing children in foster care, and whether households into which orphans are placed are richer or poorer than the household of origin. The extent to which investments in children are insured against the death of their parents (or other adults living in their households) is of great interest. However, models of insurance cannot be tested without longitudinal data on children and their extended families.

Second, even if households provide equal treatment to all children, it is not the case that orphans and non-orphans in the population will experience the same investment levels. Unless child fostering is so extensive that it results in the random placement of children across households, we expect orphans will be over-represented in households in which an adult death has occurred. To the extent that adult deaths produce declines in household living standards, orphans will be more likely than non-orphans to experience such declines. However, the living standards of orphans relative to non-orphans will be affected by the correlation between household income and the adult survival probability across households within the population. Evidence from Africa indicates that, at least early in the AIDS crisis, infection rates may have been higher among richer and better educated individuals (see Ainsworth and Semali, 1998). If so, it would not be surprising to find that orphans were on average wealthier than non-orphans. If AIDS is becoming more of a poor person's disease—which could happen if prevention measures are more quickly adopted by the wealthy—we would expect to see the living standards of orphans relative to non-orphans decline over time.

Testable implications of the equal intra-household allocation model

The model above has the following testable implications. First, given household resources y and the dependency rate n/N, investments in orphans and non-orphans will be identical. If household resources are measured with error—as will be the case using DHS data, where we have limited information on items other than household durables—we could find a spurious correlation between orphanage and school enrollment that is attributable to mismeasurement of household income. If orphans live in poorer households, and income is measured with error, some of the effects of poverty will be picked up by the orphan indicator. We can test whether this is the reason for differential enrollment of orphans and non-orphans by comparing the investments made in orphans relative to those made in non-orphans living in the same household, using household fixed effect models. If household resources determine children's school enrollment and if resources are shared equally within households, we would expect children in the same households to receive equal educational investments.

A second test of whether outcomes for orphans are due to poverty is based on a comparison of the patterns of school investments and durables for orphans and non-orphans. If both school investments and household durables are positively related to household resources, as measured by $y/(1+\beta n/N)$, then the relationship we observe between orphanage and durables should be mirrored by the pattern we observe between orphanage and school investments. Specifically, for different groups of orphans—paternal, maternal, and double orphans—we examine whether groups that have on average lower levels of household durables are also less likely to be enrolled in school.

Orphans, Caregivers and Hamilton's Rule

The model above assumed that orphans and non-orphans living in the same households receive identical treatment, and that any disadvantage orphans face is due to the poverty of the households in which they are raised. However, there are many reasons why the amount invested in a child may depend on the nature of the relationship between the child and the decision-making adults in the child's household. Adults may be willing to invest more in their own children, both because their affinity to their own children is greater, and because they are more likely to receive transfers from their children later in life. The idea that parents invest more than non-parents is consistent also with arguments from evolutionary biology. Hamilton (1964 a,b) hypothesizes that altruistic behavior between any two individuals will depend upon the degree of genetic relatedness between them, so that one's own children would be favored over grandchildren, nieces, or nephews, who in turn would be favored over more distant relatives and non-relatives.[13]

These ideas can be incorporated into the model presented above, by making the weights on children's welfare in the household utility function depend on the relationship between the child and the adults who make expenditure decisions. Suppose there are *J* possible types of relationships between the adult and a child, and let β_j denote the weight given to a child with a relationship *j*. Assume that greater values of *j* represent more distant relationships, so that β_1 is the weight for a biological child and values of β_j decrease with *j*. We assume β_1 is the true cost of a child, in the sense that a child on whom β_1 is spent will have the same welfare as an adult with expenditure of 1. A household has n_j children of each type, and chooses expenditure on each type of child to maximize:

$$U = v(C^A) + \sum_{j=1}^{J} n_j \beta_j v(C_j^C / \beta_1) .$$

[13]See Daly and Wilson (1987) for a review.

For purposes of illustration, assume that subutility functions are isoelastic, so that $v'(C) = C^{-1/\alpha}$. With household resources of y, expenditure on a biological child in the household will be:

$$C_1^C = \frac{y\beta_1}{1 + \sum_{j=1}^{J} n_j(\beta_1/\beta_j)^{-1/\alpha}}$$

and expenditure on a child of type $j>1$ will be a fraction of that of a biological child:

$$C_j^C = (\beta_1 / \beta_j)^{-1/\alpha} C_1^C$$

Orphans are disadvantaged relative to biological children of the decision-making adult, and the degree of disadvantage increases as the "distance" in the relationship with the decision-making adult grows. We present tests of this hypothesis in Section 5.

4. Orphans, household wealth and school enrollment

Household wealth

The DHS surveys do not contain information on income or financial wealth, but they do collect information on the number of household durables, which serves as a proxy for household wealth. The measure of durables we use is constructed from information on ownership of up to seven durable goods, including items such as refrigerators, radios and bicycles.[14]

[14]The list of durables varies slightly across surveys. In most cases, information is obtained on 6 durables, including a radio, television, refrigerator, bicycle, motorcycle, and a car. (The 1993 Kenyan survey did not ask about motorcycles or cars, the 1992 Malawi survey did not ask about TV's or refrigerators, and the 2000 Malawi survey did not ask about refrigerators. The 2000 Ugandan list of durables includes telephones.) The index of durables is simply the sum of the number of kinds of durables the household owns. Pooling all children aged 6-14, 30% live in households with none of these durable goods. Among those with at least one durable, the average number of durables was 1.7. An alternative approach is taken by Filmer and Pritchett (1999), who use the first principal component of an index created from the DHS household durables and characteristics of housing. We prefer to use

For each country-year, we regress the durable goods index on an indicator that the child is an orphan. In addition to the orphan indicator, the regressions include a complete set of age indicators for the child (since the child's age may be related to both household wealth and the probability that the child is orphaned), and an indicator variable for the child's gender. The coefficient on the orphan indicator, denoted as δ, measures the difference between orphans and non-orphans in household durables, adjusting only for the age and gender of the child. Because in subsequent sections we will focus on school-aged children, we estimate these regressions using samples of children aged 6-14. Estimates of δ, together with confidence intervals (at the 90% level), are graphed in the top left-hand panel of Figure 4. The results are summarized in the top panel of Table 3, which shows the average value of δ and its associated standard error, over all country-years.

The estimates indicate that orphans live in poorer households than non-orphans, measured using durable good ownership. In all country-years, the coefficient on the orphan indicator is significantly less than zero. Some types of orphans live in households that are less well off than others, which can be seen in the other three panels of Figure 4, which separate orphans by type. The top right hand panel shows regressions on samples of children who are either non-orphans or maternal orphans, with paternal and double orphans excluded. For each country-year in the top right panel, the coefficient on our orphan indicator δ reveals whether, on average, children with living fathers and deceased mothers live in households with significantly fewer durables than do children with two living parents. The lower left-hand panel repeats this exercise for paternal orphans, and the lower right panel, for double orphans. It is clear from these panels that paternal

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the count of household durables, because the units are clearly defined, which makes comparison of results across countries possible.

orphanage drives the lower living standards of orphans' households. For maternal and double orphans, there is no systematic difference in the (age and gender adjusted) number of household durables for orphans and non-orphans. However, children whose fathers have died live in households with significantly fewer durables, in every country-year (with the exception of Niger in 1998, where the result is only marginally significant).

Although orphans are poorer, there is no evidence that the living standards of households in which orphans live have systematically deteriorated (or improved) over time as the AIDS crisis has spread. For example, the number of durables in the households of paternal orphans in Ghana fell (although not significantly), whereas the number of durables rose for paternal orphans in Niger and Zambia (again, not significantly). For most countries, even those that have experienced rapid increases in orphan rates, there is no significant difference in coefficients on the orphan indicators between subsequent surveys. Among double orphans, who by definition have been absorbed into households that do not contain their parents, we find no systematic change in the durable good ownership of the households that absorb such orphans between rounds of the survey.

That orphans, and in particular paternal orphans, live in poorer households can largely be explained by the characteristics of households in which orphans live. Figure 5 graphs estimates of δ from regressions that add controls for household characteristics, including the number of household members, the fraction of household members who are children aged 14 or younger, the fraction who are aged 55 or older, and the age, education (in years) and sex of the household head, together with indicators for rural/urban status. With household controls, the estimates of δ for orphans of any type are significant in only 8 of 19 country-years. In addition, the household controls explain more than two-thirds of the lower level of durables for paternal orphans; the average estimate for paternal orphans drops from –0.284 to –0.093. After controlling for

household characteristics, double orphans appear if anything to live in better off households than non-orphans. In 12 of the 19 surveys, the estimate for double orphans is positive, and in 4 it is positive and significantly different from zero. This is consistent with a response within the extended family network in which households that are wealthier, controlling for household characteristics, take in orphans who have lost both parents.

In summary, we find that orphans on average live in poorer households than non-orphans. These differences, which are largest for paternal orphans, are largely explained by observable characteristics of the households in which orphans live. Whether orphans' schooling suffers, and whether that is due to orphans' living arrangements, their relative poverty, or both, will be the focus of the next sections.

Within-household comparisons

We use current school enrollment as our measure of investments in schooling. In Africa, enrolling children in school is costly. In addition to the foregone income of the child, schooling entails expenditures on school uniforms, supplies, and (often) school fees. We analyze school enrollment rather than educational attainment, because the former reflects current investments in a child, whereas attainment reflects the history of enrollment over the child's life. It is possible that children who are orphans moved through school more slowly in the years prior to becoming orphaned—for example, while a parent was dying. Because it is common for African children to enter and leave school periodically, and to repeat grades, we are not concerned that children will be less likely to be currently enrolled because of their enrollment history.

Because our sample consists of school-aged children who are at least 6 years old, it is unlikely that our results are driven by illness in the children who have lost parents. Mother-to-

child transmission of HIV leaves children vulnerable to infection and death, which could lead to correlation between orphanage and lower investments in a child, but one that is due to the child's own health. However, deaths of children infected at birth are highly concentrated in ages 0 to 5. Such children would rarely live to be among those we examine here. (See www.unaids.org/publications/documents/mtct/qaweb99.html .)

For each country and year, we estimate regressions of an indicator for whether a child is enrolled in school on an orphan indicator, a complete set of age indicators for the child, an indicator for the child's gender, and a set of household fixed effects. The coefficients (referred to as ζ) and standard errors for the orphan indicator are graphed in Figure 6; their averages are presented in the third panel of Table 3.

The results indicate that orphans of any type are less likely to be in school than are the non-orphans with whom they live. All estimates of ζ shown in the top left-hand panel of Figure 6 are negative, all but 3 are significant, and the average estimate is –0.072. These effects are large, given that school enrollment is on average low in many of these countries. Overall, 66 percent of children aged 6-14 in these country-years are enrolled in school, so that a 7.2 percentage point decline in school enrollment is equivalent to an 11% reduction in the chance of being in school.

The estimates for maternal and paternal orphans, shown in the top right and bottom left panels, are also generally negative, with average values of roughly –0.05. However, these effects are not precisely estimated, and are significantly different from 0 in only half of the country-years for paternal orphans (10 cases) and in 7 country-years for maternal orphans. The largest effects are for double orphans. In all but one case, double orphans are significantly less likely to go to school than the children with whom they live. For the majority of countries, double orphans are

estimated to be between 10 and 30 percentage points less likely to be in school. The average value of these coefficients across country-years is –0.157.[15]

The discrimination we find against orphans in school enrollment is equally severe for boys and girls. This is in contrast to statements made by the World Bank (2002) and UNAIDS (2002), both of which claim that girls are more likely to be pulled from school upon the death of a parent than are boys. Our data on 19 country-years support no such claims. For each country-year, we estimated a fixed effect model of school enrollment that included indicators for children's ages and sex, an indicator that the child is an orphan, and an interaction term between orphanage and sex. In several country-years, girls are at significantly greater risk for not being enrolled in school (true for Ghana 1993 and 1998, Malawi 1992, Mozambique 1997, Niger 1992 and 1998, Uganda 1995). However, with one exception (Mozambique 1997), girls who are orphans are at no greater risk of not being enrolled than are boys who are orphans. In roughly half the cases (8 of 19 country-years), the interaction between orphanage and being female is positive (although not significantly different from zero). Neither do we find increased discrimination among orphaned girls when we limit our analysis to older children aged 11-14. In no country-year was the orphan-gender interaction term significant and negative in fixed effect models run on older children and, in two cases (Tanzania 1999 and Uganda 2000), older girls who were orphans were significantly more likely to be enrolled relative to older boy orphans.

That orphans and non-orphans living in the same household receive different levels of education investments provides strong evidence against a model of equal sharing within the

[15]Lloyd and Blanc (1996) estimate similar models for school enrollment using some of the same DHS surveys. They generally reach similar conclusions for the relationship between orphanage and school enrollment. However, rather than estimating fixed effects models, they work with smaller samples of only 1 randomly selected child per household. In addition, they include indicators for whether the mother is deceased and the father is deceased but do not include an indicator for whether the child is a double orphan, thereby implicitly restricting the coefficient for double orphans to be the sum of the coefficients on indicators for whether the mother and father are deceased.

household. However, these effects are identified by comparing school enrollments of children who live in "blended" households that contain both orphans and non-orphans. It may be that orphans in blended households fare better than those living in households with orphans only. Likewise, orphans may draw away household resources from non-orphans with whom they live, so that non-orphans in blended households receive less investment than other non-orphans. As an extension to the fixed effects estimates, we examine school enrollment among these different groups of children by estimating equations similar to those discussed above, but replacing the "orphan" indicator with a set of indicators for whether the child is an orphan in a non-blended household, an orphan in a blended household, or a non-orphan in a blended household, with non-orphans in non-blended households being the omitted category. We cannot include household fixed effects in these regressions, but do control for a large set of household characteristics, including the number of household members, the fraction of household members who are children aged 14 or younger, the fraction who are aged 55 or older, and the age, education (in years) and sex of the household head, and indicators for rural/urban status.

The results, shown in Table 4, indicate that orphans are less likely to be enrolled in school regardless of whether they are members of blended households, and there is no systematic difference in the enrollment rates of orphans in non-blended and blended households.[16] (In what follows, for ease of presentation we generally show results for the most recent year of data

[16]These results are broadly consistent with existing research, which is based largely on case studies from small regions in Africa. Research on the Kagera region of Tanzania identifies delayed enrollment of younger children as one strategy for coping with adult death, but only among poorer households (Ainsworth, Beegle, and Koda, 2000). Data from the Masaka district of Uganda and from rural Tanzania find lower school attendance among orphans, but only at older ages (Kamali et al 1996, and Urassa et.al 1997). Lloyd and Blanc (1996), in a larger-scale study of children's education in seven African countries, finds some evidence that orphans are less likely to be in school than non-orphans (after controlling for a large number of other household characteristics), although the differences in enrollment rates between orphans and non-orphans are often not significant. Their research uses several of the same data sets used in this paper, but they work with smaller samples that contain only one randomly-selected child from each household.

available for each country. Results for earlier years are available upon request.) For two countries (Ghana 1998 and Namibia 1992) orphans in non-blended households are significantly less likely to be in school than orphans in blended households, and in three countries (Kenya 1998, Malawi 2000, and Zambia 1996) they are significantly more likely to be in school, and for the rest the difference is not significant. (*F*-tests of equality of these coefficients are presented in column 4.) The presence of orphans also appears to make little difference to whether non-orphans are in school. The difference between non-orphans in blended and non-blended households is significantly different from 0 in only a handful of countries (this can be read from the coefficients in column 3) and, in these cases, non-orphans in blended households have *higher* school enrollment than non-orphans in non-blended households.

A comparison of results from household fixed effect models (as in Figure 6) and those from OLS models that include the household characteristics discussed above shows little difference between the fixed effect and OLS estimates. For the "any orphan" coefficients, the OLS and fixed effect estimates were significantly different for only 6 of 19 country-years. In 5 of these 6 cases, the fixed effect estimates were larger in absolute value. (Results available upon request.) We find little evidence that the omission of controls for unobservable household characteristics bias the orphan coefficients away from zero in our OLS estimation.

Overall, the results in Tables 3 and 4 and in Figure 6 provide evidence that orphans are at significant risk for lower school enrollment, and that this risk is not due solely to their relative poverty. Orphans are less likely than non-orphans to be enrolled, whether we consider non-orphans as a group and control for household characteristics (as in Table 4), or whether we compare orphans with the non-orphans with whom they live and control for household fixed effects.

Orphanage, school enrollment, and durables

If relative poverty were the sole cause of lower schooling for orphans, we should see the same relationship between orphanage and durables that we find for orphanage and school enrollment. We saw above that paternal orphans but not maternal or double orphans tend to live in poorer households, as measured by the durable goods index. If household resources determine both durables and school enrollment, then we should find similar patterns for the school enrollment of these different types of orphans.

Figure 7 and the fourth panel of Table 3 present results from regressions of the school enrollment indicator on a set of age dummies and an indicator for the child's gender. The specification and samples are identical to those used for the regressions for durables shown in Figure 4. Orphans are less likely to be enrolled in school than non-orphans but, in contrast to the results for durable goods, the lower rates of school enrollment are typically larger for maternal and double orphans than for paternal orphans. Estimates for paternal orphans have an average value across country-years of –0.041, and are significantly negative in 12 out of 19 cases. Estimates for maternal orphans are always negative, with an average value of –0.059, and are significantly different from zero in 13 of the 19 country-years. Consistent with the fixed effects results discussed above, double orphans are typically much less likely to be in school than either maternal or paternal orphans. The average estimate of δ for these children is –0.123, and the individual estimates are significantly different from zero in all but 3 country-years. The finding that paternal orphans are on average poorer than non-orphans but are only somewhat less likely to be in school, whereas double orphans are not on average poorer than non-orphans but are substantially less likely to be in school, provides evidence that the lower school enrollment among orphans is not driven solely by wealth.

Although poverty may not be the sole cause of reduced enrollment among orphans, it may be that discrimination against orphans within households is exacerbated by poverty. We have examined whether the gap in enrollment between non-orphans and orphans is larger among poorer households, where wealth is measured by the number of household durables. We estimated models with household fixed effects identical to those presented above, but with the addition of the "orphan" indicator interacted with the durable goods index. (The durable goods index itself does not vary across children in a household, and its effect is absorbed in the household fixed effect.) If wealthier households are less likely to discriminate against orphans relative to non-orphans, then the coefficient on the orphan/durable goods interaction will be positive. However, the results indicate that the within household gap in enrollment between orphans and non-orphans does not decrease with wealth. For orphans of 'any' type, the coefficient on the interaction between the durables index and the orphan indicator is significant in only 6 if 19 cases, and is positive and significant in only 2 of 19. The average value of the coefficient on the interaction is –0.013 (with a standard error of 0.021). Results are similar for orphans of specific types.

It is indeed the case that children in wealthier households are more likely to go to school. We estimated cross-sectional regressions that include a set of household controls, the durable goods index, an orphan indicator, and an interaction of the orphan indicator and the durables index. The results for orphans of any type indicate that higher durables are significantly associated with higher school enrollment in 17 of the 19 country-years. However, consistent with the fixed-effects estimates we report, the gap in enrollment between orphans and non-orphans does not become smaller as the durable goods index rises.

We take this as additional evidence that, although poverty does result in lower school enrollment, orphans face an additional risk of non-enrollment that is not accounted for by

household wealth. In the section that follows, we explore the extent to which the risk orphans face is related to their relationships to their adult caregivers.

5. The role of caregivers in investments in children

The living arrangements of children who have lost one or both parents differ from those of children with two living parents. Table 5 shows that nearly 80 percent of children with two living parents are the child of the household head, and less than 1 percent of non-orphans live in households headed by a non-relative. In contrast, only 50 percent of maternal and paternal orphans are the child of the household head. These children are twice as likely as non-orphans to live in households headed by a grandparent, and three times as likely to be living in households headed by "other relatives." The living arrangements of double orphans differ even more from those of children with two parents. Roughly 30 percent of double orphans are living in households headed by other relatives, and over 4 percent in households headed by non-relatives. About 25 percent of double orphans are adopted or foster children of the household head, that is, they are classified as a son or daughter of the head rather than as an "other relative" or "non-relative," which may signal a greater degree of caring or expectation of permanence of the child in the home.

That the relationship of the child to the household head accounts for the lower schooling enrollment of orphans can be seen in Table 6, which shows results of regressions that include an orphan indicator, together with indicators for the relationship between the child and the head of the household. These regressions include household fixed effects, so the effects of relationship to the head are identified by within-household variation. Panel A shows the coefficients on an orphan indicator when no indicators for the relationship to the head are included. These are identical to

those graphed in Figure 6, and are repeated here for purposes of comparison with the results in Panel B, which include relationship indicators.

Adding controls for the relationship to the household head dramatically reduce the coefficients on the orphan indicators. In Kenya 1998, for example, the "effect" of being an orphan declines from –0.078 to 0.011 when the relationship indicators are included. In other countries, for example Tanzania, Uganda, Zambia and Zimbabwe, the relationship indicators account for between 30% and 60% of the lower school enrollment of orphans.

As a general pattern, the probability of school enrollment is inversely proportional to the relatedness of the child to the household head. Children listed as grandchildren or as adopted/foster children are generally at the smallest disadvantage. Children who live in household headed by an "other relative" are less likely to be enrolled than are children living with parents or grandparents, and children with the lowest rates of school enrollment are those who live in households headed by non-relatives. In many cases, the level of disadvantage associated with having a non-relative for a household head is very close in absolute terms to the average school enrollment rate in the country. For example, 87.5 percent of all Kenyan children are enrolled in school, and Kenyan children who live with non-relatives are estimated to be 80.4 percentage points less likely than others to be enrolled.

We provide more formal tests, at the bottom of Table 6, of whether the child's relationship to the household head correlates with school enrollment in the way predicted by Hamilton's Rule. In all ten country-years, children living with other relatives are significantly less likely to be enrolled than children living with a parental head of household and, in all country-years, children living with other relatives are less likely to be enrolled than are those living with grandparent head. In seven of the ten country-years presented, the difference between living with

a grandparent and with "other relatives" is significant at the 10 percent level. Moreover, children who live with non-relative heads are even less likely to be enrolled in school. With the exception of Niger 1998, in each country-year children living with "non-relative" heads are less likely to be enrolled than are children living with "other relative" heads. These results are consistent with Hamilton's Rule, and suggest that the evaluation of the risk children face upon the death of a parent must take into account the change in the child's living arrangements.

Do children with absent parents have the same risk of lower school enrollment as children with deceased parents? It is plausible that the children of parents who are absent but alive fare better because their parents select "closer" care givers. We find mixed support for this hypothesis. The last two columns of Table 5 shows the distribution of relationships to the household head for double orphans and non-orphans with two absent parents. Children with absent parents are more likely to live with grandparents and are less likely to live with adoptive or foster parents. However, nearly equal fractions of children with absent and deceased parents live with "other relatives" and with "non-relatives," the two relationship categories most closely associated with lower school enrollment.

It is also possible that absent parents select "better" care givers within each of the relationship categories and also monitor and pay care givers. We find some evidence to support this hypothesis. We selected samples of children who either live with both parents, are double orphans, or are non-orphans with two absent parents, and regressed school enrollment on interactions between relationship to head indicators and indicators for whether the child is an orphan or has absent parents. To focus attention on the groups which are most at risk of low enrollment and have large numbers of children with absent parents, we exclude all children who are siblings or foster/adopted children of the household head. The results are used to assess

whether children with absent parents have lower enrollment rates than children who live with both parents; whether the enrollment of children in this group declines as the relationship to the household head becomes less close; and whether, given the relationship to the household head, double orphans and children with two absent parents have the same school enrollment rates.

Results in Table 7 indicate that the enrollment of children with absent parents is significantly different from children who live with both parents (see the F-tests for joint significance of rows 2, 4 and 6). Relative to children who live with both parents, children whose parents leave them in the care of other relatives are significantly less likely to be in school in 8 of 10 cases, and those who live with non-relatives are significantly less likely to be in school in all cases. However, children with absent parents who are grandchildren of the household head are often significantly more likely to be enrolled than children who live with both parents. It is possible that parents who migrate for work are most likely to leave children with grandparents and to send transfers that increase enrollment. However, this hypothesis cannot be tested without data on income and transfers.

Although children with absent parents who live with relatives and non-relatives have lower school enrollment rates than children who live with two parents, in most cases double orphans fare worse than similarly situated children with absent parents. In one case (Malawi) non-orphans with non-relative heads are less likely to go to school than are orphans with non-relative heads. However, among children living with other relatives, orphans have significantly lower enrollment than children with absent parents in 5 of the 10 countries. Among children living with non-relatives, orphans fare worse in 6 of 10 countries. These results provide some evidence that the ability of living parents to select, pay, and monitor non-related caregivers may result in higher investments levels for these children than for orphans.

Although the finding that children who live with non-relatives are most at risk of low enrollment is consistent with Hamilton's rule, we know little about the selection process through which such children are placed into households, and have no information about their possible alternative living arrangements. It may be that, although orphans who live with non-relatives are quite disadvantaged, better alternatives do not exist. Further research is required on this topic.

7. Conclusions

In at least one important dimension — school enrollment — orphans are significantly disadvantaged. The results presented in this paper indicate that, although poorer children in Africa are less likely to attend school, the lower enrollment of orphans is not accounted for solely by their lower wealth. Furthermore, contrary to existing literature, we do not find that female orphans are disadvantaged relative to males. Instead, our results suggest that the special disadvantage orphans face is primarily due to their living arrangements. Across a large number of sub-Saharan African countries we find, consistent with Hamilton's Rule, that the degree of relatedness between orphans and their adult caregivers is highly predictive of children's outcomes. The reduced enrollment of orphans will have long run consequences both for these children's lives, and for the long-run prospects for the countries in which they are being raised.

These results are relevant to an on-going policy debate about the best means of maintaining orphans' living standards. Recent work argues that the disadvantage that orphans face is driven by poverty, and there is no rationale for directing resources towards orphans in favor of equally poor non-orphans (Lundberg and Over, 2000). Our findings—that orphans are less likely to be in school than non-orphans with whom they live, and that the lower within-household enrollment of orphans does not decline as household wealth rises—provide strong

evidence against this view, and instead suggests that policies must be targeted specifically to orphans. In addition, if resource allocation within households is biased against orphans, orphans may benefit little from unconditional cash transfers to their households. Instead, it may be more effective to provide orphans with non-transferable goods and services (such as vouchers for schooling or medical care), and possibly subsidize households that provide orphans with these goods and services. It is also worth examining whether policies that encourage "closer" relatives to care for children would improve their treatment.

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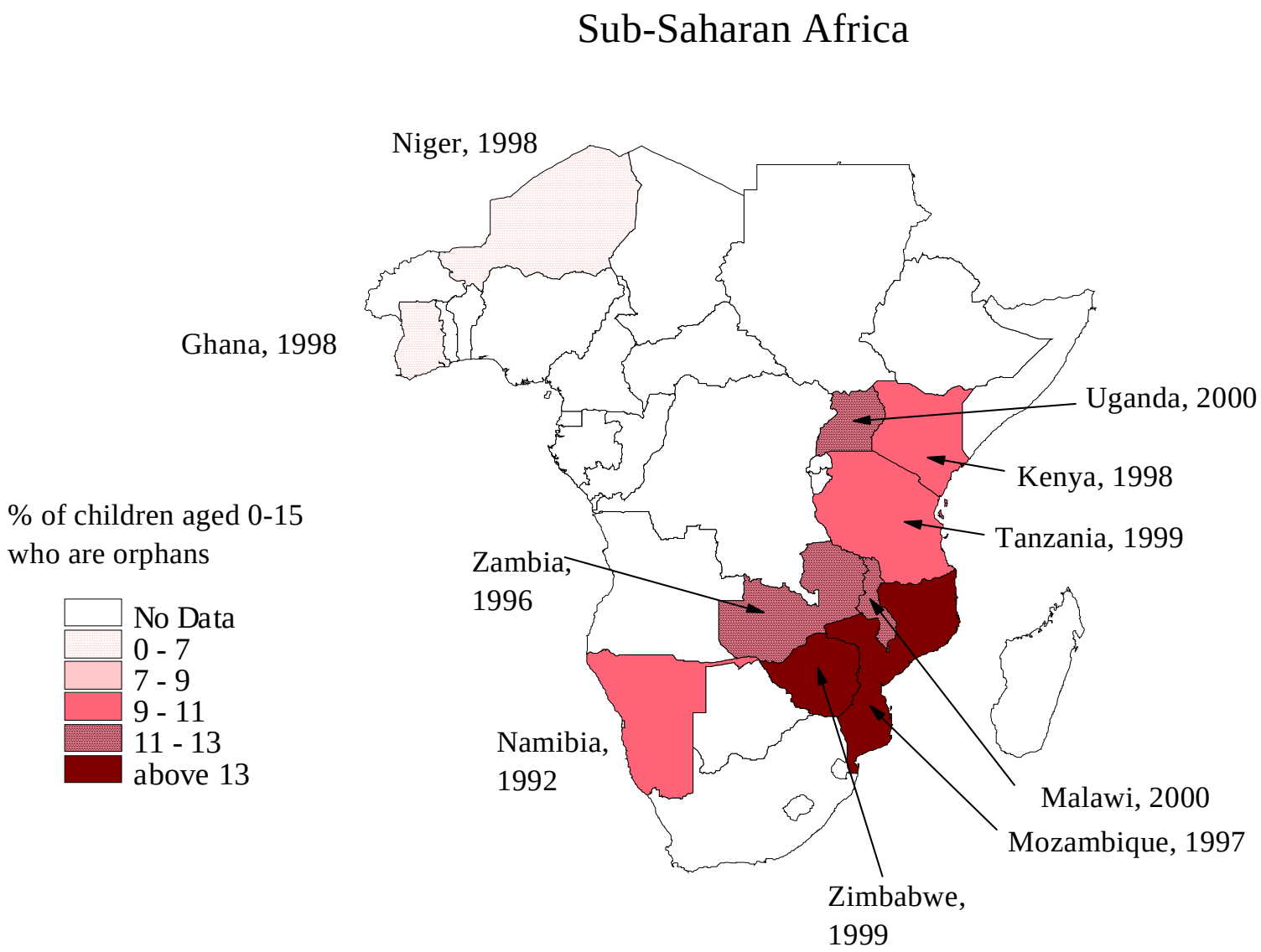

Figure 1: Rate of orphanhood, DHS data

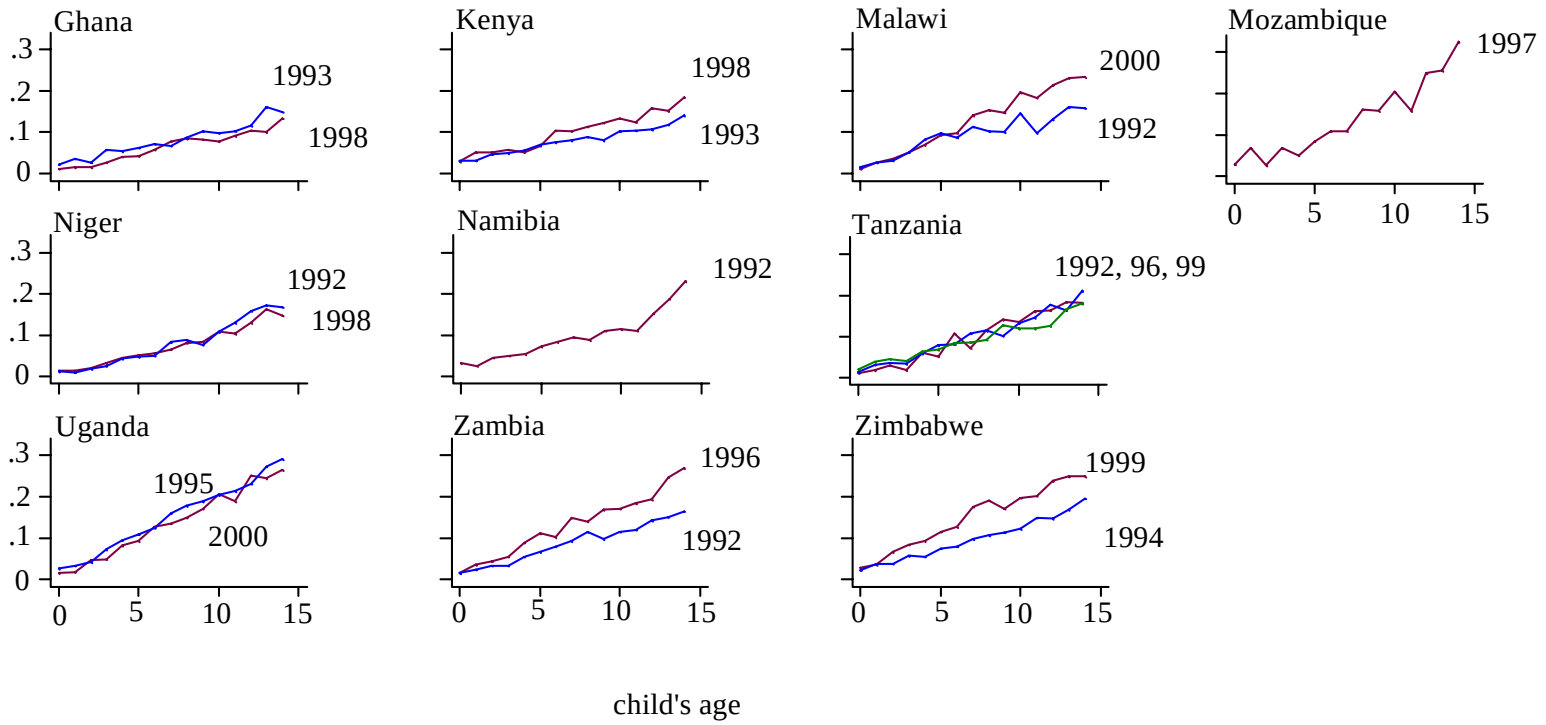

Figure 2: Rates of orphanhood by child's age and year, DHS data

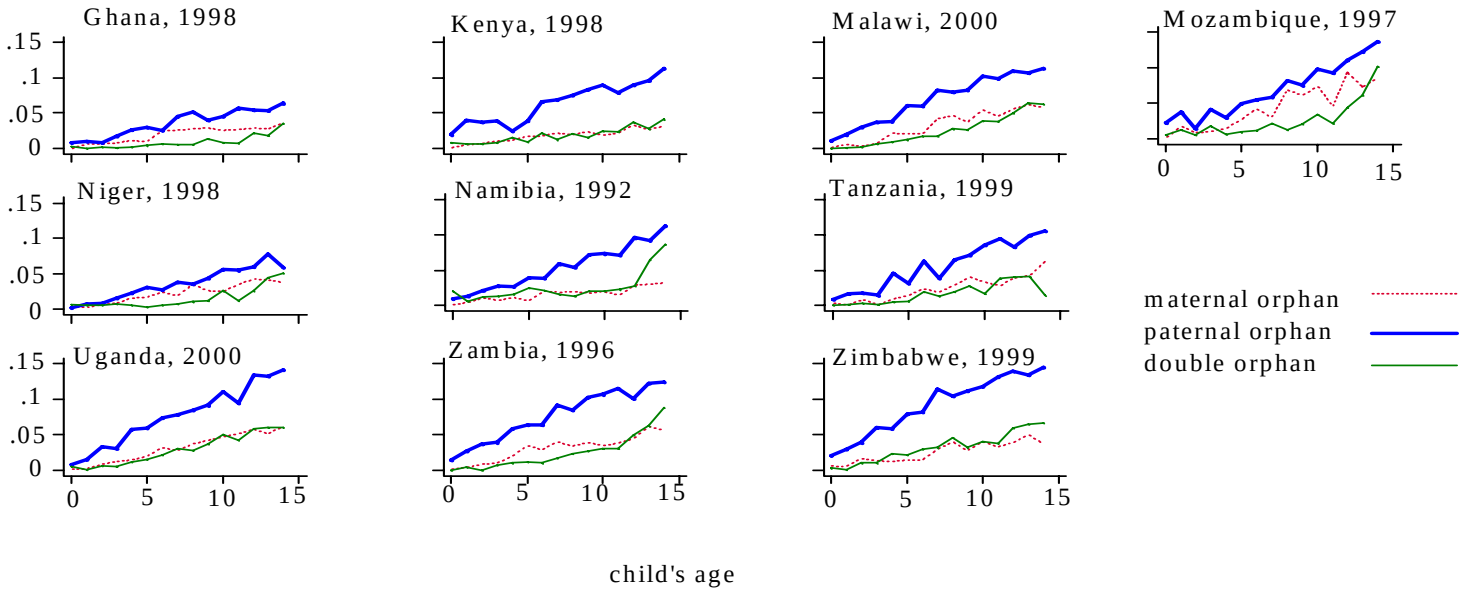

Figure 3: Rates of paternal, maternal and double orphans, by child's age

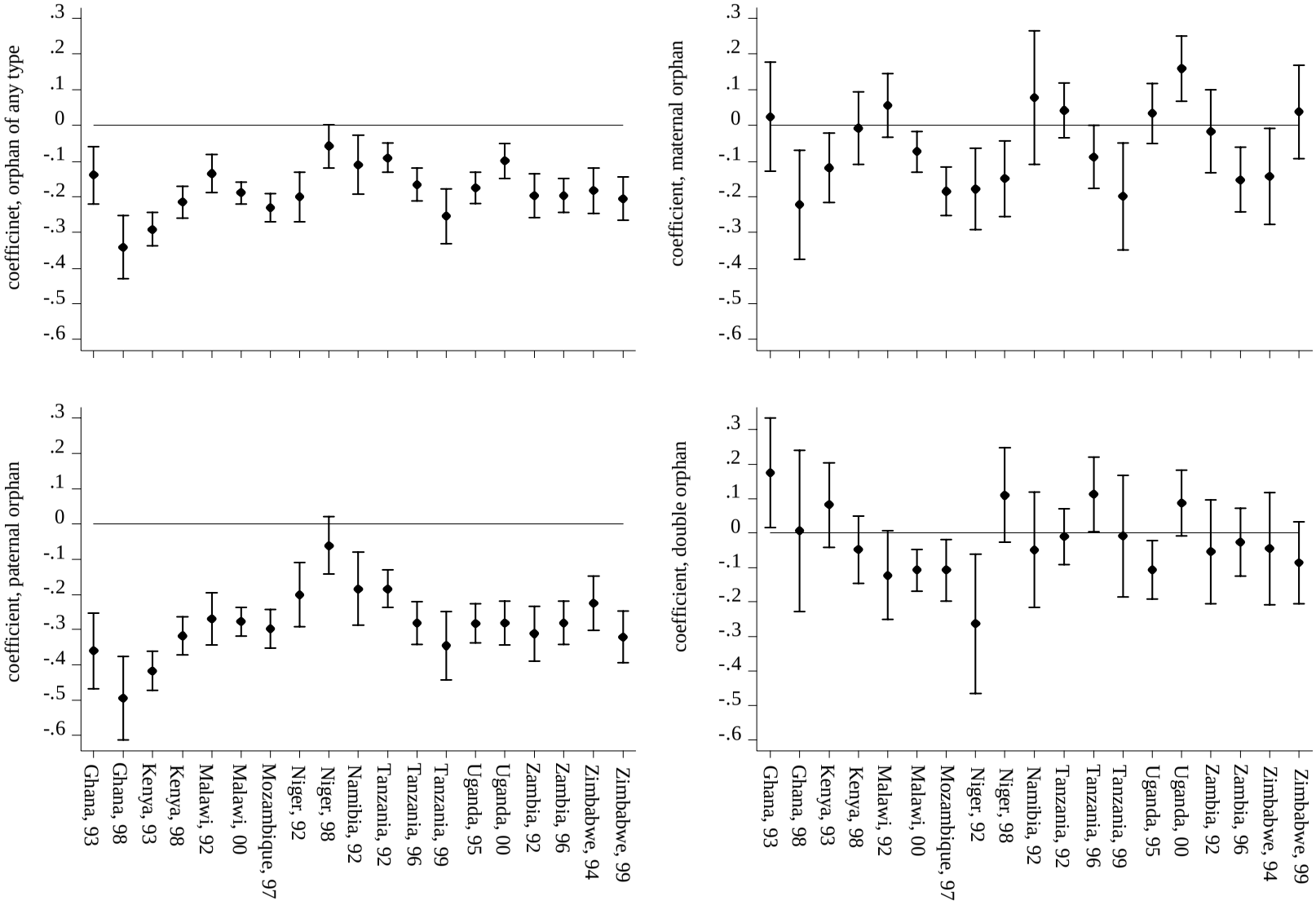

Figure 4: Coefficient estimates and confidence intervals. Regressions of household durables on orphan indicators; controls for child's age and sex; no controls for household characteristics. See Table 4 for details.

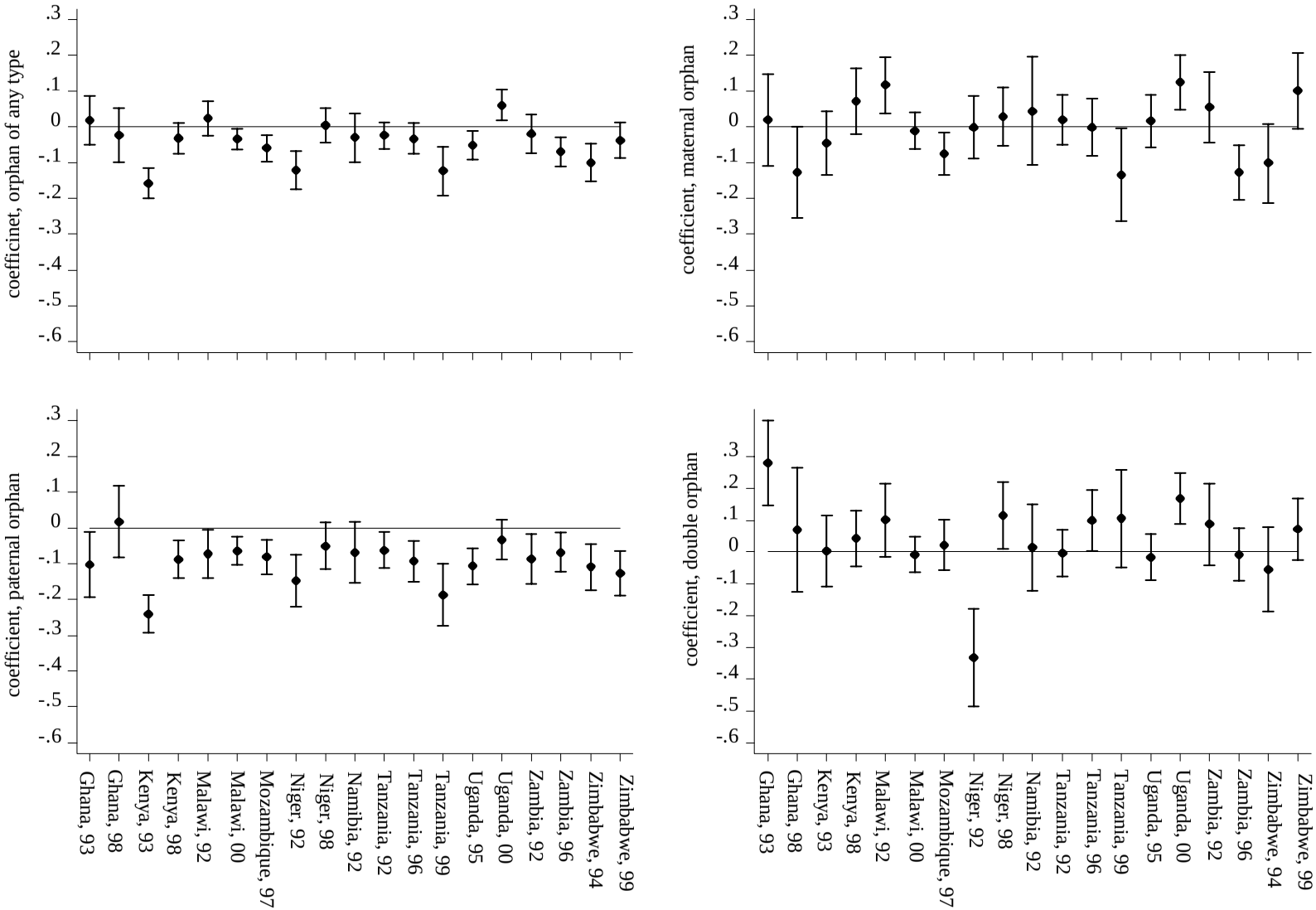

Figure 5: Coefficient estimates and confidence intervals. Regressions of household durables on orphan indicators; controls for child's age and sex; household controls included. See Table 4 for details.

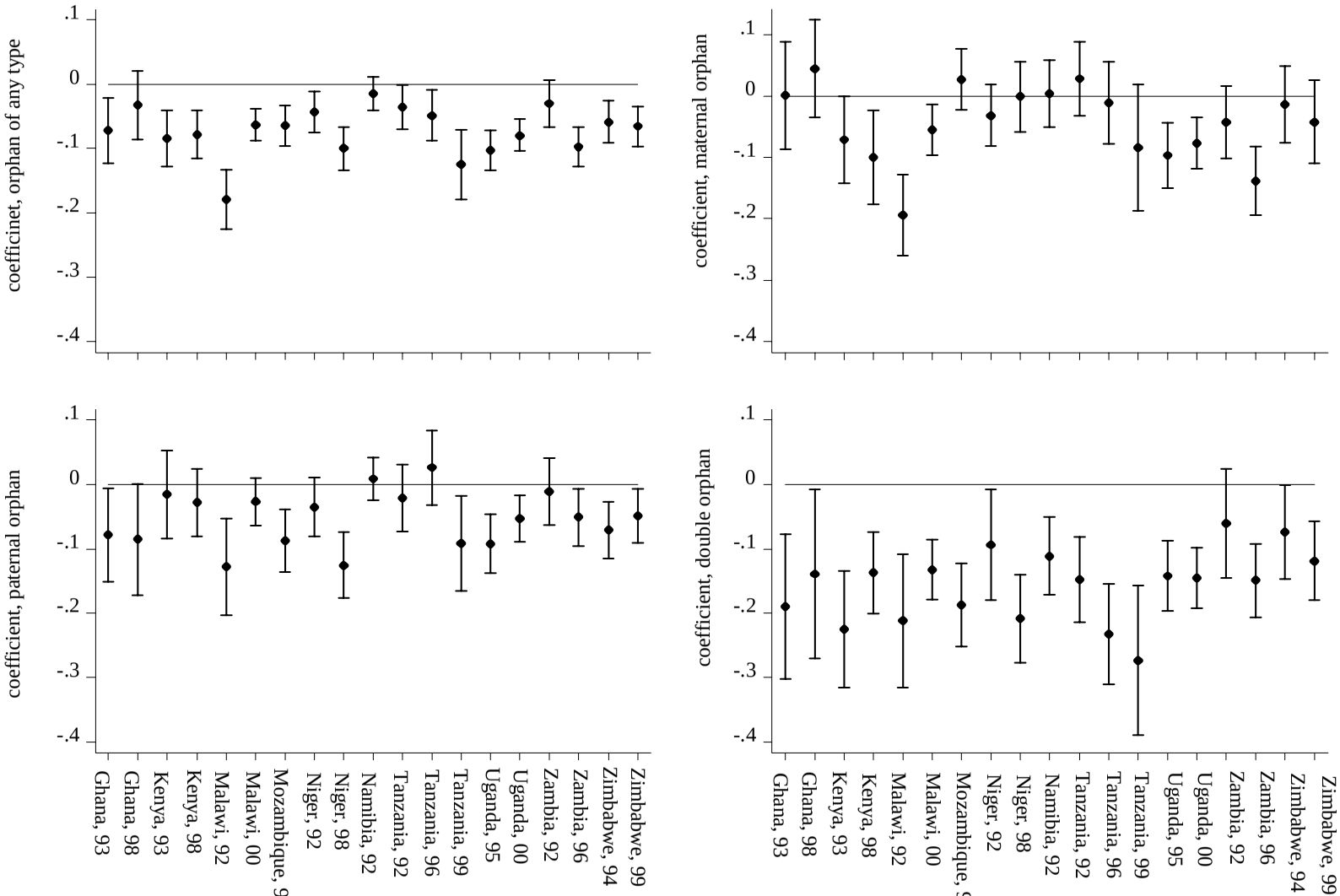

Figure 6: Coefficient estimates and confidence intervals. Regressions of school enrollment on orphan indicators; controls for child's age and sex; household fixed effects included. See Table 4 for details.

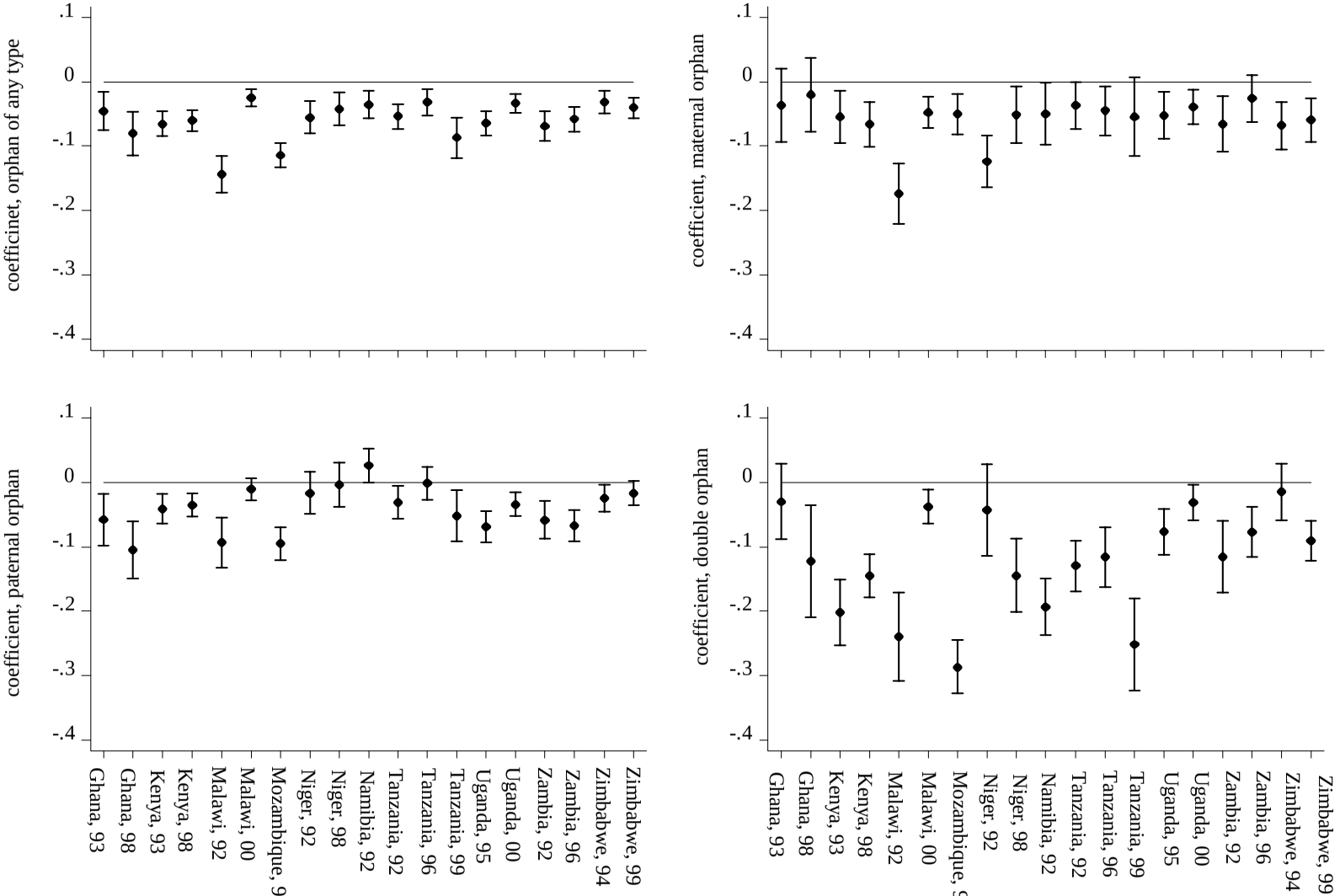

Figure 7: Coefficient estimates and confidence intervals. Regressions of school enrollment on orphan indicators; controls for child's age and sex; no household controls. See Table 4 for details.

Table 1. Rates of orphanage, DHS data

	Sample size	maternal orphan	paternal orphan	double orphan	orphan of any type
Ghana 1993	10,395	0.017	0.042	0.018	0.077
Ghana 1998	9,783	0.019	0.036	0.008	0.063
Kenya 1993	18,420	0.014	0.051	0.014	0.080
Kenya 1998	16,881	0.018	0.065	0.019	0.102
Malawi 1992	11,172	0.030	0.046	0.017	0.092
Malawi 2000	28,888	0.029	0.065	0.023	0.117
Mozambique 1997	19,891	0.042	0.067	0.025	0.135
Namibia 1992	11,123	0.015	0.050	0.030	0.095
Niger 1992	16,061	0.027	0.037	0.007	0.071
Niger 1998	17,701	0.020	0.033	0.013	0.066
Tanzania 1992	20,851	0.019	0.046	0.023	0.088
Tanzania 1996	17,930	0.023	0.055	0.017	0.095
Tanzania 1999	8,339	0.022	0.053	0.016	0.091
Uganda 1995	17,618	0.030	0.080	0.028	0.138
Uganda 2000	18,449	0.029	0.072	0.027	0.127
Zambia 1992	15,780	0.022	0.050	0.012	0.084
Zambia 1996	18,107	0.029	0.074	0.023	0.126
Zimbabwe 1994	13,244	0.019	0.065	0.016	0.100
Zimbabwe 1999	11,999	0.026	0.093	0.034	0.153

Notes: Rates of orphanage are calculated using all children age 14 and under whose parents are coded as being alive, deceased, or with unknown status. Orphans are classified into three *mutually exclusive* categories: “Maternal orphans” are children with deceased mothers and living fathers. “Paternal orphans” are children with deceased fathers and living mothers. “Double orphans” are children for whom the vital status of both parents is either “deceased” or “unknown.” Children for whom one parent is living and the other parent has unknown vital status are not counted as orphans but are retained in the sample for the purpose of calculating rates. Rates were calculated using the survey weights provided in the DHS data.

Table 2. Living arrangements of orphans and other children, DHS data

	Non-orphan	Paternal orphan	Non-orphan	Maternal orphan
Survey:	fraction who live with mother		fraction who live with father	
Ghana 1993	0.823	0.705	0.593	0.610
Ghana 1998	0.827	0.704	0.624	0.589
Kenya 1993	0.898	0.841	0.659	0.680
Kenya 1998	0.892	0.840	0.680	0.561
Malawi 1992	0.872	0.730	0.716	0.519
Malawi 2000	0.869	0.708	0.700	0.271
Mozambique 1997	0.865	0.754	0.712	0.555
Namibia 1992	0.689	0.552	0.444	0.190
Niger 1992	0.868	0.618	0.831	0.594
Niger 1998	0.882	0.615	0.815	0.596
Tanzania 1992	0.842	0.735	0.739	0.555
Tanzania 1996	0.851	0.703	0.725	0.515
Tanzania 1999	0.843	0.634	0.728	0.373
Uganda 1995	0.815	0.586	0.722	0.559
Uganda 2000	0.839	0.648	0.739	0.504
Zambia 1992	0.846	0.677	0.750	0.400
Zambia 1996	0.854	0.682	0.737	0.399
Zimbabwe 1994	0.803	0.671	0.555	0.395
Zimbabwe 1999	0.795	0.634	0.570	0.433

Notes: The sample consists of children aged 0-14 years. “Non-orphans” are children for whom the vital status of both parents is known and indicated to be living. “Maternal orphans” are children for whom the mother is indicated to be deceased and the father is indicated to be living. “Paternal orphans” are children for whom the father is indicated to be deceased and the mother is indicated to be living. Sample weights were used to compute rates.

Table 3: Summary of results in Figures 4-7

all orphans	maternal orphans	paternal orphans	double orphans
Average coefficients from Figure 4:durable goods, no household controls			
–0.183	–0.058	–0.284	–0.024
(0.036)	(0.070)	(0.046)	(0.083)
Average coefficients from Figure 5: durables, household controls			
–0.043	–0.001	–0.093	0.040
(0.031)	(0.059)	(0.040)	(0.070)
Average coefficients from Figure 6: school enrollment, household fixed effects			
–0.072	–0.045	–0.053	–0.157
(0.023)	(0.040)	(0.034)	(0.049)
Average coefficients from Figure 7: school enrollment, no household controls			
–0.060	–0.059	–0.041	–0.123
(0.014)	(0.025)	(0.018)	(0.031)

Notes: This table contains unweighted means of the coefficients shown in Figures 4-7. The numbers in parentheses are the square roots of the averaged variances of these estimates. All of the underlying regressions are of an outcome (either the numbers of household durables or an indicator for school enrollment) on an orphan indicator, and indicators for the age and sex of the child. The results in Figure 5 are based on regressions that included a set of controls for household characteristics. The household controls are indicators for urbanization (capital or large city, small city, town, countryside), education of the household head, the age of the household head and whether the head is female, the number of persons in the household, the fraction of household members who are children less than age 16, and the fraction of household members who are adults aged 55 and above. The results in Figure 6 are from regressions that included a set of household fixed effects.

Each cell in the table shows the average, across countries and years, of the coefficient on the orphan indicator included in each regression. For the results in the column marked “all orphans”, the sample consisted of all children in the sample described in the note to Appendix Table 1. The orphan indicator is an indicator that the child is any orphan of any type, or is either a maternal, paternal, or double orphan. For the results in the column marked “maternal orphan,” the orphan indicator is that the child has a deceased mother and living father. Children who are paternal or double orphans are excluded from the sample. For the results in the column marked “paternal orphan,” the orphan indicator is that the child has a deceased father and living mother. Children who are maternal or double orphans are excluded from the sample. For the results in the column marked “double orphan,” the orphan indicator is that both of the child’s parents are deceased or have unknown vital status. Children who are maternal or paternal orphans are excluded from the sample.

Table 4: Effects of co-resident orphans on school enrollment of orphans and non-orphans.

	coefficients and standard errors			F-tests and p-values	
	Orphan, non-blended household (1)	Orphan, blended household (2)	Non-orphan, blended household (3)	column 1 = column 2	column 2 = column 3
Ghana 1998	–0.127	–0.008	0.051	9.37	2.07
	(0.023)	(0.032)	(0.027)	(0.002)	(0.150)
Kenya 1998	–0.038	–0.102	0.003	8.35	16.95
	(0.011)	(0.020)	(0.017)	(0.004)	(0.000)
Malawi 2000	–0.017	–0.044	0.024	3.05	16.11
	(0.010)	(0.013)	(0.012)	(0.081)	(0.000)
Mozambique 1997	–0.095	–0.080	–0.015	0.48	8.08
	(0.014)	(0.018)	(0.016)	(0.487)	(0.005)
Namibia 1992	–0.082	–0.010	0.009	7.34	1.11
	(0.022)	(0.016)	(0.013)	(0.007)	(0.293)
Niger 1998	–0.039	–0.048	0.024	0.13	9.53
	(0.018)	(0.019)	(0.015)	(0.718)	(0.002)
Tanzania 1999	–0.089	–0.086	0.040	0.01	12.05
	(0.024)	(0.029)	(0.025)	(0.940)	(0.001)
Uganda 2000	–0.028	–0.050	0.022	1.82	18.66
	(0.011)	(0.014)	(0.012)	(0.178)	(0.000)
Zambia 1996	–0.031	–0.067	0.026	2.87	19.88
	(0.015)	(0.017)	(0.015)	(0.090)	(0.000)
Zimbabwe 1999	–0.030	–0.058	–0.013	2.25	4.90
	(0.012)	(0.016)	(0.015)	(0.134)	(0.027)

Notes: Each row represents coefficients from a single regression of school attendance on a set of orphan measures (coefficients and standard errors shown) and other controls. The three orphan measures are defined as follows: (1) "orphan, non-blended household " is an indicator that the child is an orphan who lives with no non-orphans aged 6-15; (2) "orphan, blended household" is an indicator that the child is an orphan who lives with at least one non-orphan aged 6-15; and (3) "non-orphan, blended household" is an indicator that the child is a non-orphan who lives with at least one orphan aged 6-15. The excluded category is non-orphans who live in non-blended households, i.e. with no orphans aged 6-15. Pooling all surveys, 36.2% of orphans and 8.67% of non-orphans live in blended households. All regressions include a complete set of indicators variables for the child's age, an indicator for the child's sex, indicators for urbanization (capital or large city, small city, town, countryside), education of the household head, the age of the household head and whether the head is female, the number of persons in the household, the fraction of household members who are children less than age 16, and the fraction of household members who are adults aged 55 and above.

Table 5: Orphanage and the relationship to household head

relationship to head:	non-orphans	maternal orphans	paternal orphans	double orphans	non-orphans with two absent parents
son/daughter	77.82	47.61	48.17	0.00	0.00
grandchild	11.75	23.48	20.06	32.02	52.99
brother/sister	1.21	4.25	6.09	9.37	6.18
other relative	6.50	18.42	16.42	29.26	32.23
adopted/foster child	1.72	4.15	7.23	25.24	2.93
non-relative	0.99	2.08	2.03	4.10	5.67

Notes: 164,689 observations. The data are for all children aged 6-14 whose orphan status can be determined. These frequencies are based on pooled data from all countries and years, and are not weighted. 20.85 percent of double orphans were originally classified as being the "son" or "daughter" of the household head, and we re-classified these children as adopted/foster children. We also re-classified children to be adopted/foster children if they were: 1) maternal orphans who were originally classified as sons or daughters of the head in female-headed households, or 2) paternal orphans who were originally classified as sons or daughters of heads on male-headed households. Only 0.8 percent of maternal orphans and 1.34 percent of paternal orphans were re-classified. The last column, on relationships of non-orphans with two absent parents, is based on a subset of non-orphans from the sample used in the first column.

Table 6: School enrollment, orphanage, and the relationship to the household head. Household fixed effects included.

	Ghana 1998	Kenya 1998	Malawi 2000	Mozam-bique 1997	Namibia 1992	Niger 1998	Tanzania 1999	Uganda 2000	Zambia 1996	Zimbabwe 1999
Panel A										
orphan	–0.033	**–0.078**	**–0.063**	**–0.064**	–0.015	**–0.100**	**–0.125**	**–0.079**	**–0.097**	**–0.066**
	(0.033)	**(0.022)**	**(0.015)**	**(0.019)**	(0.016)	**(0.021)**	**(0.033)**	**(0.015)**	**(0.019)**	**(0.019)**
Panel B										
grandchild	0.008	–0.005	**–0.055**	**–0.064**	–0.033	–0.045	–0.062	–0.002	**–0.047**	–0.038
	(0.038)	(0.024)	**(0.019)**	**(0.029)**	(0.020)	(0.026)	(0.039)	(0.025)	**(0.026)**	(0.023)
brother/sister	–0.020	**–0.174**	**–0.125**	**–0.130**	–0.023	**–0.150**	–0.085	–0.027	**–0.094**	**–0.117**
	(0.093)	**(0.067)**	**(0.044)**	**(0.050)**	(0.055)	**(0.061)**	(0.083)	(0.053)	**(0.050)**	**(0.057)**
other relative	**–0.082**	**–0.111**	**–0.077**	**–0.175**	**–0.042**	**–0.118**	**–0.070**	**–0.121**	**–0.150**	**–0.091**
	(0.033)	**(0.024)**	**(0.020)**	**(0.024)**	**(0.017)**	**(0.026)**	**(0.036)**	**(0.018)**	**(0.021)**	**(0.025)**
adopted/foster child	–0.022	**–0.077**	–0.047	**–0.070**	0.028	**–0.097**	**–0.107**	–0.010	0.003	–0.033
	(0.051)	**(0.039)**	(0.036)	**(0.033)**	(0.051)	**(0.027)**	**(0.054)**	(0.031)	(0.037)	(0.044)
non-relative	**–0.344**	**–0.807**	**–0.741**	**–0.526**	**–0.097**	**–0.175**	**–0.566**	**–0.539**	**–0.355**	**–0.487**
	(0.084)	**(0.041)**	**(0.036)**	**(0.060)**	**(0.026)**	**(0.042)**	**(0.101)**	**(0.042)**	**(0.096)**	**(0.071)**
orphan	–0.013	0.011	–0.013	–0.011	–0.008	**–0.048**	**–0.088**	**–0.034**	**–0.051**	**–0.045**
	(0.033)	(0.024)	(0.016)	(0.020)	(0.017)	**(0.023)**	**(0.034)**	**(0.016)**	**(0.020)**	**(0.020)**
F-test (p-value): grandchild=other relative	3.58	10.29	0.67	10.23	0.18	4.46	0.03	16.94	10.96	2.86
	(0.059)	(0.001)	(0.413)	(0.001)	(0.672)	(0.035)	(0.868)	(0.000)	(0.001)	(0.091)
F-test (p-value): other relative=nonrelative	8.72	231.12	292.6	31.77	4.28	1.51	22.30	94.35	4.53	28.34
	(0.003)	(0.000)	(0.000)	(0.000)	(0.039)	(0.219)	(0.000)	(0.000)	(0.033)	(0.000)
observations	5,585	9,797	16,109	10,377	5,310	9,012	4,702	10,053	9,951	6,922

Notes: Panel A shows the coefficient on an indicator that the child is an orphan (of any type) from a regression of school enrollment on an orphan indicator, an indicator for the age and sex of the child, and a set of household fixed effects. The regressions shown in Panel B add a set of indicators for the relationship of the child to the household head. Standard errors in parentheses. The sample is of all children ages 6-14 who live in households in which all children in this age group can be identified as "orphans" or "non-orphans." Estimates in **bold** type are significant at the 10% level of better.

Table 7: School enrollment and the relationship to the household head among double orphans and children with two absent parents

		Ghana 1998	Kenya 1998	Malawi 2000	Mozambique 1997	Namibia 1992	Niger 1998	Tanzania 1999	Uganda 2000	Zambia 1996	Zimbabwe 1999
(1)	grandchild x orphan	0.014	–0.025	–0.009	**–0.337**	**–0.177**	–0.013	**–0.179**	0.035	–0.017	**–0.082**
		(0.091)	(0.041)	(0.025)	**(0.050)**	**(0.054)**	(0.080)	**(0.070)**	(0.029)	(0.044)	**(0.030)**
(2)	grandchild x absent parents	**(0.200)**	0.012	0.018	**0.070**	–0.002	–0.039	**0.061**	**0.072**	**0.052**	**–0.055**
		(0.029)	(0.019)	(0.015)	**(0.024)**	(0.018)	(0.023)	**(0.029)**	**(0.019)**	**(0.022)**	**(0.018)**
(3)	other relative x orphan	**–0.172**	**–0.188**	**–0.044**	**–0.315**	**–0.183**	**–0.188**	**–0.279**	**–0.059**	**–0.116**	**–0.149**
		(0.101)	**(0.042)**	**(0.027)**	**(0.045)**	**(0.042)**	**(0.088)**	**(0.074)**	**(0.028)**	**(0.037)**	**(0.037)**
(4)	other relative x absent parents	–0.049	**–0.102**	**–0.057**	**–0.097**	0.001	**–0.115**	**–0.090**	**–0.059**	**–0.032**	**–0.086**
		(0.032)	**(0.022)**	**(0.018)**	**(0.023)**	(0.017)	**(0.027)**	**(0.031)**	**(0.017)**	**(0.020)**	**(0.023)**
(5)	non-relative x orphan	**–0.763**	**–0.900**	**–0.543**	**–0.549**	**–0.497**	**–0.334**	**–0.954**	**–0.570**	–0.286	**–0.880**
		(0.207)	**(0.073)**	**(0.066)**	**(0.179)**	**(0.080)**	**(0.099)**	**(0.243)**	**(0.084)**	(0.182)	**(0.223)**
(6)	non-relative x absent parents	**–0.351**	**–0.740**	**–0.779**	**–0.428**	**–0.068**	**–0.114**	**–0.255**	**–0.370**	**–0.342**	**–0.607**
		(0.069)	**(0.035)**	**(0.037)**	**(0.068)**	**(0.026)**	**(0.040)**	**(0.084)**	**(0.043)**	**(0.085)**	**(0.059)**
P-values from F-tests											
Rows 1, 3 & 5 jointly insignificant		0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.006	0.000
Rows 2, 4 & 6 jointly insignificant		0.000	0.000	0.000	0.000	0.062	0.000	0.000	0.000	0.000	0.000
Row 1 = Row 2		0.038	0.366	0.268	0.000	0.001	0.752	0.001	0.194	0.125	0.357
Row 3 = Row 4		0.238	0.063	0.677	0.000	0.000	0.423	0.017	0.979	0.037	0.131
Row 5 = Row 6		0.057	0.046	0.002	0.530	0.000	0.038	0.006	0.033	0.779	0.234
observations		3,566	6,324	10,871	6,372	3,358	6,980	3,240	6,534	6,743	3,999

Notes: The regressions shown in this Table are based on a sample of children aged 6-14 who are either live with both parents, are double orphans, or who have two living but absent parents. Children who were siblings or foster/adoptive children of the household head were excluded. The coefficients and standard errors shown are from a regression of schooling enrollment on a set of indicators of the relationship of the child to the household head (grandchild, other relative, or non-relative) interacted with indicators for whether the child is an orphan or has absent parents. The excluded category is children living with both parents. All regressions also include a complete set of indicators variables for the child's age, an indicator for the child's sex, indicators for urbanization (capital or large city, small city, town, countryside), education of the household head, the age of the household head and whether the head is female, the number of persons in the household, the fraction of household members who are children less than age 16, and the fraction of household members who are adults aged 55 and above. Estimates in **bold** type are significant at the 10% level of better.

Appendix Table 1. Average household characteristics for children ages 6-14, DHS data.

	average # household members		fraction members who are children aged 0-14		fraction of members who are aged 55+		average years of education of household head		fraction in female headed households	
Orphan?	no	yes	no	yes	no	yes	no	yes	no	yes
Ghana 93	6.51	5.95	0.596	0.586	0.055	0.080	5.06	4.47	0.334	0.500
Ghana 98	6.27	5.49	0.563	0.559	0.064	0.101	5.83	4.90	0.346	0.558
Kenya 93	7.42	6.68	0.598	0.595	0.046	0.059	5.06	3.38	0.289	0.662
Kenya 98	6.61	5.91	0.584	0.573	0.041	0.058	6.31	4.47	0.269	0.679
Malawi 92	6.60	6.09	0.572	0.553	0.057	0.106	4.01	3.05	0.207	0.487
Malawi 00	6.43	5.93	0.574	0.549	0.052	0.100	4.42	3.87	0.221	0.532
Mozambique 97	6.86	6.44	0.555	0.556	0.052	0.062	2.75	1.87	0.209	0.448
Namibia 92	9.88	10.50	0.535	0.524	0.075	0.094	3.55	3.20	0.298	0.425
Niger 92	9.82	9.48	0.561	0.528	0.057	0.087	0.38	0.32	0.062	0.172
Niger 98	8.77	7.91	0.569	0.542	0.058	0.087	0.79	0.68	0.082	0.269
Tanzania 92	8.11	7.65	0.555	0.534	0.060	0.079	3.39	3.02	0.119	0.370
Tanzania 96	7.41	6.62	0.564	0.545	0.058	0.089	4.05	3.40	0.150	0.429
Tanzania 99	7.72	6.91	0.553	0.525	0.056	0.103	4.18	3.23	0.158	0.437
Uganda 95	7.33	6.78	0.617	0.604	0.048	0.079	4.71	3.92	0.196	0.494
Uganda 00	7.38	6.85	0.611	0.590	0.044	0.081	5.33	4.51	0.210	0.549
Zambia 92	8.44	7.65	0.554	0.545	0.041	0.058	5.87	5.05	0.099	0.367
Zambia 96	7.79	7.21	0.561	0.533	0.042	0.068	6.52	5.81	0.154	0.439
Zimbabwe 94	7.14	6.99	0.572	0.561	0.055	0.072	5.02	3.98	0.343	0.608
Zimbabwe 99	6.55	6.34	0.553	0.548	0.060	0.093	6.05	4.64	0.343	0.636

Notes: The sample consists of children aged 6-14 years living in households for which all children in this age group can be classified as “orphans” or “non-orphans.” “Non-orphans” are coded as children for whom both parents are indicated to be living. “Orphans” are those for whom one parent is living and other is deceased, or for whom both parents are either deceased or have unknown vital status. Children who have one living parent but the vital status of the other parent is unknown are not classified as orphans or non-orphans. They, and the children aged 6-14 with whom they live, are excluded from the sample. Households with missing values for the controls used in the following regressions are also excluded. Of the original sample of 184,403 children aged 6-14 years, 3,272 were excluded because at least one child aged 6-14 could not be classified as an orphan or non-orphan. An additional 8,594 observations were excluded due to missing information on personal or household characteristics. The final sample is contains 172,537 observations.