Orphanhood, Household Composition, and Child Outcomes in Sub-Saharan Africa

15 August 2009

Thomas W. Pullum
University of Texas at Austin
tom.pullum@mail.utexas.edu

K. Fern Greenwell
World Health Organization
greenwellk@who.int

Much of Sub-Saharan Africa has seen substantial increases in the proportion of children who have lost parents because of HIV/AIDS. Many of these children are taken in by grandparents, aunts and uncles, or other relatives. The increase in orphanhood has occurred within a context in which many children normally live with foster parents and cousins. Using recent data from the Demographic and Health Surveys (DHS) project for 26 countries, this research examines school attendance in relation to whether the child is an orphan or lives separately from living parents. It is found that children who have living parents but do not live with them tend to have the same negative outcomes as children whose parents have died, and that orphans who live with nonorphans are more likely than the nonorphans to have negative outcomes.

Paper presented at the Meetings of the International Union for the Scientific Study of Population, Marrakech, Morocco, September 2009.

Orphanhood, Household Composition, and Child Outcomes in Sub-Saharan Africa

Introduction

An important consequence of the increased mortality from HIV/AIDS in Sub-Saharan Africa during the past twenty years or so has been an increase in the number of children who have lost one or both parents. In general it is not possible to determine whether specific parental deaths have been AIDS-related or from some other cause, but there is little doubt that in the region an increase in the number of orphans can be largely attributed to that source (USAID *et al*. 2002). In 17 sub-Saharan countries with a DHS survey in 1995-2000, Bicego *et al*. (2003) document a strong, positive association between the levels and trends of orphan prevalence with the HIV prevalence estimates in most countries.

Many community-based programs have been developed to ameliorate the difficulties faced by orphans. These programs are motivated by the sense that orphans have disadvantages beyond those faced by other children. A large literature has developed on a wide range of potential negative consequences of orphanhood, particularly in contexts of high HIV prevalence.

Important potentially negative consequences of orphanhood relate to educational outcomes. Bicego *et al*. (2003) found in five sub-Saharan countries that orphans were less likely to be in the expected grade level, especially at younger ages, compared to nonorphans. Furthermore, while the loss of both parents was most detrimental to educational attainment, the loss of the mother had a stronger negative effect than the loss of the father. Similarly, from a panel household survey in Tanzania, Ainsworth *et al*. (2005) provided evidence that school enrollment was delayed for maternal orphans in Tanzania, and for girls already attending school the number of hours in school diminished sharply immediately after losing a parent.

Using longitudinal data and the timing of the maternal death relative to the orphan's school enrollment, Case and Ardington (2006) show that, relative to nonorphans, a maternal death in particular has a negative impact on the child's school enrollment and on the number of years of schooling. Further, educational outcomes for maternal orphans are worse than for the nonorphans that they might live with regardless of the wealth status of the household.

The potential negative consequences of orphanhood may also be considered in the wider context of a single parent or blended family structure on children's educational and other outcomes. For example, McLanahan and Sandefur (1994) demonstrate that children growing up in single parent homes, and stepchildren, will not be as successful in education, work prospects and creating and maintaining a family as their peers growing up in a traditional nuclear family. Likewise, Gertler (2004) shows that children's educational advancement tends to be compromised if the parents are not married. Pollak and Ginther (2003) found that even joint biological children in a stable blended family do not fare better in educational outcomes than the stepchildren with whom they live. Amato (2005) provides evidence that children growing up with two continuously married

parents are less likely to experience a wide range of cognitive, emotional, and social problems, not only during childhood but also in adulthood.

Any statistical investigation into negative outcomes of orphanhood requires great care. First, a cross-sectional survey will not identify orphans who died before the survey, from AIDS or from neglect as a result of orphanhood. This is the potentially most devastating outcome, yet it cannot be observed because the child will not even appear in a mother's birth history. Furthermore, a measure of the educational equity gap between orphans and non-orphans may be blurred because the vulnerability of the child is likely to begin before the death of a parent, starting when there is a terminally ill adult in the household which already may disrupt prior routines such as school attendance (Ainsworth and Filmer 2006).

Second, reporting on orphans, particularly about events that may have happened in the past, may be inaccurate if the child has moved from one household to another. Children who do not live with both birth parents are likely to move more frequently McLanahan and Sandefur (1994). The caretaker or adult respondents may not know the child as well as a parent would. Third, parental deaths do not occur at random, with respect to the characteristics of the child. Children born into a generally less favorable set of circumstances may be somewhat more likely to be orphaned, as well as somewhat more likely to experience generally negative outcomes, leading to an association between orphanhood and outcomes that is not causal. This kind of selection effect provides a competing explanation of negative outcomes--if they are found--but is not an issue if negative outcomes are not found.

A fourth limitation, but one that is manageable, is that many of the outcomes for which there is a higher potential disadvantage for orphans are age-related. This is particularly true for education outcomes (Case and Ardington 2006). School attendance varies considerable by age, even within the 6-17 age range. Moreover, orphans do not have the same age distribution as non-orphans. Because the risk of becoming an orphan is cumulative, orphans systematically tend to be older than non-orphans. It is therefore essential to make detailed adjustments for age when comparing age-related outcomes for orphans and non-orphans.

In Sub-Saharan Africa, the allocation of orphans to the households of relatives has been greatly facilitated by a long tradition of fostering by the extended family[1]. Orphans are much more likely to reside with the extended family than to be placed in an orphanage or adopted by non-relatives. If just one parent has died, the orphan may remain with the surviving parent, but often single orphans, and especially double orphans, are taken in by relatives, typically aunts or uncles, or grandparents, or occasionally older siblings who have already formed households (Foster 2000, Monasch and Boerma 2004). For various reasons, many children who are *not* orphans do not live with their biological parents (Ainsworth 1996). Many of the same mechanisms that lead to the fostering of children with surviving parents also operate for orphans following the death of one or both parents.

Orphanhood and non-coresidence are fundamentally confounded with each other, especially in a context with high levels of fostering. To better ascertain the effects of each, it is desirable to distinguish between children who are living apart from their parents *because* their parents have

[1] A child is "fostered" if he or she is not living with either parent but has at least one living parent.

died and those who are living apart from their parents *even though* at least one parent is still living. In practice, there are limits to the accuracy of this distinction, because some of the children who are orphans may have been fostered *before* their parents died, and the parental deaths were not followed by a change of household.

The analysis will include an examination of the relative importance of the absence of the mother and the absence of the father. Some evidence that the absence of the mother is more damaging for educational outcomes was cited above. Anderson *et al*. (1999) show that men in Cape Town, South Africa invest the most in biological children who are of their current mate, and make intermediate levels of investment in biological children of previous mates and in stepchildren of current mates. Men make the weakest investment in stepchildren of previous mates. Using data from Ugandan nuclear households, Bishai *et al*. (2003) demonstrate the importance of the *number* of close relative caretakers in the home--the degree of biological relatedness--whereby the number is positively significantly related to a child's chance of survival for children with HIV+ mothers. Ainsworth and Filmer (2006) found that orphan status is a predictor of lower school enrollment, and that double orphans fared the worst, followed by maternal orphans and finally paternal orphans.

Glick and Sahn (1999) use data from Guinea (not specific to orphans) to show that, as elsewhere, education of parents is positively associated with children's education. The effect, however, depends on the gender of the child, especially with regards to mothers' education. While fathers' education has an effect on both girls' and boys' schooling, mothers' education has a strong effect on girls' school attainment and none on boys'.

Case et al. (2001) found that children raised by stepfathers or adopted fathers are not at greater risk for low educational attainment so long as the biological mother is present; however, children raised by a stepmother are at risk even if the biological father is present. Birth mothers, therefore, had a relatively more important role than birth fathers.

We will also consider the possible effects of orphans and nonorphans residing in the same household. Case et al. (2001) give evidence that birth children in mixed families (i.e., in families with stepchildren) do as well as children raised by both birth parents. In a subsequent paper, Case et al. (2004) found that orphans living with non-orphans, regardless of the household wealth standing, were less likely to be enrolled in school. This is consistent with Hamilton's rule whereby the closeness of biological ties govern altruistic behavior; non-orphans benefit from biological ties with adults in a way that non-orphans in the same household cannot. With regards to health care and stepchildren in the U.S., Case and Paxson (2000) found that fewer investments are made in stepchildren's health, unless birth children are also living in the household.

To summarize, this paper will focus on how orphanhood and/or fostering affect school enrollment. School enrollment is a measure of current status, contemporaneous with the measurements of orphanhood and fostering status. The goal is to identify how much of any negative effect of orphanhood on school enrollment can be attributed to orphanhood itself, that is, to the death of one or both parents, and how much might be attributed to non-coresidence with living parents. Data from 26 countries in Sub-Saharan Africa will be analysed, drawing on information from the most recent DHS household survey, conducted between 2003 and 2007.

Variables

Outcome variables

The primary interest for most DHS surveys is in the survey of women aged 15-49, but this research will only use the data in the household survey. The household survey lists all members of the sampled households, with their age and sex, which are used to identify eligible respondents for the survey of women, and often for a parallel survey of men. However, the household survey contains a great deal of information beyond age and sex. For our purposes, the most important additional information consists of the school enrollment of the school-age population; four questions about orphanhood and co-residence with parents for children aged 0-17; the type of place of residence; and the quintile of household wealth.

The only question about schooling in DHS household surveys that will be analysed here refers to whether the child is attending school. The binary outcome *In_school* will be coded 1 if the child is currently attending school (or attended during the current school year) and 0 otherwise.

Additional analysis has been conducted using the question about current grade, in which a binary outcome *Normal* is coded 1 if the child is at or above the standard grade for the child's age, and 0 if the child is below that standard grade or is not in school. Those results will not be included here because they are mostly similar to those for attendance but with much less evidence of systematic variation.

Explanatory variables

Orphanhood has a potential influence on educational status, especially if schooling is not compulsory or is only nominally compulsory. Parents, or other adults in the household, may be required to pay school fees or provide school uniforms, enroll the child, make sure that schoolwork is done, and so on. Orphanhood and non-coresidence with parents are described with four questions in the DHS household survey.

The first orphanhood/coresidence question asks whether the mother is still alive. If she is, a second question asks whether she is in the household. If she is in the household, her line number is coded. There are two similar questions about the father. It is not necessary for a co-resident parent to be the household head. These four questions are the basis for the constructed variables *Orphan_Type* and *Residence_Type*, as follows:

Orphan_Type
1 Both parents alive
2 Mother alive, father not
3 Father alive, mother not
4 Double Orphan

Residence_Type
1 Both parents in household
2 Mother in household, father not
3 Father in household, mother not
4 Neither parent in household

Many studies classify orphans into "maternal" and "paternal" orphans, defined simply by whether the mother has died or the father has died, respectively. Under that usage, the terms are not mutually exclusive. Maternal orphans are children with *Orphan_Type*=3 or 4; paternal orphans can have *Orphan_Type*=2 or 4. That is, under the alternative definitions, double orphans would be both maternal and paternal orphans. *Orphan_Type* is a typology with complete and mutually exclusive categories, an analytic advantage. *Residence_Type* also consists of complete and mutually exclusive categories.

These two variables can be synthesised as a composite variable, *Orphan_Residence_Type*, which consists of the nine (rather than 4x4=16) logically possible distinct pairings of *Orphan_Type* and *Residence_Type*. Table 1 shows how the nine possible combinations are linked to *Orphan_Type* and *Residence_Type*.

Orphan_Residence_Type
1 Living with both parents
2 Living with mother only; both alive
3 Living with father only; both alive
4 Living with neither; both alive
5 Living with mother, father dead
6 Living with neither, mother alive, father dead
7 Living with father, mother alive
8 Living with neither, father alive, mother dead
9 Both parents dead

Table 1. Categories of Orphan_Residence_Type: nine distinct combinations of Orphan_Type and Residence_Type.

	Residence_Type			
Orphan_Type	Both parents in household	Mother in hh, father absent	Father in hh, mother absent	Neither parent present
Both parents alive	1	2	3	4
Mother alive, father not	.	5	.	6
Father alive, mother not	.	.	7	8
Both parents dead	.	.	.	9

Orphan_Residence_Type is constructed in such a way that the confounding of orphanhood and non-coresidence is minimised, although not eliminated. Children in categories 1, 2, or 3 are neither orphaned nor fostered. Fostered children are in categories 4, 6, or 8. Orphaned children are in categories 5, 6, 7, 8, or 9. Children in categories 6 or 8 are *both* orphaned and fostered. For these children, negative outcomes could result from the loss of one parent or, alternatively, from non-coresidence with the surviving parent. Children in categories 2 or 3 are living with only one of their surviving parents, and are partially at risk of any negative consequences of non-coresidence.

As will be shown, in many countries some categories of *Orphan_Residence_Type* are not significantly different in terms of effects on school attendance. A slight simplification of this variable will be called *Symmetric_OR_Type* because it does not distinguish between mothers and fathers in terms of survival and co-residence. Its categories are listed and then identified in table 2 in terms of correspondence with *Orphan_Type* and *Residence_Type*.

Symmetric_OR_Type
1 Living with both parents
2 Living with one parent, both alive
3 Living with neither parent, both alive
4 Living with one parent, other parent dead
5 Living with neither parent, one parent alive
6 Both parents dead

Table 2. Categories of Symmetric_OR_Type: six combinations of Maternal_status and Paternal_status.

	Residence_Type			
Orphan_Type	Both parents in household	Mother in hh, father absent	Father in hh, mother absent	Neither parent present
Both parents alive	1	2	2	3
Mother alive, father not	.	4	.	5
Father alive, mother not	.	.	4	5
Both parents dead	.	.	.	6

The category labels give priority to co-residence, but the same categories would result if priority were given to parental survival, as follows:

Symmetric_OR_Type (equivalent definition)
1 Both parents alive, living with both
2 Both parents alive, living with one
3 Both parents alive, living with neither
4 One parent alive, living with that parent
5 One parent alive, not living with that parent
6 Both parents dead

Three of the categories of *Symmetric_OR_Type* are a pooling of two categories of *Orphan_Residence_Type*, one of which refers to the absence (by death or residence) of the father, and the other to the absence of the mother. If, say, *Symmetric_OR_Type* has the same explanatory power as *Orphan_Residence_Type*, then the absence of the father and the absence of the mother are statistically equivalent. However, if the two variables do not have the same explanatory power, then we would expect the absence of the mother to be consistently more important than the absence of the father, or the reverse.

For each of these constructed variables, category 1 is the natural reference category. For *Orphan_Type*, category 1 consists of children with both parents alive. The other three variables have the same reference category, a *subset* of the reference category for *Orphan_Type*: children who have both parents alive *and* are living with both of them. Comparisons of other categories with category 1 will identify differences associated with orphanhood, non-coresidence, or a combination of both.

A final explanatory variable is defined in terms of the composition of the children age 0-17 in the household. *Mixture_Type* has four categories:

Mixture_Type
1 Nonorphan living in a household with no orphans
2 Nonorphan living in a household with one or more orphans
3 Orphan living in a household with one or more nonorphans
4 Orphan living in a household with no nonorphans

As described earlier, there is evidence that orphans are at a disadvantage when they live with other children who are not orphans. The four complete and mutually exclusive categories of *Mixture_type* allow us to identify such an effect. The variable does not distinguish whether any of the surviving parents live in the same household as the child; it is defined solely in terms of whether the reference child, or other children in the household, have lost a parent. The reference category consists of nonorphans living only with other nonorphans.

Control variables

The risk of becoming an orphan, defined by the death of the biological parents, is cumulative. Transitions to becoming a single orphan and subsequently a double orphan are irreversible. Therefore, within any single cohort of children, the proportion who are orphans must increase monotonically with age.[2] The outcome variable is also related to age. Therefore it is necessary to have as detailed as possible a control for age. Age will be included in the analysis as a categorical variable, measured in single years, the finest level of detail in the DHS household surveys. The analysis is limited to ages 6-17 because 6 is the minimum age for school enrollment and 17 is the maximum age for the orphan and residence variables.

[2] Non-coresidence with a parent is reversible, if the parent is alive, but also tends to increase with age.

In the countries under study, the child's sex and type of place of residence are also important influences on school enrollment. Typically, girls are more likely to be enrolled in the early years, from approximately age 6 to age 12, but afterwards they drop out at a higher rate than boys. At the level of secondary or post-secondary schooling, students are predominantly boys. There is also more access to schools in more urban areas. Therefore controls for sex and place of residence will be included. Interactions between age and sex, and age and type of place are usually significant and will always be included.

An extremely powerful correlate of school attendance is household wealth. DHS has developed an indicator of this based on household possessions. It is defined slightly differently in different countries, but in each country has been coded into quintiles (hv270). Household wealth differs dramatically across the different types of household structures in which children live. It is probably an important mechanism through which parental death or absence may alter the probability that a child attends school. This variable will be included in some models. When it is included, any orphanhood and residence effects are net of the intervening role of household wealth.

Data

The countries included in this analysis are all of the 26 countries in Sub-Saharan Africa that conducted DHS surveys during the interval 2003-2007. Table 3 lists these countries, with recent estimates from the Population Reference Bureau and UNFPA of the population, adult HIV prevalence, primary school enrollment of girls and boys, and the percentage of the population in extreme poverty.

Some additional surveys could have been included but before 2003 most DHS surveys did not extend the parental survival and coresidence questions through age 17. The Burkina Faso survey, conducted in 2003, only extended the questions through age 14 but it is included here.

Some basic information from each survey is provided in tables 4 and 5, separately for ages 6-11 and 12-17, respectively. In each table, column c1 gives the percentage of children who are living with both parents, which is category 1 of *Residence_Type*, *Orphan_Residence_Type*, and *Symmetric_OR_Type*. Column c2 gives the percentage who are orphans, either single or double (categories 5, 6, 7, 8, 9 of *Orphan_Residence_Type*). Column c3 gives the percentage who are fostered, that is, who have at least one living parent but are not living with a parent (categories 4, 6, and 8 or *Orphan_Residence_Type*). As described earlier, c2 and c3 are not mutually exclusive; children who have one surviving parent but are not living with that parent will appear in both columns. Some children (those in categories 2 and 3 of *Orphan_Residence_Type*) are not included in c1, c2, or c3. However, these columns give a concise profile of the different household types in which children live.

Table 3. Overview of the 26 countries in Sub-Saharan Africa included in this analysis. A blank cell indicates that the percentage was not provided by the source.

Country	Mid 2008 Population*	Adult HIV Prevalence (%)*	Primary Enrollment, Females (%)**	Primary Enrollment, Males (%)**	Extreme Poverty (%)**
Benin	9,309,000	1.3	103	69	
Burkina Faso	15,213,000	2.1	51	35	61.2
Cameroon	18,468,000	6.0	98	84	33.4
Chad	10,111,000	3.4	87	53	
Congo	3,847,000	4.4	88		
Cote d'Ivoire	20,677,000	6.0	88	66	12.3
Ethiopia	79,087,000	2.4	85	57	31.3
Ghana	23,947,000	2.3			44.8
Guinea	10,302,000	1.2	75	51	
Kenya	37,954,000	6.7			26.5
Lesotho	1,801,000	23.9	99	108	43.1
Liberia	3,942,000	1.4	137	99	
Madagascar	18,912,000	0.1	104	100	49.1
Malawi	13,630,000	13.3	158	158	
Mali	12,716,000	1.5			72.8
Mozambique	20,387,000	10.3	98	73	37.9
Namibia	2,089,000	14.6	112	114	34.9
Niger	14,731,000	0.7	39	26	61.4
Nigeria	148,071,000	3.2			70.2
Rwanda	9,609,000	4.3	124	121	35.7
Senegal	12,688,000	0.4	78	68	26.3
Swaziland	1,129,000	26.3	128	121	
Tanzania	40,213,000	7.0	63	63	19.9
Uganda	29,194,000	7.9	146	136	
Zambia	12,197,000	15.4	81	76	63.7
Zimbabwe	13,481,000	26.0	98	95	36

* Source: Population Reference Bureau World Population Data Sheet
** Source: UNFPA Population and Reproductive Health Country Profiles, 2003

Across countries there is great variation in the percentages c1, c2, and c3. c1 is largest in the Benin 2006 survey--91% and 86% for the two age groups; c2 is largest in the Lesotho 2004 and Rwanda 2005 surveys, reaching 39% and 40% for ages 12-17; c3 is largest in the Namibia 2006/7 survey—36% and 42% for the two age groups. In most countries, c2 is less than c3, but there are several exceptions.

Columns c4, c5, and c6 in tables 4 and 5 give the percentages in the first three categories (c1, c2, and c3, respectively) who are currently attending school. A visual inspection shows vast differences in school enrollment from one country to another. If orphanhood and non-coresidence had no effects on the chance a child was attending school, then (except for compositional differences and sampling variation) each survey would give approximately the

same percentages in c4, c5, and c6. The tables show many differences between the percentages within the same survey but there is no clear pattern by which, say, children in category c2 or c3 are more likely or less likely than children in category c1 to be in school. Multivariate analysis, within each country, is required to clarify the pattern.

Table 4. The numbers of children age 6-11 in the 26 surveys, the percentages in different household types, and for each type, the percentage in school. DHS surveys 2003-2007.

code	survey	cases	c1	c2	c3	c4	c5	c6
1	Benin 2006	17542	90.8	8.2	0.4	61.9	58.9	40.3
2	Burkina Faso 2003	11755	73.8	8.9	10.8	29.0	30.2	32.9
3	Cameroon 2004	8814	53.3	11.3	20.0	78.9	85.1	86.9
4	Chad 2004	5765	69.7	9.2	11.1	39.5	49.3	47.3
5	Congo 2005	4873	49.4	9.3	18.4	85.6	88.6	87.6
6	Cote d'Ivoire 2005	3948	53.4	8.3	19.5	47.7	55.2	47.6
7	Ethiopia 2005	12820	71.3	11.9	9.3	32.0	38.5	37.9
8	Ghana 2003	4714	54.9	7.6	17.3	55.3	60.2	61.6
9	Guinea 2005	7878	64.5	8.2	15.9	43.0	47.0	44.5
10	Kenya 2003	6158	56.6	13.9	11.0	85.7	84.6	85.6
11	Lesotho 2004	5791	47.7	29.9	22.5	84.5	83.4	80.6
12	Liberia 2007	6414	46.8	7.4	24.2	31.3	30.2	29.1
13	Madagascar 2003/4	6757	63.7	8.1	15.0	83.9	74.3	78.4
14	Malawi 2004	11538	53.2	16.7	20.7	81.2	81.8	80.3
15	Mali 2006	14274	75.8	6.5	11.1	38.0	36.3	39.5
16	Mozambique 2003	11521	55.0	13.4	15.7	62.0	66.1	62.4
17	Namibia 2006/7	6404	25.7	18.4	36.4	82.0	91.0	86.9
18	Niger 2006	10034	66.2	7.4	11.1	40.6	39.2	36.6
19	Nigeria 2003	5851	68.4	8.9	13.0	65.9	74.8	72.1
20	Rwanda 2005	7965	57.7	22.4	11.5	78.1	80.1	75.3
21	Senegal 2005	11659	54.7	9.1	17.9	51.4	52.7	52.1
22	Swaziland 2006/7	3705	22.4	25.3	32.3	84.5	84.8	84.1
23	Tanzania 2004	8403	58.6	9.9	16.6	64.6	71.8	67.4
24	Uganda 2006	9232	50.3	16.7	20.6	81.8	82.9	83.9
25	Zambia 2007	6707	54.3	15.9	18.6	68.7	76.4	72.8
26	Zimbabwe 2005/6	7564	38.2	26.2	24.7	89.4	87.8	87.7

c1: percent of children who are living with both parents
c2: percent of children who are single or double orphans
c3: percent of children who are fostered
c4: of children living with both parents, the percent in school
c5: of children who are single or double orphans, the percent in school
c6: of children who are fostered, the percent in school

Table 5. The numbers of children age 12-171 in the 26 surveys, the percentages in different household types, and for each type, the percentage in school. DHS surveys 2003-2007. See table 4 for definitions of the columns.

code	survey	cases	c1	c2	c3	c4	c5	c6
1	Benin 2006	11715	85.5	13.3	0.7	64.2	92.0	40.3
2	Burkina Faso 2003*	5013	67.5	12.9	14.0	31.1	73.3	32.9
3	Cameroon 2004	4098	45.9	16.6	24.4	84.8	90.4	86.9
4	Chad 2004	4188	55.7	17.8	19.7	49.5	75.8	47.3
5	Congo 2005	4627	38.9	17.7	26.6	88.4	87.6	87.6
6	Cote d'Ivoire 2005	3306	39.8	15.3	32.6	50.8	76.4	47.6
7	Ethiopia 2005	5738	61.1	19.7	14.2	58.1	82.6	37.9
8	Ghana 2003	2350	45.1	12.5	22.9	73.8	90.2	61.6
9	Guinea 2005	3230	60.7	13.4	17.6	54.7	84.9	44.5
10	Kenya 2003	3057	51.0	17.8	14.8	88.1	92.2	85.6
11	Lesotho 2004	6227	40.8	39.1	23.1	83.7	79.6	80.6
12	Liberia 2007	4313	37.6	13.4	31.2	77.1	87.0	29.1
13	Madagascar 2003/4	3126	56.2	12.6	21.0	80.9	90.1	78.4
14	Malawi 2004	8338	43.4	26.3	25.9	85.3	82.9	80.3
15	Mali 2006	5696	70.3	10.0	15.0	47.4	85.7	39.5
16	Mozambique 2003	8715	42.4	22.6	24.0	79.7	83.2	62.4
17	Namibia 2006/7	6100	19.1	29.2	41.9	88.0	76.5	86.9
18	Niger 2006	3890	62.2	11.7	13.9	42.3	79.6	36.6
19	Nigeria 2003	2506	59.8	13.3	17.5	75.3	91.8	72.1
20	Rwanda 2005	7036	40.3	40.3	16.7	75.9	75.4	75.3
21	Senegal 2005	5388	50.0	14.1	21.6	55.4	83.7	52.1
22	Swaziland 2006/7	3571	20.1	35.5	32.3	86.4	78.6	84.1
23	Tanzania 2004	7214	47.3	17.2	24.9	81.3	85.9	67.4
24	Uganda 2006	7033	40.5	26.8	24.7	86.8	83.5	83.9
25	Zambia 2007	5239	39.1	29.1	28.3	88.7	82.5	72.8
26	Zimbabwe 2005/6	6376	31.1	35.6	27.5	80.9	77.5	87.7

* the highest age in the Burkina Faso survey is 14, rather than 17

Figure 1 summarizes each country's combination of c2 and c3 for ages 6-11 and 12-17 with a line segment. In that figure, the surveys are identified by the numerical code given in the left margin of tables 4 and 5. The two age groups in each survey refer to different birth cohorts, but they show higher levels of orphanhood and fostering for ages 12-17 than for 6-11, as would be expected for a single cohort.

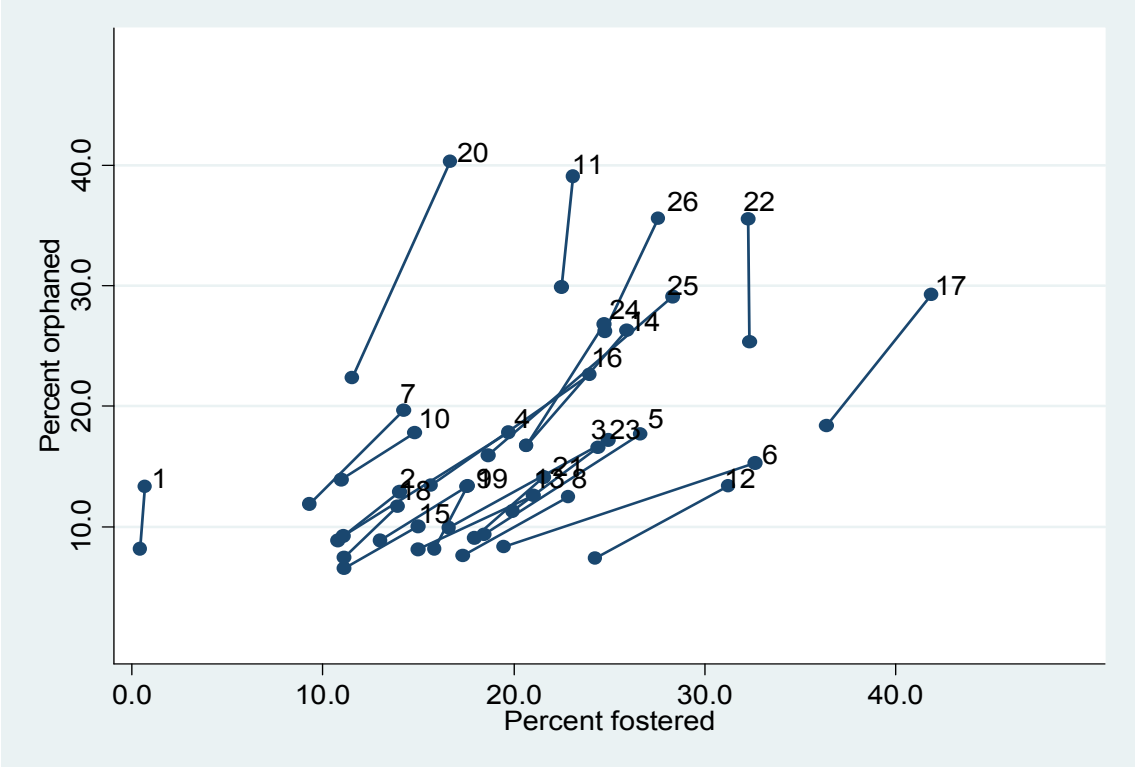

Figure 1. Scatterplot of the percentages of children age 6-11 who are orphaned or fostered (columns t2 and t3 in table 4), and the corresponding percentages for ages 12-17 (columns t2 and t3 in table 5). Country codes given on the figure match with the codes in tables 4 and 5.

The weighted distribution of *Mixture_Type* within each survey is given in table 6. In all surveys except Cote d'Ivoire 2005, the great majority of children are nonorphans living alone or exclusively with other nonorphans. In that survey, however, orphans are very broadly dispersed across households, so that most nonorphans live with at least one orphan. In most surveys, a majority of orphans live with nonorphans, rather than being concentrated in households that contain only orphans. The only exceptions to this rule are Ethiopia 2005, Kenya 2003, Madagascar 2003/4, and Rwanda 2005.

Table 6. Percentage distribution of children age 6-17 by their orphan status and the orphan status of any other children (age 0-17) in the household, within each of the 26 surveys.

	Nonorphans living with		Orphans living with	
survey	Nonorphans	Orphans	Nonorphans	Orphans
Benin 2006	81.5	8.3	6.3	4.0
Burkina Faso 2003	80.3	9.9	6.8	3.1
Cameroon 2004	78.6	8.6	7.5	5.4
Chad 2004	79.7	8.9	6.8	4.6
Congo 2005	79.8	15.5	10.9	2.8
Cote d'Ivoire 2005	30.1	57.7	11.9	0.3
Ethiopia 2005	82.2	4.2	5.4	8.2
Ghana 2003	85.0	5.9	4.9	4.2
Guinea 2005	80.5	9.6	6.8	3.3
Kenya 2003	79.5	5.2	6.2	9.3
Lesotho 2004	55.9	9.9	13.1	21.2
Liberia 2007	81.5	8.9	6.4	3.2
Madagascar 2003/4	84.8	4.6	4.4	6.2
Malawi 2004	69.2	10.0	10.7	10.1
Mali 2006	86.0	6.1	4.9	3.1
Mozambique 2003	73.1	10.7	10.0	6.3
Namibia 2006/7	55.9	20.6	18.3	5.2
Niger 2006	83.7	7.8	5.9	2.6
Nigeria 2003	84.6	5.8	4.8	4.7
Rwanda 2005	60.8	8.3	12.2	18.8
Senegal 2005	74.7	14.6	8.9	1.9
Swaziland 2006/7	47.3	21.7	21.8	9.2
Tanzania 2004	75.4	10.3	9.4	4.9
Uganda 2006	64.8	14.3	13.4	7.5
Zambia 2007	64.3	14.1	13.2	8.4
Zimbabwe 2005/6	55.6	13.4	16.0	15.1

Methods

For efficient data processing, the 26 surveys were pooled into a single file, but each survey is analysed separately. Logit regression is the main statistical technique because the outcome variable, *In_school*, is binary. All of the analysis was done with Stata 10.

A possible strategy to identify effects of orphanhood and/or non-coresidency, and to distinguish between them, would be to see whether the categories of *Orphan_Residence_Type* have statistically significantly different coefficients. This strategy was used in an earlier analysis of five of these DHS surveys (Pullum 2009) but we believe it is less conclusive than the strategy to be used here, because *Orphan_Residence_Type* cannot completely distinguish between orphanhood and non-coresidence. Some categories, particularly 6 and 8, involve both conditions, and categories 2 and 3 involve co-residence with only one of the two surviving parents.

The basic strategy of this paper is to compare nested models. Consider the following possible models, defined in terms of which explanatory variable is used:

Model 0: No explanatory variable included
Model 1: *Orphan_Residence_Type*
Model 2: *Orphan_Type*
Model 3: *Residence_Type*
Model 4: *Symmetric_OR_Type*
Model 5: *Mixture_Type*

Referring back to table 1, it is clear that *Orphan_Type*, *Residence_Type*, and *Symmetric_OR_Type* are all restricted versions of *Orphan_Residence_Type*, in which some categories of the latter variable are combined with one another. Therefore model 1 will always fit the same data at least as well models 0, 2, 3, or 4.

Orphan effects are implied if model 2 fits significantly better than model 0, and also if model 1 fits significantly better than model 3. The latter comparison, between models 3 and 1, is particularly important, because it implies that information about orphanhood *adds* significantly to information about residence. Similarly for residence effects, which are implied if model 3 fits significantly better than model 0, and also if model 1 fits significantly better than model 2.

The important hierarchical comparisons are as follows:

Test 1_0: Model 1 vs. Model 0
Test 2_0: Model 2 vs. Model 0
Test 3_0: Model 3 vs. Model 0
Test 4_0: Model 4 vs. Model 0
Test 5_0: Model 5 vs. Model 0
Test 1_2: Model 1 vs. Model 2
Test 1_3: Model 1 vs. Model 3
Test 1_4: Model 1 vs. Model 4.

The results of these tests will be used to develop the following classification scheme:

Orphan effects as indicated by test 2_0 and test 1_3
None: neither test is significant
Weak: test 2_0 is significant, but test 1_3 is not
Conditional: test 1_3 is significant, but test 2_0 is not
Strong: both tests are significant

Residence effects as indicated by test 3_0 and test 1_2
None: neither test is significant
Weak: test 3_0 is significant, but test 1_2 is not
Conditional: test 1_2 is significant, but test 3_0 is not
Strong: both tests are significant

These inferences from the comparisons of models will be briefly described, in terms of potential orphan effects. "None" means that *Orphan_Type* does not significantly improve our ability to predict whether a child is attending school, and *Orphan_Residence_Type* does not predict attendance any better than *Residence_Type*. "Strong" means that *Orphan_Type* does significantly improve our ability to predict whether a child is attending school, and *Orphan_Residence_Type* also predicts attendance better than *Residence_Type*. "Weak" means that that there appear to be orphan effects when *Orphan_Type* is used but that those effects are apparently due to information about non-coresidence that is confounded with orphanhood, because *Orphan_Residence_Type* does not add significantly to *Residence_Type*.

The "conditional" outcome is the reverse of "weak": there are no initial indications of orphan effects using *Orphan_Type*, but *Orphan_Residence_Type* adds significantly to *Residence_Type*. This is a logically possible outcome, and corresponds to the finding in a sequence of regressions that, say, a predictor *x1* is not significant unless included as an interaction with another predictor, *x2*. Although possible, this rarely happens in regression, and it happens only rarely here.

Orphan and residence effects are symmetric with respect to the mother and the father if test 1_0 is significant and test 1_4 is not significant, that is, if model 4 fits as well as model 1. In such a situation, *Symmetric_OR_Type* would be preferred to *Orphan_Residence_Type*. However, if *Orphan_Residence_Type* is significantly better, then there are three logical possibilities: the absence of the mother consistently has a more negative effect than the absence of the father; or the reverse (the absence of the father consistently has a more negative effect than the absence of the mother); or there is ambiguity in the relative importance of the two parents, in terms of the effect on school enrollment.

The analysis of *Mixture_Type*, in model 5, does not involve any comparisons other than with model 0. If that difference is statistically significant at the .01 level, then we infer that there are important differences between children, in their probability of attending school, that are related to the possible combinations of orphans and nonorphans in the same household.

All models and tests will be run with two different scenarios:

Scenario C: Includes controls for age (in single years), sex, type of place, and the interactions of age with sex and age with type of place

Scenario C+W: In addition to the controls in model C, includes the five-category variable for household wealth (hv270)

Scenario C simply adjusts for the rather complex way in which age, sex, and type of place are related to school attendance, as well as for their relationship with the explanatory variables. Scenario C+W also adjusts for the association between household structure (from the child's perspective) and the wealth of the household. If orphanhood and/or non-coresidence show effects in Scenario C+W, then they operate above and beyond the intervening role of household wealth. In general, weaker effects would be expected in Scenario C+W than in Scenario C.

Models will be estimated with adjustments for sampling weights (hv005) and for clustering (hv001). Because weights are used, coefficients are unbiased estimates of the population values,

and robust standard errors are calculated with Stata. An adjustment for clustering is made because otherwise the estimated standard errors would be somewhat too low and the risk of type I error would be somewhat larger than the nominal level (.01). Model selection will be done on the basis of the log of the likelihood function, comparing nested models[3]. When models have been corrected for design effects, the Wald chi-square cannot be used reliably for this purpose.

Two final comments will be made in anticipation of the results. The first comment concerns our focus on statistical significance at the rather arbitrary level of .01 and the omission of coefficients that do not reach that level. The more general practice is to present p-values and to show coefficients or odds ratios regardless of whether they meet the criterion for statistical significance. Our only reason has been to simplify the presentation. With 26 surveys and several constructed variables and models, the inclusion of all coefficients as well as p-values or standard errors would make it difficult to see the forest for the trees. We recognize the shortcomings of a focus on significance tests, in particular that significance is very dependent on the number of cases in a category.

As a second comment, the results are consistently phrased in terms of surveys rather than countries. The reason is simply to call repeated attention to the dependence of the findings upon the specific data sources, including their sample sizes and the dates of the surveys. Moreover, in the limited context of this paper it is not possible to go into related country-specific evidence that would provide context and background and a deeper interpretation of the findings. It is hoped that we or other researchers can undertake that task. The interest here is in a broad picture of similarities and differences across the 26 surveys.

Results

Orphan effects and residence effects

The strength of orphan effects and residence effects is indicated in table 7. The most comprehensive finding from our analytical strategy is that with only one exception (Scenario C+W for the Cameroon 2004 survey), the effect of non-coresidence is consistently "Strong". That is, *Residence_Type* is consistently significant and *Orphan_Residence_Type* consistently adds significantly to *Orphan_Type*.

By contrast, orphan effects are "Strong" for only ten surveys under Scenario C and eight surveys under Scenario C+W. Surveys that show highly significant effects under both scenarios are Guinea 2005, Liberia 2007, Mali 2006, Mozambique 2003, Nigeria 2003, Senegal 2005, and Zambia 2007.

Orphan effects are insignificant for six surveys under Scenario C and nine surveys under Scenario C+W. Surveys that show no significant evidence of orphan effects under either scenario are Ghana 2003, Kenya 2003, Namibia 2006/7, Swaziland 2006/7, and Tanzania 2004. Otherwise the orphan effects are generally "Weak", and least often "Conditional".

[3] If two nested models are equivalent, then -2 times the difference in the log likelihoods has a chi-square distribution with degrees of freedom equal to the difference in df for the two models.

In an earlier analysis of the Kenya 2003 survey, Mishra et al. (2005) found that "orphaned and fostered children age 6-14 are significantly less likely to be attending school than non-orphaned, non-fostered children of HIV-negative parents." The present analysis does not include HIV status of the parents, but suggests that after including controls for age, sex, and residence, the educational disadvantage noted by Mishra et al. is due to non-coresidence but not orphanhood.

Table 7. Patterns of statistically significant orphan effects and residence effects on school attendance in the 26 surveys, in logit regressions that include sex, type of place of residence, and single year of age.

	Scenario C		Scenario C+W	
survey	Orphan Effects	Residence Effects	Orphan Effects	Residence Effects
Benin 2006	Weak	Strong	Weak	Strong
Burkina Faso 2003	Strong	Strong	None	Strong
Cameroon 2004	Conditional	Strong	Conditional	Strong
Chad 2004	Conditional	Strong	None	None
Congo 2005	Weak	Strong	Weak	Strong
Cote d'Ivoire 2005	None	Strong	Strong	Strong
Ethiopia 2005	Strong	Strong	Weak	Strong
Ghana 2003	None	Strong	None	Strong
Guinea 2005	Strong	Strong	Strong	Strong
Kenya 2003	None	Strong	None	Strong
Lesotho 2004	Weak	Strong	Weak	Strong
Liberia 2007	Strong	Strong	Strong	Strong
Madagascar 2003/4	Weak	Strong	Weak	Strong
Malawi 2004	Weak	Strong	None	Strong
Mali 2006	Strong	Strong	Strong	Strong
Mozambique 2003	Strong	Strong	Strong	Strong
Namibia 2006/7	None	Strong	None	Strong
Niger 2006	Conditional	Strong	None	Strong
Nigeria 2003	Strong	Strong	Strong	Strong
Rwanda 2005	Weak	Strong	Weak	Strong
Senegal 2005	Strong	Strong	Strong	Strong
Swaziland 2006/7	None	Strong	None	Strong
Tanzania 2004	None	Strong	None	Strong
Uganda 2006	Weak	Strong	Weak	Strong
Zambia 2007	Strong	Strong	Strong	Strong
Zimbabwe 2005/6	Strong	Strong	Weak	Strong

The table in the Appendix gives the specific chi-square values for the nested tests of whether there are orphan effects (the test of whether *Orphan_Residence_Type* adds significantly to *Residence_Type*) or residence effects (the test of whether *Orphan_Residence_Type* adds significantly to *Orphan_Type*). All of these tests have 5 degrees of freedom. The ratio of the two chi-square values is also given. This ratio is not in itself a test statistic, but it gives a very

clear indication that orphan effects are almost always[4] statistically much less pronounced than residence effects, even when both are described as "Strong".

Joint orphan and residence effects

The statistical significance of these sets of effects does not in itself imply that orphanhood or non-coresidence is a disadvantage for the child; it is clearly necessary to look at the direction, as well as the magnitude, of specific effects. Tables 8 (for Scenario C) and 9 (for Scenario C+W) give the odds ratios for school attendance for *Orphan_Residence_Type*, with category 1 (nonorphans living with both parents) as the reference category. In order to make the tables easier to read, only odds ratios that are significant at the .01 level are shown. Also, in order to make the tables easier to read, odds ratios less than 1 are shown in bold type and those greater than 1 are in italics.

Cameroon 2004 and Nigeria 2003 are noteworthy because their significant odds ratios are always greater than 1. For both surveys, categories 2 and 5—in which the child lives only with the mother, whether or not the father is living—show an approximate doubling of the odds of attending school, relative to the reference category. Cameroon 2004 also shows similar positive effects for categories 4 and 8, in which the child is fostered and lives with neither parent, even though both, or just the father, are still alive. It seems likely that these positive effects can be attributed to an explicit strategy of placing a child in a household or location that will promote school attendance. In Namibia 2006/7, the only significant odds ratio is for category 5, in Scenario C+W, and it is also positive. In Senegal 2005, the only significant odds ratio is for category 2, in Scenario C, and it is positive.

With very few other exceptions, the significant odds ratios in these tables are much less than 1. The most consistent pattern, found in 16 surveys under Scenario C and 19 surveys under Scenario C+W, is that category 4—nonorphans who are fostered—show a very serious disadvantage with respect to school attendance. Even after adjusting for household wealth (in Scenario C+W), six surveys--Benin 2006, Cote d'Ivoire 2005, Madagascar 2003/4, Mozambique 2003, Rwanda 2005, and Uganda 2006—suggest approximately a 50% reduction in the odds of being in school if a child lives separately from two living parents. Categories 6, 8, and 9 show comparable penalties, although in fewer surveys, probably because of smaller numbers of cases in those categories. Together, categories 4, 6, 8, and 9 include all children who are living separately from both parents, whether or not the parents are living or dead.

Rwanda 2005 stands out as a survey in which almost all categories of *Orphan_Residence_Type* show a significant disadvantage relative to the reference category. In each scenario, five categories of *Orphan_Residence_Type* give odds of being in school that are less than half as great as in the reference category. As noted earlier, and for reasons that are well known, Rwanda has very high levels of orphanhood.

In tables 8 and 9, some surveys that showed strong orphan effects in tables 7 and A1 have few significant coefficients for the orphan categories (5-9) of *Orphan_Residence_Type*. The Cote

[4] The only exceptions are the Chad 2004 survey, scenario C+W, and in the Zambia 2007 survey, both scenarios.

d'Ivoire 2004 survey illustrates this seemingly contradictory pattern. With Version C+W, as shown in tables 7 and A1, there are strong orphan effects, but in table 9, not a single coefficient that refers to orphans was significant at the .01 level. Closer inspection of the coefficients of *Orphan_Residence_Type* in model 1 that describe orphans has shown that several of them are individually significant at a less demanding level, but confirmed that none of them reached the .01 level.

Table 8. Odds ratios for Orphan_Residence_Type categories 2-9, with category 1 as reference category. Blank if not significant at the .01 (two-tailed) level. Odds ratios <1 are in bold type. Odds ratios >1 are in italics. See table 1 for definitions of categories. Model 1, Scenario C.

survey	2	3	4	5	6	7	8	9
Benin 2006			**0.48**	**0.82**				**0.61**
Burkina Faso 2003			**0.68**					
Cameroon 2004	*2.69*		*1.72*	*1.80*			*2.06*	
Chad 2004								
Congo 2005			**0.69**	**0.51**				
Cote d'Ivoire 2005			**0.66**					
Ethiopia 2005			**0.61**		**0.61**		**0.40**	**0.57**
Ghana 2003					**0.47**			
Guinea 2005								**0.43**
Kenya 2003								
Lesotho 2004			**0.52**	**0.77**	**0.49**			**0.56**
Liberia 2007			**0.72**			**0.50**		
Madagascar 2003/4	**0.69**	**0.56**	**0.50**		**0.49**	**0.49**		
Malawi 2004	**0.72**		**0.67**					**0.66**
Mali 2006			**0.68**				**0.33**	
Mozambique 2003			**0.62**		**0.58**		**0.43**	**0.42**
Namibia 2006/7								
Niger 2006		**0.67**	**0.74**					
Nigeria 2003	*2.09*			*2.05*				
Rwanda 2005		**0.52**	**0.49**	**0.75**	**0.36**	**0.63**	**0.38**	**0.43**
Senegal 2005		*1.47*						
Swaziland 2006/7								
Tanzania 2004			**0.67**		**0.67**			
Uganda 2006			**0.65**	**0.73**	**0.49**		**0.50**	**0.64**
Zambia 2007	**0.72**						**0.47**	
Zimbabwe 2005/6	*1.37*		**0.68**		**0.69**	**0.50**		**0.62**
Summary	3+,3-	1+,3-	1+,16-	2+,5-	9-	4-	1+,6-	9-

In table 9, when the effects for the orphan categories are significant, they are consistently negative, with only two exceptions: category 5 in Namibia 2006/7 and Nigeria 2003 are positive. The children in category 5 have lost their father and are living with their mother. We hypothesize that in those surveys, children in this condition tend to have moved into another household, along with the mother, in which education is promoted. This hypothesis could be investigated by examining the relationship of the children to the household head (hv101).

There are a few surveys, such as Benin 2006, for which some of the orphan categories, particularly categories 5 and 7 of *Orphan_Residence_Type*, are individually significant but collectively they do not satisfy the criterion for strong orphan effects. It would certainly be appropriate to investigate these conditions further but, again, this cannot be done here.

Table 9. Odds ratios for Orphan_Residence_Type (ort) categories 2-9, with category 1 as reference category. Blank if not significant at the .01 (two-tailed) level. Odds ratios <1 are in bold type. Odds ratios >1 are in italics. See table 1 for definitions of categories. Model 1, Scenario C+W.

survey	2	3	4	5	6	7	8	9
Benin 2006			**0.43**		**0.27**			**0.54**
Burkina Faso 2003			**0.64**					
Cameroon 2004	*2.46*		*1.40*					
Chad 2004								
Congo 2005			**0.63**	**0.55**				**0.47**
Cote d'Ivoire 2005			**0.53**					
Ethiopia 2005			**0.56**		**0.60**		**0.43**	**0.58**
Ghana 2003					**0.45**			
Guinea 2005			**0.67**					**0.34**
Kenya 2003			**0.56**		**0.45**		**0.37**	
Lesotho 2004			**0.57**		**0.54**			**0.62**
Liberia 2007			**0.64**					
Madagascar 2003/4		**0.62**	**0.45**		**0.47**			
Malawi 2004			**0.72**					**0.70**
Mali 2006			**0.63**					
Mozambique 2003			**0.52**		**0.49**		**0.35**	**0.38**
Namibia 2006/7				*1.62*				
Niger 2006	*1.37*	**0.64**	**0.74**					
Nigeria 2003	*2.01*			*1.94*				
Rwanda 2005		**0.50**	**0.45**	**0.80**	**0.33**		**0.37**	**0.41**
Senegal 2005								
Swaziland 2006/7			**0.70**					
Tanzania 2004			**0.59**		**0.62**			
Uganda 2006			**0.54**		**0.46**		**0.47**	**0.63**
Zambia 2007	**0.71**						**0.48**	**0.65**
Zimbabwe 2005/6	*1.33*		**0.63**		**0.65**	**0.53**		**0.60**
Summary	4+,1-	3-	1+,19-	2+,2-	11-	1-	6-	11-

Relative importance of the mother and the father

For any specific type of indicator of child welfare, such as school attendance, it is possible that the mother and the father have different functions, and therefore their absence—from either death or non-coresidence--can have different impacts on the outcome. It would be possible to test whether there is a statistically significant difference in the coefficients for categories 2 and 3 of *Orphan_Type* or categories 2 and 3 of *Residence_Type*. The strategy used here will be

somewhat different, as part of the general effort to minimize the confounding of orphanhood and non-coresidence; we will look for asymmetries in the categories of *Orphan_Residence_Type*.

Earlier the variable *Symmetric_OR_Type* was constructed by combining three pairs of categories of *Orphan_Residence_Type*: categories 2 and 3, 5 and 7, 6 and 8. The two variables will have the same explanatory power if there is no significant difference between the two categories in each pair. In the 2-3 pair, both parents are alive but the child lives only with the mother or the father, respectively. In the 5-7 pair, the child is a single orphan living with the only surviving mother—the mother or the father, respectively. In the 6-8 pair, the child is a single orphan living with neither parent, but the surviving parent is the mother or the father, respectively.

Thus, within each of the three pairs of categories, the first category refers to the absence (by death or non-coresidence) of the father and the second refers to the absence of the mother. We can identify four possible comparisons between model 1 (*Orphan_Residence_Type*) and model 4 (*Symmetric_OR_Type*), which are only relevant when there are both strong orphan effects and strong residence effects, that is, when model 1 fits significantly better than models 0, 2, and 3:

Symmetric: model 1 does not fit significantly better than model 4. It makes no difference whether it is the mother or the father who is absent.

Mother dominant: model 1 fits significantly better than model 4 and the effects for *Orphan_Residence_Type* categories 3, 7, and 8 are consistently *less than* the effects for categories 2, 5, and 6, respectively. The absence of the mother is consistently more damaging, for this outcome, than the absence of the father.

Father dominant: model 1 fits significantly better than model 4 and the effects for *Orphan_Residence_Type* categories 3, 7, and 8 are consistently *larger than* the effects for categories 2, 5, and 6, respectively. The absence of the father is consistently more damaging, for this outcome, than the absence of the mother.

Ambiguous: model 1 fits significantly better than model 4 but the effects for *Orphan_Residence_Type* categories 3, 7, and 8 are not consistently different, in direction, from the effects for categories 2, 5, and 6, respectively. Two of the three differences indicate that one parent is more important and the third indicates that the other parent is more important.

This classification is made without statistical tests of the differences between pairs of coefficients, but just using the signs of the differences.

Table 10 is an amplification of table 7 for just those surveys and scenarios that showed both strong orphan effects and strong residence effects. For each of those surveys/scenarios, we determine whether there is evidence that the effects are symmetric with respect to the mother and father, or mother dominant, father dominant, or ambiguous, according to the preceding description. Of those 18 situations, 8 are symmetric, that is, *Symmetric_OR_Type* fits the data just as well as the more detailed *Orphan_Residence_Type*. Guinea 2005 and Mozambique 2003, in particular, stand out as settings in which there is no evidence that the absence of the mother or of the father is more important for school attendance, whether or not household wealth is

included in the model. The other 10 situations are approximately equally divided between four in which the absence of the mother is more critical and six in which the evidence of the relative importance of the mother and father is mixed, or ambiguous. In Nigeria 2003, the absence of the mother is consistently more damaging than the absence of the father, whether or not household wealth is included in the model. There are no situations in which the coefficients consistently imply that the absence of the father is more critical than the absence of the mother.

Table 10. Evidence that the absence of the mother or the absence of the father is more critical for school attendance. Limited to the surveys and scenarios that showed (in table 10) both strong orphan effects and strong residence effects ("—" indicates that this condition does not apply).

survey	Scenario C	Scenario C+W
Burkina Faso 2003	Ambiguous	--
Cote d'Ivoire 2005	--	Symmetric
Ethiopia 2005	Symmetric	--
Guinea 2005	Symmetric	Symmetric
Liberia 2007	Ambiguous	Mother dominant
Mali 2006	Symmetric	Ambiguous
Mozambique 2003	Symmetric	Symmetric
Nigeria 2003	Mother dominant	Mother dominant
Senegal 2005	Symmetric	Ambiguous
Zambia 2007	Ambiguous	Ambiguous
Zimbabwe 2005/6	Mother dominant	--

Mixtures of orphans and nonorphans

The final explanatory variable is *Mixture_Type*, which was constructed to help clarify whether orphans are at a disadvantage when they are in the same household as nonorphans. The reference category consists of nonorphans living only with nonorphans, and all three of the other possible combinations of orphans and nonorphans are compared with that category. Results of logit regressions of *In_school* on *Mixture_Type* under scenarios C and C+W are presented in table 11 in terms of odds ratios that are significant at the .01 level. Two patterns, involving many surveys, clearly emerge. First, in many of the surveys (11 under Scenario C and 12 under Scenario C+W) there is a significant disadvantage for orphans who are living with nonorphans (category 3 of *Mixture_Type*). When significant, the reduction in the odds of attending school is usually in the range of 20% to 40% for these children, compared with the reference category.

The second pattern, seen in fewer surveys, is that nonorphans living with orphans (category 2) show an *advantage* when compared with the reference category. This pattern could be a result of the selective tendency to place orphans in households that are more prosperous than average, and that possibility is supported by the reduction of surveys showing this pattern from 8, in Scenario C, to 4, under Scenario C+W. The four surveys that continue to show the pattern in Scenario C+W are Cote d'Ivoire 2005, Malawi 2004, Namibia 2006/7, and Zambia 2007. For these

surveys, the odds of attending school are increased by 30% to 74% for nonorphans who live with orphans. None of these surveys shows the other pattern--a disadvantage for orphans living with nonorphans (category 3)--providing further evidence that in these countries there is a pronounced tendency to place orphans in relatively more prosperous households.

Table 11. Odds ratios for Mixture_Type (m) categories 2-4, with category 1 as reference category. Blank if not significant at the .01 (two-tailed) level. Odds ratios <1 are in bold type. Odds ratios >1 are in italics.

	Scenario C			Scenario C+W		
survey	m=2	m=3	m=4	m=2	m=3	m=4
Benin 2006	*1.21*	**0.78**			**0.71**	
Burkina Faso 2003					**0.76**	
Cameroon 2004						
Chad 2004	*1.84*	*1.59*				
Congo 2005		**0.70**			**0.69**	
Cote d'Ivoire 2005	*1.66*	*1.60*		*1.55*		*2.42*
Ethiopia 2005		**0.67**			**0.65**	
Ghana 2003						
Guinea 2005						
Kenya 2003						
Lesotho 2004		**0.68**			**0.72**	
Liberia 2007						
Madagascar 2003/4		**0.59**				**0.65**
Malawi 2004	*1.51*			*1.41*		
Mali 2006		**0.56**			**0.59**	
Mozambique 2003	*1.29*		**0.71**		**0.76**	**0.71**
Namibia 2006/7	*1.68*			*1.74*		
Niger 2006						
Nigeria 2003			*2.03*			*1.92*
Rwanda 2005		**0.57**	**0.74**		**0.55**	**0.77**
Senegal 2005		**0.74**			**0.74**	
Swaziland 2006/7						
Tanzania 2004		**0.77**			**0.76**	
Uganda 2006	*1.29*	**0.72**	**0.73**		**0.69**	
Zambia 2007	*1.45*			*1.30*		
Zimbabwe 2005/6		**0.73**			**0.72**	
Summary	8+	2+,11-	1+,3-	4+	12-	2+,3-

m=1 Nonorphan with nonorphans only
m=2 Nonorphan with mix
m=3 Orphan with mix
m=4 Orphan with orphans only

Conclusions

The initial motivation for this research was a desire to detect potential disadvantages of orphans with respect to outcomes such as school attendance. As described in the introduction, such a disadvantage has been reported for several countries in Sub-Saharan Africa. The most obvious direct effect of orphanhood is the absence of one or both parents from the child's household. In much of Sub-Saharan Africa, a high percentage of children live separately from their parents, regardless of orphanhood. The motivation then shifted to a desire to detect potential disadvantages of children living separately from their parents, whether because of orphanhood or for other reasons.

In virtually all of the surveys (the exception is Chad 2004, for Scenario C+W), there are strong effects on school enrollment if the child lives separately from parents. These effects are positive in four surveys (Cameroon 2004, Namibia 2006/7, Nigeria 2003, and Senegal 2005), indicating the selective placement of children in households where schooling is promoted. Otherwise, information about non-coresidence always adds significantly to information about orphanhood status in a *negative* way.

If the child has two living parents but is living with neither of them (category 4 of *Orphan_Residence_Type*), the implications for schooling are especially damaging in most surveys. In Scenario C+W, which adjusts for household wealth, the most significant educational deficits are for children who have at least one living parent but are not living with any parent (categories 4, 6, and 8)—and for double orphans.

There is much more variation in whether orphanhood adds statistically significant information to residence status, but when it does add, the effects are almost always negative. Eight surveys that show highly significant effects, whether or not adjusted for household wealth, are Guinea 2005, Liberia 2007, Mali 2006, Mozambique 2003, Nigeria 2003, Senegal 2005, and Zambia 2007. In Nigeria 2003 (as in Namibia 2006/7, Scenario C+W) the only effect that is individually significant is for paternal orphans living with the mother. For them the odds of being in school are greater than for the reference category, indicating a net educational advantage, rather than disadvantage, but otherwise the effects of orphanhood, when significant, are negative.

Focusing on the surveys and models in which both residence effects and orphan effects are strong, the effects are sometimes symmetric or balanced with respect to the whether it is the mother or the father who is absent. Guinea 2005 and Mozambique 2003 are examples of this pattern. In Nigeria 2003, the absence of the mother is consistently more damaging than the absence of the father. The evidence that one parent is more critical than the other is often ambiguous, but it is never found that the absence of the father is consistently more damaging than the absence of the mother.

In about half of the surveys, orphans who live in a household with nonorphans are significantly disadvantaged relative to nonorphans who live only with nonorphans, a pattern that was noted in the literature review and could be expected. However, in about half of the surveys, this pattern is *not* statistically significant. There are only a few surveys, such as Mozambique 2003 and Rwanda 2005, in which orphans living only with other orphans are significantly disadvantaged

relative to nonorphans living only with nonorphans. Several surveys, particularly Cote d'Ivoire 2005, Malawi 2004, Namibia 2006/7, and Zambia 2005/6, show evidence that orphans tend to be placed in households that promote education, even after adjusting for household wealth.

Expanding on the latter observation, in some countries, the absence of negative educational consequences for orphans may be due to a tendency for them to be placed in households, within the extended family, that are relatively better able to care for them. This kind of compensating effect could vanish if such households cease to be available. Foster (2000) identified potential early signs of extended families becoming saturated with absorbing an increasing number of orphans and vulnerable children, namely by the change in the choice of substitute caregiver (e.g., fostering by older grandparents instead of by a sibling), the establishment of child-headed households, and sibling dispersal and migration. On the other hand, Monasch and Boerma (2004) did not find consistent evidence of absorption capacity waning among extended family members, but they identified a risk of orphans living in households with less favorable demographic characteristics, namely female-headed households with less earning potential, larger households with a weaker dependency ratio, and households with an older head of household. These factors are further associated with lower school attendance.

Among the economic determinants identified by Ainsworth (1996) for fostered children age 7-14 years in Cote d'Ivoire, poverty of the sending family was surprisingly not significant. Rather, Ainsworth found evidence of demand from host households for labor, whereby foster children perform more housework than birth children and, although the host household is likely to invest in a foster child's upkeep and education, the investments are overall less than for biological children in the same household (about the same investment for the foster child as for biological girls, but less than that for biological boys).

Zimmerman (2003), on the other hand, found evidence in South Africa (which unfortunately did not have a DHS survey suitable for inclusion in our analysis) that increased human capital is an incentive for families to foster out children. He further found that for children fostered out to families with close relatives, resources invested in these children were equal to those invested in biological children, whereas those fostered to distant relatives suffered the 'Cinderella effect'. Building on these economic models, Cichello (2003), also showed that in KwaZulu-Natal, children fostered to distant relatives had lower enrollment rates, but this did not prove to have long-term negative effects on overall school progress achieved.

The main strategy used in this paper—a comparison of nested models--could be applied to other child outcomes. A major advantage of the approach for school attendance has been that this outcome is a current status. It is also the principal outcome that is available in the household survey. The DHS surveys do not normally include information about the duration of orphanhood or non-coresidence. Most other child outcomes are limited to children younger than age 5, and are typically collected in the survey of women, rather than households, so they are missing for orphans. Unicef's Multiple Indicator Cluster Surveys (MICS) would be an alternative data source, because in its design more child outcomes are collected within the household survey. It is hoped that the comparative framework used in this paper will encourage the broader application of models and explanations that have tended to be country-specific.

Bibliography

Ainsworth, Martha. 1996. Economic Aspects of Child Fostering in Côte d.Ivoire. In *Research in Population Economics, Vol. 8.* Editor T. Paul Schultz. JAI Press Inc.

Ainsworth, M., Beegle K., and Koda G., 2005. The Impact of Adult Mortality and Parental Deaths on Primary Schooling in North-Western Tanzania. *Journal of Development Studies* 41(3) 412–39.

Ainsworth, M. and Filmer D. 2006. Orphanhood, Poverty, and School Enrollment. *Human Development and Public Services Research*. World Bank Research Brief http://econ.worldbank.org/wbsite/external/extdec/extresearch/

Amato, P.R. 2005. The Impact of Family Formation Change on the Cognitive, Social, and Emotional Well-Being of the Next Generation. *Future of children,* 15 (2)75-96.

Anderson, K.G., Kaplan, H, Lam, D., Lancaster, J. 1999. Paternal care by genetic and stepfathers: Reports by Xhosa high school students. *Evolution and Human Behavior*, 20: 433-451.

Beegle K., De Weerdt J.D., and Dercon S. 2006. Orphanhood and the long-run impact on children. *American Journal of Agricultural Economics*, 88(5) 1266-1272.

Bicego, G., Rutstein S., and Johnson K. 2003. Dimensions of the emerging orphan crisis in sub-Saharan Africa. *Social Science and Medicine* 56(6) 1235-1247.

Bishai, David, El Daw Suliman, Heena Brahmbhatt, Fred Wabwire-Mangen, Godfrey Kigozi, Nelson Sewankambo, David Serwadda, Maria Wawer, Ron Gray. 2003. Does Biological Relatedness Affect Survival? *Demographic Research, Volume 8*.

Case A., and Ardington C., 2006. The impact of parental death on school outcomes: Longitudinal evidence from South Africa. *Demography*, 43(3) 401-420

Case, Anne and Christina Paxson. 2001. Mothers and Others: Who Invests in Children's Health? *Journal of Health Economics*, 20(3), 301-328.

Case, A., Paxson C., and Ableidinger, J. 2004. Orphans in Africa: Parental Death, Poverty and School Enrollment. *Demography* 41(3): 483-508

Case A., Lin I.F., and McLanahan S., 2001. Educational attainment of siblings in stepfamilies. *Evolution and Human Behavior*, 22(4) 269-289.

Castle, Sarah E. 1995. Child Fostering and Children's Nutritional Outcomes in Rural Mali: The Role of Female Status in Directing Child Transfers. *Social Science and Medicine*, 40(5), 679-693.

Cichello, Paul L. 2004. Child Fostering and Human Capital Formation in KwaZulu-Natal: An Economist's Perspective. *Social Dynamics*, 29(2).

Deleire T., and Kalil A., 2002. Good things come in threes: Single-parent multigenerational family structure and adolescent adjustment. *Demography*, 39(2) 393–413.

Downey, D. 1994. The school performance of children in single-mother and single-father families: Economic or interpersonal deprivation. *Journal of Family Issues*, 15(1) 129-147.

Eloundou-Enyegue, Parfait M. and David Shapiro. 2004. Are African Families Becoming Overextended? A Historical Analysis of the Effects of Family Extension on Schooling Inequalities in Cameroon.. Paper presented at 2004 Population Association of America Annual Meetings, Boston, MA.

Evans D.K., and Miguel E., 2007 Orphans and Schooling in Africa: A longitudinal analysis. *Demography***.** 44(1)35-57.

Foster, G. 2000. The capacity of the extended family safety net for orphans in Africa. *Psychology, Health, and Medicine*, 5(1)55-63.

Foster, G., and Williamson, J. 2000. A review of current literature of the impact of HIV/AIDS on children in sub-Saharan *AIDS 2000*, 14 (suppl. 3):275-284.

Gertler P., Levine D.I., and Ames M. 2004. Schooling and Parental Death. *The Review of Economics and Statistics*, 86(1) 211-225.

Ginther, Donna K. and Robert A. Pollak. 2003. Does Family Structure Affect Children's Educational Outcomes?. NBER Working Paper 9628.

Glick P and Sahn D.E. 2000. Schooling of girls and boys in a West African country: the effects of parental education, income, and household structure. *Economics of Education Review*, 19(1) 63-87.

Isiugo-Abanihe, Uche. 1985. Child Fosterage in West Africa. *Population and Development Review* 11(1), 53-73.

Kobiané J.F, Calvès A., and Marcoux, R., 2005. Parental Death and Children's Schooling in Burkina Faso. *Comparative Education Review*, 49(4) 468-489.

Lloyd, Cynthia B. and Ann K. Blanc. 1996. Children's Schooling in sub-Saharan Africa: The Role of Fathers, Mothers, and Others. *Population and Development Review*, 22(2), 265-298.

Lloyd C.B., and Gage-Brandon A.J. 1992. Does sibsize matter? Implications of family size for children's education in Ghana" Presented at the Annual Meeting of the Population Association of America, Denver, Colorado, April 30 - May 2, 1992.

Manning, W.D., and Lamb K.A. 2004. Adolescent Well-Being in Cohabiting, Married, and Single-Parent Families. *Journal of Marriage and Family*, 65(4) 876 – 893.

McLanahan, Sara and Gary Sandefur. 1994. *Growing Up with a Single Parent: What Hurts, What Helps*. Harvard University Press, Cambridge, MA.

Mishra, Vinod, Fred Arnold, Fredrick Otieno, Anne Cross, and Rahavuth Hong. 2005. Education and nutritional status of orphans and children of HIV-infected parents in Kenya. *DHS Working Paper #24*. ORC Macro.

Monasch R., and Boerma J.T. 2004. Orphanhood and childcare patterns in sub-Saharan Africa: an analysis of surveys from 40 countries. *AIDS*. 18 Supplement 2:55-65.

Ntozi, J.P 1997. Widowhood, remarriage and migration during the HIV/AIDS epidemic in Uganda. *Health Transition Review, Supplement to Volume 7,*125-144.

Nyambedha E.O., Wandibba S., and Aagaard-Hansen. 2003. Changing patterns of orphan care due to the HIV epidemic in western Kenya. *Social Science & Medicine*, 57(2) 301-311.

Nyamukapa C, and Gregson, S., 2004. Extended families and women's roles in safeguarding orphans' education in AIDS-afflicted rural Zimbabwe. *Social Science and Medicine*, 60(10)2155-2167.

Page, Hilary J. 1989. Childbearing vs. Childrearing: Coresidence of Mother and Child in sub-Saharan Africa. In *Reproduction and Social Organization in Sub-Saharan Africa*. Editor Ron J. Lesthaeghe. University of California Press, Berkeley, CA.

Pollak Robert A. and Ginther, Donna K. 2003. Does Family Structure Affect Children's Educational Outcomes?. NBER Working Paper 9628.

Pullum, Thomas W. 2007. Orphanhood in Malawi, 2004-2006. Report prepared for the Malawi Ministry of Women and Child Development, with UNICEF support. In press.

Schaal, S. and Elbert T. 2006. Ten Years After the Genocide: Trauma Confrontation and Posttraumatic Stress in Rwandan Adolescents. *Journal of Traumatic Stress* 19 (1) 95-105.

Sear R., Steel F., McGregor I.A., and Mace R. 2002. The effects of kin on child mortality in rural Gambia. *Demography*, 39(1) 43-63.

Sharma, M.P. 2006. Orphanhood and Schooling Outcomes in Malawi, *American Journal of Agricultural Economics*, 88(5) 1273 – 1278.

Steelman, L., Powell B, Werum R and Carter S. 2002 Reconsidering the effects of sibling configuration: Recent Advances and Challenges. *Annual Review of Sociology*, 28: 243-269.

United Nations. 2006. World Population wall chart.

United Nations. 2007. World Mortality wall chart.

USAID, UNICEF and UNAIDS. 2002. *Children on the Brink 2002: A Joint Report on Orphan Estimates and Program Strategies,* Washington DC: USAID.

Zimmerman, Frederick J. 2003. Cinderella Goes to School: The Effects of Child Fostering on School Enrollment in South Africa. *Journal of Human Resources* 38(3), 557-590.

Appendix

Table A1. Chi-square values for test 1_3 and test 1_2, which test whether Orphan_Residence_Type adds significantly to Residence_Type or Orphan_Type, respectively, and the ratio of the first chi-square value to the second one. These chi-square statistics have five degrees of freedom and the .01 critical value is 15.09.

	Scenario C			Scenario C+W		
survey	Orphan Effects	Residence Effects	Ratio	Orphan Effects	Residence Effects	Ratio
Benin 2006	3.1	22.2	0.14	4.5	30.9	0.14
Burkina Faso 2003	20.7	47.0	0.44	13.8	61.8	0.22
Cameroon 2004	23.5	189.7	0.12	24.3	141.4	0.17
Chad 2004	15.4	36.0	0.43	8.5	5.0	1.70
Congo 2005	8.1	30.7	0.26	6.2	31.9	0.20
Cote d'Ivoire 2005	11.8	70.1	0.17	16.8	117.8	0.14
Ethiopia 2005	16.2	85.1	0.19	10.1	107.9	0.09
Ghana 2003	13.5	30.3	0.44	8.7	33.2	0.26
Guinea 2005	17.6	27.2	0.65	22.8	44.5	0.51
Kenya 2003	5.9	22.9	0.26	5.0	38.5	0.13
Lesotho 2004	4.4	93.6	0.05	5.3	73.7	0.07
Liberia 2007	38.4	53.6	0.72	32.7	67.9	0.48
Madagascar 2003/4	4.0	109.8	0.04	2.4	116.2	0.02
Malawi 2004	5.5	78.6	0.07	6.7	41.6	0.16
Mali 2006	44.7	91.7	0.49	27.6	110.3	0.25
Mozambique 2003	22.2	154.9	0.14	19.8	247.5	0.08
Namibia 2006/7	3.8	25.3	0.15	6.3	31.5	0.20
Niger 2006	16.6	69.4	0.24	14.6	86.6	0.17
Nigeria 2003	24.9	60.9	0.41	20.9	45.8	0.46
Rwanda 2005	13.0	141.8	0.09	11.3	177.4	0.06
Senegal 2005	34.1	53.9	0.63	29.1	51.7	0.56
Swaziland 2006/7	5.9	26.2	0.23	5.1	27.0	0.19
Tanzania 2004	2.7	53.2	0.05	5.0	94.9	0.05
Uganda 2006	14.6	61.0	0.24	10.1	97.3	0.10
Zambia 2007	24.9	23.9	1.05	24.4	26.5	0.92
Zimbabwe 2005/6	16.1	72.7	0.22	10.5	85.3	0.12