School Proximity and Child Labor
Evidence from Rural Tanzania

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ABSTRACT

Is improved school accessibility an effective policy tool for reducing child labor in developing countries? We address this question using microdata from rural Tanzania and a regression strategy that attempts to control for nonrandom location of households around schools as well as classical and nonclassical measurement error in self-reported distance to school. Our analysis shows that school proximity leads to a rise in school attendance but no significant fall in child labor.

I. Introduction

Child labor is a pervasive phenomenon. The most recent global estimates from the International Labor Office (2006) show that, as of 2004, there were around 191 million children aged five to 14 in economic activity worldwide, around one-sixth of the child population. Sub-Saharan African children are at disproportionate risk of being classified as economically active, with approximately 26 percent of children working.

A major concern regarding child labor is that credit constraints or the absence of positive bequests might lead to a suboptimal level of human capital accumulation among low-income households, perpetuating an intergenerational poverty trap (Ba-

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land and Robinson 2000; Edmonds 2008). In addition, even if child labor does not come to the detriment of schooling (and in fact it might lead to the acquisition of skills that are valuable later in life) and despite no evidence of appreciable short-run health effects (Beegle, Dehejia, and Gatti 2009), concerns arise from the possibility that labor early in life might in the long-run undermine an individual's physical, psychological, or cognitive development. It may also negatively impact learning capacity in adulthood. Given this, a legal ban on child labor may appear to be a viable policy option (Basu and Van 1998). However, this might prove hard to enforce, especially when children are disproportionately working for their parents.

An alternative policy option that is often advocated is drawing children into school.[1] School attendance might be easier to monitor and, to the extent that schooling displaces child labor, policies that affect the costs of or the returns to school might prove effective in combating child labor.

A closer look at the data however suggests that this conclusion is far from warranted. Figure 1 shows that a large proportion of children in Africa, by far the continent with the highest child labor incidence, are neither in school nor in work, suggesting that increased school attendance might not translate into lower child labor. Similarly, the circumstance that a large proportion of children combine work with school also suggests that the tradeoff between these two activities might be less clear-cut than suspected and generally modeled in the economic literature.[2]

There is considerable evidence that children's school enrollment is responsive to variations in the costs of and the quality of schooling (see, for example, Banerjee et al. 2007; Beegle and Burke 2004; Duflo, Hanna, and Ryan 2008, Siddiqi and Patrinos 1995). However, evidence on the effect of these variables on child labor is mixed (Grootaert and Patrinos 1999). Perhaps the most convincing evidence comes from the Conditional Cash Transfers literature. Most of these programs contain an element of randomization or pseudo-randomization in treatment assignment, making their evaluation particularly credible. These policies appear to lead to a rise in schooling and a reduction in child labor (Ravallion and Wodon 2000 for Bangladesh; Skoufias and Parker 2001 for Mexico; Attanasio et al. 2006 for Colombia; Edmonds and Schady 2010 for Ecuador), and, with few exceptions, the increase in enrollment appears larger than the fall in child labor, implying that increased enrollment comes in part from reduced inactivity. These results might suggest that child labor is relatively unresponsive to variations in the cost of schooling. In addition, the cash transfer component associated to these programs is likely to exaggerate the negative effect of reductions in the costs of schooling on the incidence of child labor.

1. The United States Department of Labor (1998), for example, states, "Universal primary education is widely recognized as one of the most effective instruments for combating child labor. . . . To be effective in eliminating child labor, education must be useful, accessible, and affordable." ILO (2006) states that "improving access to quality education is essential for reducing the incidence of child labour."

2. This pattern is not unique to Africa (see for example Biggeri et al. 2003). Also, youths in many but not all OECD countries combine work with school (this phenomenon is widespread in Australia, Canada, Denmark, the Netherlands, the United Kingdom and the United States but almost nonexistent in Belgium, France, Greece, Italy, Portugal, and Spain. See OECD 1999). Some studies for the U.S. account for selection into work while in school; for instance, Eckstein and Wolpin (1999) report a negative effect of in-school work on school performance, while Hotz et al. (2002) report no effect on subsequent labor market outcomes.

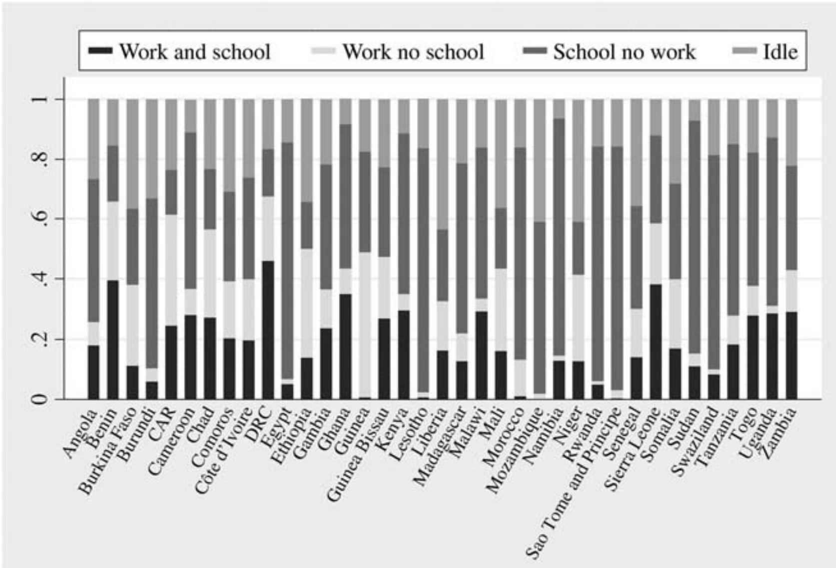

Figure 1
Children's Time Use in Africa

Notes: The figure reports the distribution of children's time across four activities (work and school, work and no school, school and no work, idleness) across African countries. All data refer to the age range 5–14 expect for DRC (5–15), Mozambique (10–14) Namibia (6–14) and Sao Tome and Principe (10–14). Reference year varies between 1994 and 2008 depending on the country. Source, for all countries except the DRC: Understanding Children's Work computation on different microdata. See http://www.ucw-project.org/cgi bin/ucw/Survey/Main.sql?come = Tab_Continent.sql&continent = 1 (accessed October 24th 2010) for precise data sources and definitions. For the DRC: authors' computations on the Demographic and Health Survey, Democratic Republic of the Congo.

In this paper we aim to broaden our understanding of the determinants of child labor and the appropriate policy response by concentrating on one specific dimension of the cost of attending school: travel time to school. It is widely acknowledged that school availability and accessibility impose binding constraints on children's ability to attend school in many developing countries (see, for example, Lavy 1996; Foster and Rosenzweig 1996; Duflo 2001; Handa 2002; and Filmer 2004, for observational evidence, and, most recently, Burde and Linden 2009, for experimental evidence) but how this affects child labor is much less well established. While Siddiqi and Patrinos (1995), and Bhalotra and Tzannatos (2003) conclude that distance to school typically increases child labor, Grootaert and Patrinos (1999) find little supporting evidence in favor of this conclusion. A recent review of the literature by Understating Children Work (2010), the interagency (ILO-UNICEF-World Bank) research project on child labor, provides a nuanced picture of the relationship between child labor and school accessibility, with some studies finding a negative effect and other studies finding no effect. Existing studies differ markedly in the definition of accessibility, mostly relying on whether a school is present in the village or not, and estimates are typically plagued by endogeneity issues stemming from households' residential location choices, casting some doubts on causal interpretation of the estimates.

Tanzania lends itself naturally to an analysis of the effect of distance to school on children's time-use. Although in the last decade the country has made considerable progress in reducing child labor and enrolling children in school, partly due to high economic growth (Utz 2007), as of 2000/01 more than 60 percent of children in rural areas were involved in some productive activity, with an average working week of around 26 hours. School attendance was far from universal, at around 67 percent. Additionally, more than 10 percent of children lived at least at five kilometers from the closest school, implying a daily travel time to school of at least two hours. Because it has been argued that distance is an important predictor of school attendance among Tanzanian children (Bommier and Lambert 2000; Beegle and Burke 2004), one might suspect that it could also contribute to explaining Tanzania's high level of child labor.

One advantage of our data compared to most existing survey data is that they provide distance to the closest primary school for each household in the sample, rather than village level availability. In addition, this question is asked to all households, irrespective of whether children in the household attend school or not. By exploiting variations in accessibility to school across households in the same village, this approach allows us to separately identify the effect of school distance from unobserved village characteristics. Tanzanian villages typically cover large physical areas and most of them have one (and only one) primary school. Households hence are typically rather dispersed around schools, which in principle generates sufficient variation in distance to school among households in the same village to identify the effect of interest.

There are a number of empirical challenges to our analysis. Not differently from any observational paper that exploits variation in residential location across households, it is possible that households might not be randomly located within villages. Better-off households, who presumably have a lower propensity to send their children to work, might also be more likely to live closer to the administrative center of the village, where schools are typically located. This might lead to erroneously conclude that higher school distance causes lower school attendance and higher child labor.

Our empirical strategy attempts to deal with nonrandom assignment of households to different distances from schools by including in the regressions not only a large array of observable household socioeconomic controls, but also distance to a large number of additional facilities. A number of falsification exercises support the validity of our identification assumption. As a complementary strategy, we also examine the differential effect of distance to school between younger (aged 7–10) and older (aged 11–14) siblings, in practice controlling for unobserved household characteristics that are common to all children in a household and that might contaminate Ordinary Least Squares (OLS) estimates.

Because distance to school is self-reported, one second concern pertains to measurement error and the ensuing attenuation bias of the OLS estimates. For this reason, in addition to OLS, we present both Two-Stage Least Squares (2SLS) estimates that control for classical measurement error as well as estimates that control non-parametrically for nonclassical measurement error.

Our empirical analysis shows that increasing distance to school appears to lead to a fall in schooling and no appreciable rise in work. If anything, we find evidence that the incidence of child labor falls as distance to school increases, although coefficients are never statistically significant. This suggests that, as distance to school increases, children are less likely to combine work with school and are more likely to work only.

We rationalize this result using a simple labor supply model with child labor, schooling, and leisure. We show that while improved school accessibility increases the incentives to attend and, thus, reduces the incentives to work among children currently out of school, it also frees up time among children already in school, hence increasing the incentives to engage in work among this group.

The structure of the paper is as follows. Section II introduces the data and presents descriptive evidence on child labor, schooling, and school accessibility in rural Tanzania. Section III presents a stylized model of child labor and schooling. Section IV discusses the specification and identification of the empirical model and presents the regression results. Section V discusses these results and concludes.

II. Institutional Background and Descriptive Evidence

Tanzania is one of the most populous (population of about 32 million) and poorest countries in Sub-Saharan Africa (annual GDP per capita in 2001 was on the order of US$ 540, after the Democratic Republic of Congo, Sierra Leone, Chad, Niger, and Malawi, with a poverty rate of 31 percent). Like many other Sub-Saharan African countries, the economy is largely based on agriculture, which accounts for around 80 percent of employment and 60 percent of GDP (Utz 2007).

Despite being an early starter among countries in the region in prompting universal primary education, school enrollment fell precipitously during the 1980s and 1990s. This was the result of rapidly deteriorating economic conditions, rising poverty, and the government's underinvestment in education (Al-Samarrai and Reilly 2000; Beegle and Burke 2004; Wedgwood 2007), coupled with exponential population growth and low returns to education.[3] Figures from the United Nations Educational, Scientific and Cultural Organization (2005) show that gross enrollment in compulsory primary education (grades 1–7) in 2000 was on the order of 63 percent, down from 98 percent in 1980 (Wedgwood 2007). Net enrollment was substantially lower and on the order of 49 percent, due to a combination of late entry, intermittent attendance, and grade repetition.[4]

3. Psacharopoulos and Patrinos (2002) report a figure for the return to primary education in Tanzania of 7.9 percent, well below most of the other countries in the region.

4. This situation has changed considerably since 2000. In 2001 the Primary Education Development Programme (PEDP) was launched and school fees in primary education were abolished. Apparently in response to the abolition of school fees, between 2000 and 2003 primary enrollment increased by over two million pupils (Shitundu 2005).

In order to document the incidence of child labor and school attendance in Tanzania, we use microdata from the 2000/01 Household Budget Survey (HBS). This is a large cross-sectional representative survey covering 22,178 households and 108,092 individuals in both urban and rural areas. In addition to information on housing and socioeconomic characteristics, the survey also provides information on self-reported distance and travel time to a large number of infrastructures plus information on school enrollment and work in the week preceding the survey.[5] In the analysis we restrict the sample to children aged 7–14 (corresponding to the theoretical primary-school age) in rural areas, where school supply constraints are most likely to be binding. This gives a sample of 8,642 children in 539 villages.[6]

A. Children's time-use

Table 1 reports information on time-use of Tanzanian children separately by age. To derive the information in this table we use the response to a question about the main and secondary activities of the child in the week preceding the survey. These include both work inside the household (on the household farm, in the household business or household chores) and work outside the household for pay. Working children are defined as those reporting work either inside or outside the household as either their primary or secondary activity (or both).

Unfortunately the HBS data do not allow us to separately identify unpaid work inside the household and paid work outside the household. The survey, however, provides information on labor earnings in the past year. Only 30 children in our sample (0.3 percent of total children and less than 1 percent of the fraction of working children) report labor earnings. This suggests that working children are disproportionately engaged in work inside the home.[7]

Around 60 percent of children are in work. Interestingly, participation is high already at early ages with 55 percent of children aged 7–10 in work. Row 2 reports school attendance. This is derived from a separate question in the survey that records if the child is currently attending school. As noted by others, although the legal entry age in school is 7, school entry is very delayed in Tanzania. While among children aged 11–14, school attendance is on the order of 78 percent, this figure is only 52 percent for children aged 7–10. Several forces appear to explain low enrollment rates at early ages: supply constraints and distance to school apparently being two of them (Mason and Khandker 1996). As said, work in combination with school is

5. The sampling scheme is stratified as follows. First, 1,158 Primary Sampling Units (PSUs) were chosen in order to guarantee a regional representation: about half of these PSUs were rural villages. From each of these PSUs, between 12 and 24 households were interviewed between May 2000 and June 2001. The sampling scheme guarantees a mix of low, medium, and high income households in each PSU. A unique identifier allows us to identify households in the same village, although the identity of the village cannot be ascertained.

6. We exclude domestic employees, accounting for less than 0.5 percent of the sample, and the few individuals with no reported gender.

7. In order to corroborate this claim, we consulted other data sources on child labor in Tanzania (1991/2004 Kagera Health and Development Survey, 2000/01 Integrated Labor Survey, the 2007 HBS and the 1993/94 Human Resource Development Survey). None of these sources allowed us to separate child labor within and outside the household.

Table 1
Children's Time-use and Distance to School: Descriptive Statistics by Age

	(1) Age 7–10	(2) Age 11–14	(3) All
1. Work	0.554	0.649	0.599
2. School	0.525	0.782	0.645
3. Work and school	0.279	0.476	0.371
4. Idle	0.198	0.045	0.126
5. Work only	0.276	0.173	0.228
6. School only	0.246	0.305	0.274
7. Hours work (if in work)	26.825	25.136	25.945
8. Average time to school (hours)	0.481	0.492	0.486
9. Average distance to school (kilometers)	2.559	2.435	2.501
10. percent children within given distance from school (kilometers)			
1	0.34	0.35	0.34
2	0.58	0.58	0.58
3	0.72	0.72	0.72
4	0.83	0.85	0.84
5	0.89	0.89	0.89
11. percent villages with at least one child within given distance from school			
1	0.80	0.80	0.80
2	0.94	0.94	0.94
3	0.98	0.98	0.98
Observations	4,597	4,045	8,642

Notes: The table reports time-use patterns of children age 7–14 in rural Tanzania. Source: HBS, 2000/01.

widespread, with more than half of those in school reporting some work activity (Row 3). A nonnegligible proportion of children (13 percent) also declare being idle, that is neither in work nor in school (Row 4), although this is largely ascribable to delayed school entry rather than inactivity among teenagers. Finally, working children work on average 27 hours per week (Row 7), approximately equivalent to a part-time adult job (the average work week among prime-age rural men in the HBS is 53 hours).

To get a sense of the constraints that school attendance impose on children's time in Tanzania, it is important to note that, over the period of observation, the typical primary school day was six hours and children were expected to attend seven days a week (although absenteeism, especially on Sundays, the market day, is widespread), implying that a child attending school full time would devote more than 40 hours per week to school.[8] These figures show that the long normal school day coupled with typically long working hours take a large toll on children's time in rural Tanzania.[9]

B. School accessibility

Row 8 of Table 1 reports information on self-reported travel time to the closest primary school expressed in fractions of hours. Travel to school is on average half an hour per day in each direction. The HBS also reports self-assessed physical distance to the closest primary school. Because this variable is reported in intervals, 0–1 kilometers, 1–2 kilometers, etc., we transform it into a cardinal variable using the midpoints of each interval (namely 0.5 kilometers, 1.5 kilometers, etc.). Average school distance to the closest primary school in Row 10 is around 2.5 kilometers,[10] implying an average speed to school of around five kilometers per hour, similar to what is generally estimated for an average adult on regular terrain and normal conditions. This possibly suggests that the HBS respondents interpret this question as referring to "normal" travel time by an adult. Travel time might be considerably larger for a child, especially a young child.[11]

The remaining rows of Table 1 provide additional information on the distribution of distance to school—72 percent of children live within three kilometers from the closest primary school and 89 percent live within five kilometers, implying a daily travel time to school of at least two hours for more than 10 percent of children.

The variation in distance to school among children in the sample is largely ascribable to the circumstance that Tanzanian villages cover large physical areas and that households live in rather widespread radiuses around schools, rather than to fact that some villages have schools while others do not. Indeed, as a result of the early 1970s decentralization experience, most Tanzanian villages are endowed with a school (Semboja and Therkildsen 1994).[12] This can be seen in Row 11 of Table 1

8. Beegle and Burke (2004) using data from the Kagera region find that, despite considerable absenteeism, average weekly hours of schools are on the order of 31. The HBS 2001 also reports hours of school in the previous week but only for those who declare schooling as their primary or secondary activity. The average hours of school among these children is 39 hours and this figure is remarkably similar for those in work and those not in work. We are wary of using this variable since it appears that 7 percent of children currently attending school do not declare schooling as either their primary or secondary activity. These are children with stronger labor market attachment and more likely to be absent from school. Because of this, average hours of school in the HBS are likely to be overestimated.

9. Hours of work among children in school are approximately half that of children out of school (respectively 18 and 37 hours).

10. This figure is in the same ballpark as the one found in other data sets. Distance to primary school among those currently in school in the 1993 Human Resource Development Survey (HRD) is 1.8 kilometers In the HBS school distance among children currently in school is 2.1 kilometers

11. Indeed, we find no association between children's age or gender and self-reported travel time, whether conditional or unconditional on travel distance. This possibly implies that respondents are unlikely to interpret this question as referring to the travel time taken by children in their household to reach the closest school.

12. The HBS data do not provide direct information on whether a village has a school and since the identity of the villages is unknown, one cannot ascertain if a village has a primary school using auxiliary data sources. Mason and Khandker (1996) found that all villages in the 1993 HRD data have a primary school. The same is found by Beegle and Burke (2004) for Kagera.

that shows that around 80 percent of villages have at least one child living within one kilometer radius from the closest primary school and that essentially all villages have a child in a radius of at most three kilometers from school. Consistent with this, village fixed effects explain around 27 percent of the variance in school distance, meaning that a large fraction of the variation in school distance is within villages.

III. A Model of Work and School with Travel Time to School

In this section, we turn to a formal analysis of children's optimal work and schooling decisions as schools become more accessible. Accessibility here is modeled as travel time to school. For simplicity we model schooling as discrete, although this is not a crucial assumption.[13] This assumption picks up the notion that there are low returns to intermittent attendance: Children cannot just attend school for a few hours (days) per day (week) without being severely penalized.

Assume that households maximize the following utility function:

$$(1) \quad \max_{C,E,P} U(C,P,E) = \ln(I + wM) + a\ln(P) + bE$$

$$\text{s.t.} \quad C = wM + I, \quad M + P + E(1+t) = 1, \quad M,P \geq 0, \quad E = 0,\bar{E}$$

where C is consumption, P is leisure time, E is schooling (that is either zero or $\bar{E}$), I is household income excluding income from child labor, w is the children's wage rate, M is hours of work, and t is travel time to school. We assume that the time endowment is fixed and equal to 1. We have made a specific assumption on the form of utility function, largely in the interest of tractability. For our purpose, it is sufficient to show that, for a well-behaved utility function, the effect of school distance on work is ambiguous.

The comparative static of the model is derived analytically in the appendix and is illustrated in Figure 2. The figure plots the different regions corresponding to a child's optimal time use as a function of travel time to school (t) on the horizontal axis and income (I) on the vertical axis. The different lines partition the $t0I$ space into four regions corresponding to different patterns of time use. A bolder line splits the space into work and out of work.

At low levels of school distance, children combine work with school (if from low-income households) or devote only to school (if from high-income households). As t increases, work participation falls, as some children previously combining work with school now drop out of the labor market move to school only. Further increases in t lead to a rise in work and potentially push some children into inactivity. School participation falls unequivocally as t rises.

In practice, making schools more accessible has an unambiguous effect on school attendance but an *ambiguous* effect on child labor. This is because children initially

13. Similar result can be obtained with E continuous using the utility function in Equation 1 assuming monetary costs of school.

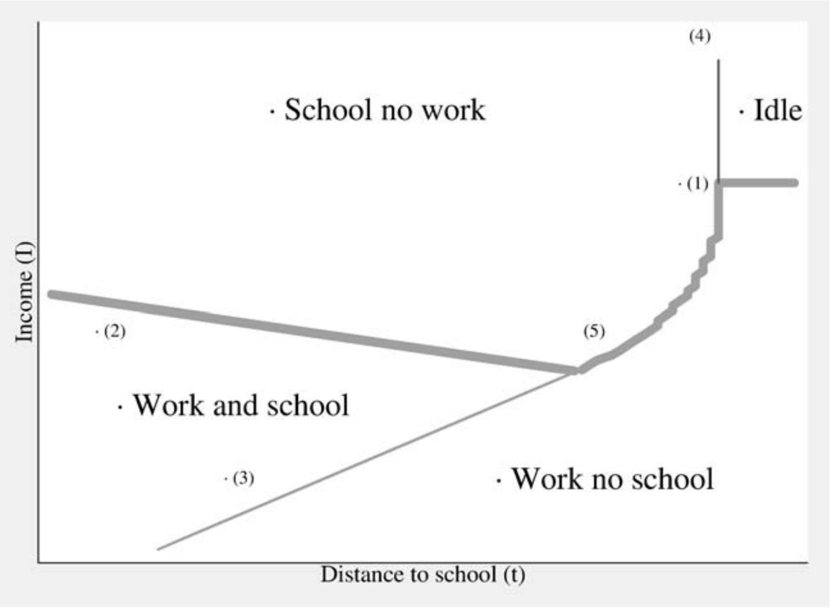

Figure 2

Changes in Travel Time to School and Children's Time Use

Notes. The figure reports the solution to Model 1 in the space *t0I*. Equation 1 is: $I{:}w/a$, Equation 2 is $I=[w(1-\bar{E}(1+t)]/a$, Equation 3 is: $I=w[1-k(1-\bar{E}(1+t))]/(k-1)$, Equation 4 is $t=(1-z-\bar{E})/\bar{E}$ and Equation 5 is $t=(1-m-\bar{E}\ )/\bar{E}$ where *m, z* and *k* are defined in the appendix. See also text and appendix for details.

combining work and school might decide to cut their labor supply as travel time increases in order to remain in school. If, as often assumed in the theoretical literature, children do not combine work with school, a fall in travel time to school will unequivocally decrease child labor. However, precisely because school appears not to be incompatible with some amount of work (and indeed this is true for 40 percent of Tanzanian children), the effect of accessibility on work is ambiguous.

Based on the above model, the probability of work is $\Pr(M>0)=\Pr(I<g(t))$, where $g(t)$ is a continuous but nonmonotonic (first decreasing and then increasing) function of t (the bold line in Figure 2).

Assuming that income can be expressed as a linear function of some observables X's plus an error term v, and using a first order approximation for $g(.)$, it follows that:

$$\text{(2)}\quad \Pr(M>0)=\Pr(v<\beta_0+\beta_1 t+X'\beta_2)$$

This equation is at the basis of our empirical analysis in the next section, where the sign of β_1 is a priori indeterminate.

Table 2
Self-reported Reasons for Working and Not Attending School

Not in school	
School too expensive	13.51
School Useless/uninteresting	11.53
Child working	7.82
School too far	4.61
Child too old	4.33
Child ill/pregnant	3.82
Child failed exam	0.48
Child got married	0.10
Other	53.82
Work	
To supplement household income	42.50
To assist in household enterprise	45.75
Education program not suitable	2.17
School too far	0.48
Other	9.11

Notes: The top part of the table reports the distribution of the main reason for children not attending school as reported by the adult respondent. Figures refer to children aged 7–14 in rural Tanzania. Number of observations is 3,034. Source HBS 2000/01. The bottom part of the table reports the distribution of the main reason for children working as reported by the adult respondent. Figures refer to children aged 7–14 in rural Tanzania. Number of observations: 5,036. Source: MICS, Tanzania 2001.

IV. School Distance and Child Labor

A. Preliminary evidence

Before presenting a formal empirical analysis, we start by presenting some suggestive evidence of the effect of school distance on attendance and child labor. Table 2 presents the frequency distribution for the main reason given in the survey for children not attending school in the reference week. This question is asked in the HBS with reference to all children not in school. The most important reason provided for lack of attendance is the monetary cost of school (14 percent of children), together with lack of interest or lack of perceived usefulness (12 percent). Around 8 percent of children appear not to attend as they are involved in work, implying that work possibly displaces schooling. Interestingly, though, around 5 percent of children appear not to attend due to the school being too far.[14]

14. This answer is strongly correlated with the household's self-reported distance to school. Average distance to school among those currently out of school who report distance as being the major constrains is 6.41 kilometers versus 2.46 kilometers among other children out of school.

The bottom part of the table refers to the main reason provided by the adult respondent for children currently being in work. Although this question is not available in the HBS, this is asked in the 2001 Tanzania UNICEF Multiple Indicator Cluster Survey (MICS). Almost 90 percent of parents declare that their children work in order to either supplement household income or to provide help in the family enterprise or business. Interestingly, only a negligible fraction (half a percentage point) of parents report that their children work due to schools being too far from the place of residence.

Although clearly some caution must be exerted in drawing inference based on subjective responses, these figures appear to suggest that school distance is not perceived as a major determinant of children's work in Tanzania. Work is apparently driven by poverty and it possibly displaces schooling. We now turn to a more formal analysis of the effect of school distance on school attendance.

B. Basic regression results

In the rest of this section we present the results of a number of regressions of children's time-use on distance to primary school. Because we have no credible instrument for assignment of children to schools, we attempt to recover the effect of school distance on children's time-use by controlling for observable household and unobservable village characteristics and, in some specifications, for unobserved household characteristics.

Based on Equation 2, in the rest of the paper we regress children's time-use (Y: work, school, etc.) on the household's self-reported travel distance to the nearest primary school measured in kilometers (t) plus a set of controls (X):

$$(3) \quad Y = \beta_0 + \beta_1 t + X'\beta_2 + u$$

where u is an error term.[15]

We use physical distance rather than travel time as a measure of school accessibility. We do so because, although travel distance is potentially not free of measurement error (the consequences of which we discuss below), we are particularly concerned that travel time might be endogenous to school attendance. Those who have a stronger ability or desire to send their children to school might also be the ones who are able to cover the same distance in a shorter time via faster modes of transport.

Table 3 reports OLS estimates of Equation 3. Each row refers to a different dependent variable and each column to a different specification. The dependent variable is a either a dummy for participation (in work, school, or combinations of the two) or a continuous variable for hours of work (including zeros for those not in work). Coefficients in Table 3 where the dependent variable is dichotomous (0/1) are multiplied by a factor of 100. For brevity, in Table 3 we report only the coefficient on the distance to school variable. The full set of coefficients for the

15. We use a linear probability model as this naturally lends itself to the inclusion of village fixed effects as well as to the use of instrumental variables that we present below. Results based on a logit or a bivariate probit (not reported) are very similar.

Table 3
Distance to Primary School and Children's Time-use

Dependent variable	(1)	(2)	(3)	(4)
1. Work	0.422***	0.184	−0.131	−0.258
	(0.140)	(0.225)	(0.231)	(0.229)
	[2.47]	[1.07]	[−0.77]	[−1.50]
2. School	−1.663***	−0.791***	−0.479***	−0.371**
	(0.134)	(0.159)	(0.158)	(0.169)
	[−9.02]	[−4.29]	[−2.60]	[−2.01]
3. Work and school	−1.098***	−0.611***	−0.554***	−0.515***
	(0.142)	(0.159)	(0.182)	(0.168)
	[−10.35]	[−5.77]	[−5.23]	[−4.85]
4. Work only	1.521***	0.796***	0.423*	0.257
	(0.127)	(0.234)	(0.233)	(0.233)
	[23.33]	[12.24]	[6.49]	[3.95]
5. School only	−0.565***	−0.180	0.075	0.145
	(0.125)	(0.137)	(0.140)	(0.158)
	[−7.23]	[−2.30]	[0.95]	[1.86]
6. Neither school nor work	0.243**	0.072	0.130	0.057
	(0.095)	(0.143)	(0.165)	(0.131)
	[6.75]	[1.98]	[3.57]	[1.59]
7. Hours of work	0.438***	0.198*	0.013	−0.005
	(0.059)	(0.105)	(0.096)	(0.098)
	[0.06]	[0.03]	[0.00]	[−0.00]
HH controls	No	yes	yes	Yes
Distance controls	No	no	yes	Yes
Village FE	No	no	no	Yes

Notes: The table reports the OLS coefficient on distance to primary school (multiplied by 100 in Rows 1 to 6). Each cell refers to a separate regression. Rows refer to different dependent variables while columns to different specifications. All regressions control for age dummies, a gender dummy, dummies for relationship to the household head (spouse, child of head, child of spouse, grandchild, other relative) and dummies for month of observations. Household controls include household head's and spouse's sex, age, and age squared, head's number of completed school years, farming land owned, number of cattle and sheep owned, number of meals per day, whether the household had fewer than usual number of meals in the last 30 days, dummies for the number of household members, dummies for whether the house has foundations, material of the roof (grass or leaves, mud and grass, cement, metal sheets, asbestos, tiles, other) type of floor (earth, concrete, other), type of walls (poles, poles and mud, mud only, mud bricks, baked bricks, concrete, other), type of toilet (no toilet, flush toilet, latrine, other), type of water access (private in house, private outside house, neighbor, in community, rain catchment, public well, private well, spring, river, dam or lake, other), whether the house has electricity, and number of rooms. We also include dummies for missing covariates. Distance controls include market place, shop, health center, traditional birth attendant, hospital, cooperative society, mill, secondary school, bank, post office, police, primary court, religious center, public transport, community center, place where the household gets water during the dry season, and place where the household gets wood for fire. The number of observations is 8,642. Standard errors clustered by household in round brackets. The implied proportional change associated to a one standard deviation increase in distance to primary school (3.5 kilometers) is reported in square brackets. *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

regressions where work is the dependent variable is reported in Table A1 in the Appendix.

All specifications control for dummies for child's age and gender, dummies for the child's relationship to the household head (spouse, child of head, child of spouse, grandchild, and other relative) plus month of interview dummies. By including month of interview dummies we control for the potential seasonality in children's work and schooling linked to the harvest season and the school holiday period (mid-June to early July and early December to mid-January). Standard errors are clustered at the household level.

For each estimated coefficient in Table 3, the implied proportional change associated to a one standard deviation increase in distance to primary school (3.5 kilometers) is reported in square brackets.

Column 1, Row 1 illustrates that one extra kilometer to the closest primary school is associated to a rise in the probability of work of 0.42 percentage points. This is largely ascribable to a fall in the probability of combining work and school and an even bigger rise in the probability of work with no school (Rows 3 and 4). Higher distance to school appears also to be associated to lower school attendance: The estimated coefficient is on the order of -1.66 percentage points. The magnitude of the effects is somewhat sizeable, as shown by the implied proportional changes associated to a one standard deviation in school distance. For example, it appears that a one standard deviation increase in school distance reduces the probability of attending school by 9 percent and increases the probability of work and no school by 23 percent.

In Column 2, we keep with the theoretical model and we additionally control for a very large array of arguably exogenous household characteristics that proxy for household socioeconomic status, including durable ownership and housing characteristics (X).[16] The coefficient on child labor falls (this is now 0.18 and statistically insignificant) and the coefficient on school increases (that is now -0.79 as opposed to -1.66 in Column 1). This is evidence that more affluent households live closer to schools and that their children are less likely to work and are more likely to attend school. The concern is that proximity to school proxies for the household socioeconomic status that is only partially accounted for by observed household characteristics: poorer households might live further away from the administrative center of the village where schools tend to be located. Indeed, studies have shown that household location is correlated to children's time use.[17] This is further confirmed in Column 3 where we include the household's self-reported distance to a large array of other infrastructures and services.[18] Point estimates fall further in absolute value:

16. These are: household head's and spouse's characteristics (sex, age, number of completed school years) as well as measures of wealth and income (farming land owned, number of cattle and sheep owned; whether the house has foundations, material of the roof, type of floor, walls toilet, water access, electricity connection and number of rooms; usual number of meals per day, whether the household had fewer than usual number of meals in the last 30 days, and number of individuals in the household by age).

17. Fafchamps and Wahba (2006), for example, show that proximity to urban areas is negatively correlated to the incidence of child labor, although the probability of market work is higher for children living nearby cities.

18. These are: police station, traditional birth attendant, religious center, primary court, hospital, place for water, place for wood, market, shop, health center, secondary school, bank, post office, transport, mill, community center, and cooperative.

For example, the coefficient on schooling remains negative (−0.48) and significant at conventional levels while the coefficient on work is now negative and small but statistically insignificant. Indeed, households living closer to schools also live closer to other facilities, and closeness to facilities other than schools is systematically associated with lower child labor and higher schooling.

To address the concern that omitted village characteristics might affect our estimates, we finally include village fixed effects in our regressions. These regressions offer the advantage of comparing children in the same labor market, so they purge our estimates of any differential returns to education or work opportunities that are specific to each village. Compared to the corresponding estimates in Column 3, the inclusion of village fixed effects (Column 4) tends to lower the point estimates in the child labor equation while the reverse happens in the schooling equation.

Column 4 shows that child labor is overall unaffected by school distance: The point estimate is negative (−0.26) but statistically insignificant. Hours of work also appear not to vary with school distance. Row 3 shows that children who live further away from school tend to be less likely to combine work and school (coefficient −0.51). This is associated with an almost equal fall in schooling on the order of 0.37 percentage points. We also find no statistically significant variation in inactivity, school only, or work only.

Once all controls are included, the magnitude of the effects is small. Estimates in Row 2, Column 4 of Table 3 imply that a one standard deviation increase in distance to school is associated to a fall in the probability of school attendance of 2 percent and a similar (but statistically insignificant) fall in the probability of work (1.5 percent). These are modest effects, consistent with the survey results in Table 2.

C. Within-household estimates

Although the regression estimates in Table 3, Column 4 control for a large array of observed household characteristics, a concern still remains that unobserved household characteristics might be correlated with children's time use.

One possibility is to use a within-household estimator. This clearly requires some variation in distance to school across siblings. One difficulty here is that all the children in the sample are of primary school age, so there is no variation in distance to the closest school within households.[19]

As an alternative approach, we exploit the differential effect of distance to the closest primary school across children of different ages. Results are reported in Table 4, where, for brevity, we only report results for school, work and hours of work. Here we present three specifications. All specifications interact distance to school with a dummy for the age group 7–10. While Column 1 refers to the entire sample, Column 2 refers to a restricted sample of households with at least one younger (age 7–10) and one older (11–14) child. Finally, a within-household regression that controls additionally for household fixed effects is presented in the last column. All specifications include the whole set of household and distance controls plus house-

19. Because coresidence rates in Tanzania decay rapidly with age and these are likely to be correlated with distance to school, we cannot expand the age range and use distance to the closest primary and secondary schools.

Table 4
Distance to Primary School and Children's Time-use. Heterogeneous Effects by Age

	(1)	(2)	(3)
Dependent Variable: Work			
Distance to school (kilometers)	−0.377	−0.228	
	(0.250)	(0.275)	
Distance × age 7–10	0.190	−0.077	0.005
	(0.268)	(0.293)	(0.344)
Dependent Variable: School			
Distance to school (kilometers)	0.025	−0.063	
	(0.291)	(0.312)	
Distance × age 7–10	−0.634**	−0.549*	−0.599
	(0.284)	(0.326)	(0.371)
Dependent Variable: Hours of work			
Distance to school (kilometers)	−0.006	0.045	
	(0.157)	(0.171)	
Distance × age 7–10	0.001	−0.137	−0.104
	(0.148)	(0.145)	(0.158)
Household fixed effects	no	no	yes
Sample	all	restricted	restricted

Notes: The table reports similar specifications to those in Column 4 of Table 3 where the coefficient on school distance is interacted with a dummy for the younger age group (7–10 years). Column 1 refers to the entire sample. Column 2 refers to the sample of households with a young (age 7–10) and an old (age 11–14) child. Column 3 refers to the same restricted sample and includes household fixed effects. See also notes to Table 3.

hold fixed effects, as in Column 4 of Table 3, and we again cluster standard errors by household.

Results in Column 1 show that there is a differential effect of school distance on children's time use according to age: It appears that distance to school postpones school entry, lowering school attendance among young children (coefficient: −0.63), but not among older children (coefficient: 0.02). Distance to school imposes a binding constraint on children's school attendance only at early ages, when walking to school might be particularly arduous or hazardous. However, the effect of greater distance to school on the child labor gap between younger and older siblings is small

(0.19) and insignificant, even if younger children's work involvement is far from trivial (see Table 1).

Results are similar when we use the restricted sample in Column 2. Column 3 finally reports results with household fixed effects. Clearly, the main effect cannot be identified. Still, though, we can identify the interaction term. It is remarkable that household fixed effect regressions lead to very similar results to the OLS in Column 2, although point estimates are not significant. Differences in work involvement between younger and older siblings are essentially insensitive to variations in distance to school (coefficient 0.005). Results in Table 4 provide further evidence that our main conclusion that work involvement is unaffected by school accessibility is unlikely to be driven by unobserved household heterogeneity.

D. Nonlinear effects

In Table 5 we investigate whether there are nonlinearities in the effect of distance on children's time-use. Here we revert to the main specification that abstracts from potentially differential effects across age groups and report regression coefficients from a specification that includes dummies for households at different distances (1–2 kilometers, 2–3 kilometers, 3–4 kilometers, 4–5 kilometers, and more than five kilometers, with less than one kilometer being the omitted category). Again, for brevity, we only report results for school, work, and hours of work. We see clear patterns in the probability of attending school as distance increases: There is a clear negative gradient and the marginal effects decrease with distance. Being between one to two kilometers from school relative to being within one kilometer decreases school attendance by about five percentage points, while being at between four and five kilometers relative to between three and four kilometers lowers the probability of school attendance by only around half a percentage point. Similar to what we found in Table 3, the coefficients in the work regression are small, show no clear pattern, and are statistically insignificant.

E. Falsification tests

The OLS estimates in Tables 3 to 5 attempt to control for nonrandom assignment of children to school through the inclusion of a large array of household controls, distances to other infrastructures, village fixed effects, and even household fixed effects. It is reassuring that, consistent with what others have found in the literature, we find that school distance appears to impose a binding constraint on children's school attendance. Despite this, we find no statistically significant effect of school distance on child labor.

As a way to check the validity of the identification assumption, we present a number of falsification tests. The first five rows of Table 6 report regressions of log household per capita income, participation, and hours of work for the head and his spouse on the same specification as in Table 3, Column 4. If school distance proxies for the household socioeconomic status and unobserved determinants of labor supply, one would expect these variables to be systematically related to school proximity. Indeed, we find no evidence that, along any of these dimensions, households living further away from school behave differently from those living nearby. These findings also appear to rule out the possibility that children living further away from schools

Table 5
Nonlinear Effects

Dependent variable	(1) + 1–2 kilometers	(2) + 2–3 kilometers	(3) + 3–4 kilometers	(4) + 4–5 kilometers	(5) + > 5 kilometers	(6) Observations
1. Work	1.942	− 1.849	1.712	1.291	− 0.930	8,642
	(1.604)	(1.947)	(2.217)	(2.745)	(2.652)	
2. School	− 5.043***	− 5.381***	− 6.092***	− 6.602**	− 9.573***	8,642
	(1.412)	(1.790)	(2.125)	(2.919)	(2.699)	
3. Hours of work (zero if not working)	0.405	− 0.479	0.342	1.180	1.738	8,642
	(0.682)	(0.851)	(0.953)	(1.353)	(1.290)	

Notes: The table reports similar specifications to those in Table 3, Column 4 where now the distance variable is measured by dummies for different intervals. See also footnotes to Table 3.

Table 6
Robustness Checks

Falsification Tests	
1. Household head's work	−0.097
	(0.090)
2. Household head hours of work (zero if not working)	−0.146
	(0.103)
3. Household head's spouse work	0.095
	(0.068)
4. Household head's spouse hours of work (zero if not working)	0.069
	(0.126)
5. Log Household per capita income	−0.002
	(0.005)
Measurement Error	
6. Work (2SLS)	−0.278
	(0.342)
7. Work (controlling for perfect negative selection)	−0.955***
	(0.212)
8. Work (controlling for perfect positive selection)	0.070
	(0.217)
Definition of work	
9. Work restrictive definition	−0.154
	(0.205)

Notes: The table reports similar specifications to those in Table 3, Column 4, with different dependent variables. Household per capita income excludes income from child labor. Row 6 reports 2SLS estimates where distance to school is instrumented by self-reported travel time to school. Rows 7 and 8 report worst-case scenario perfect positive and negative selection in distance to school. Row 9 uses a restrictive definition of child work that excludes household chores. See text for details. See also notes to Table 3.

happen to work less than children close by due to limited work opportunities, a competing explanation for the results in Table 3. These finding lend some support to the assumption that, conditional on a large set of observed covariates, school proximity is randomly allocated across households and that the coefficients in Table 3 carry a causal interpretation.

F. Measurement error and definition of work

An additional concern regards measurement error in the distance measure. Self-reported distance is potentially an error-ridden measures of accessibility (see, for example, Gibson and McKenzie 2007), leading to an attenuation bias in the estimates. If anything, classical measurement error should lead to estimates of the effect of distance on child labor that are biased toward zero. This might explain the predominance of zero effects found for work. The measurement error problem is likely to be exacerbated by the inclusion of village fixed effects.

In order to account for classical measurement error, we instrument travel distance to school using the household reported travel time to the nearest school. Although travel time might also be an error-ridden measure of school accessibility, 2SLS should purge the estimates of classical measurement error in so far as the measurement errors in these two variables are uncorrelated.

The first-stage estimates (not reported) show that the average speed to school is around 4.3 kilometers per hour, in line with the results shown in Table 1 (results with the inclusion of fixed effects are slightly lower than simple OLS estimates: Speed to school is higher in villages where households live in more widespread areas). The estimate is very precise, with a t-statistic of around 8. Table 6, Row 6 reports 2SLS estimates of Equation 3. These are similar to, though less precise than, the OLS estimates in Table 3, Column 4, with work being negatively but not significantly affected by distance to school.

Potentially, a more serious concern is nonclassical measurement error—that is, the circumstance that measurement error is correlated to actual distance. One possibility is that households whose children are out of school tend to over-report distance to school. In this case, reported distance to school will be negatively correlated to school attendance. This might be due, for example, to some misinformed households overestimating distance to school and, hence, being less likely to send their children to school. Households with no children in school might also have less precise information about the distance to the closest school or they might overreport distance to school as a way to rationalize their decision not to enroll their children to either themselves or the interviewer. To the extent that school and work are negatively correlated, this will imply that working children are in fact closer to schools than reported, suggesting that the coefficient in the child labor regression will be overestimated. This would presumably reinforce the main conclusion of the paper—that is, that lower school distance does not lead to a fall in child labor.

To check for this, we have assigned to each household with at least one child out of school the minimum distance among the households with all children currently in school in its village of residence. Estimates that use this modified regressor, derived under the worst-case scenario of negative selection, should provide a lower bound for the actual effect in the child labor regression. These regressions are reported in Row 7 of Table 6. As expected, the worst-case scenario coefficient (-0.95) is well below the coefficient in Table 3, Column 4, suggesting that negative selection is not an issue for the main conclusion of this paper.

Perhaps a more worrisome source of nonclassical measurement error stems from the circumstance that those in school report distance to the school they actually attend rather than the closest school. If there is more than one school in the village or some children attend schools in other villages, the opposite bias might arise, with the coefficient in the child labor regression being downward biased. In this case, nonclassical measurement error in distance to school is negatively correlated to child labor. We have used a similar procedure to account for this source of selection. For each household with at least one child in school, we have replaced reported school distance with the maximum distance among households with no children in school in its village of residence. Results are reported in Row 8 of Table 6. The upper bound estimate for the coefficient in the child labor regression in the case of perfect positive selection is 0.070 and statistically insignificant.

Our definition of work includes household chores. As a way to probe the robustness of our results in Row 9 of Table 6 we finally report regressions where work only includes work in the market or unpaid family work. Results are again unchanged with no evidence of increased school distance having any effect on this margin of participation (coefficient -0.15 and not significant at conventional levels).

As additional robustness checks (not reported) we have reimputed schooling for those 72 children that fail to report it. We are particularly concerned that these might be children at higher distance and with lower probability of school attendance and higher probability of work. We have again computed worst- and best-case scenario selection-adjusted estimates of the effect of school distance on children's time use. Results, perhaps unsurprisingly given that the percentage of selected observations is rather small, are essentially unchanged. We come to similar conclusions if we reimpute distance for the 20 observations that fail to report it. Again we impute the lowest and the highest distance in their village or residence to compute bounds.

V. Summary and Conclusions

This paper investigates how distance to school affects child labor using data from rural Tanzania. While our theoretical analysis echoes Ravallion and Wodon's (2000) point that increased school enrollment does not necessarily lead to an equal fall in child labor, we go one step further, by arguing that increases in enrollment induced by improved school accessibility might at least in principle even lead to a rise in child labor.

Using data from Tanzania in 2000/01, we show that, while a one-kilometer increase in distance to school is on average associated to a fall of around 0.4 percentage points in the probability of school attendance, there is no significant effect on child labor at either the intensive or extensive margin. Our results are unchanged when we attempt to control for selection of households around schools and potential measurement error, and are robust even to the inclusion of household fixed effects once we allow for the effect of school distance on work to vary across age groups.

It is worth emphasizing that our finding that improved school accessibility does not lead to a fall in child labor and it can, at least in theory, lead to a rise in child labor does not detract from the benefits of making schools more accessible in rural areas of developing countries. We have shown that closer schools lead to increased school attendance. In addition, there might be unmeasured benefits, such as making more time available for homework, hence further increasing children's human capital accumulation.

Although it appears that increased school accessibility does not lead to increased work involvement in Tanzania, it is also worth emphasizing that most Tanzanian children are employed inside the home and they are highly likely to combine work with school. This explains why making schools more accessible appears to have no significant effect on children's labor involvement. As said, children in many low-income countries appear to combine these two activities, so the lessons learned from this paper are likely to apply to other countries.

Our results, however, might not apply to instances where children disproportionately tend to work for pay in the market and they are not free to decide how many hours to allocate to work (as in Edmonds and Schady 2010). This might be particularly relevant from a policy perspective, as there is a well-founded belief that market work is more harmful to children and more likely to come to the detriment of school than work on the household farm.

In terms of external validity, it is finally important to remark that our results exploit the variation in distance to school across households in the same village. Despite Tanzanian villages being quite widespread, these estimates are only able to identify the effect of marginal changes in distance to school among households relatively close to school: Almost 90 percent of households in the sample live within a radius of five kilometers from the closest school. Our results might not necessarily extrapolate to households living at higher distance or, most importantly, to increased availability of schools in rural areas of developing countries that completely lack them. It is likely that such increased availability will lead to an unambiguous fall in child labor.

Appendix

In this appendix we solve the optimization problem in Equation 1 in the text. For simplicity, let $\bar{E}(1+t)<1$, that is, let the time endowment be sufficient to cover schooling time, inclusive of travel time to school, no matter what the distance to the closest school is. The Lagrangean for the maximization problem in Equation 1 is:

$$L=\ln(I+wM)+a\ln(1-E(1+t)-M)+bE+\lambda_M M \qquad \lambda_M M\geq 0$$

The first order condition with respect to M gives:

$w/(I+wM)\leq a/(1-E(1+t)-M)$ with equality for $M>0$.

Assuming $E=\bar{E}$, a child is in work if $I<w(1-\bar{E}(1+t))/a$ and the optimal hours of work are: $M_E=[w(1-\bar{E}(1+t))-aI]/[w(1+a)]$.

The value of the indirect utility function for a child choosing work and school is:

$$\text{(A1)} \quad U(I+wM_E,1-\bar{E}(1+t)-M_E,\bar{E}) = (1+a)\ln\left[(I+w(1-\bar{E}(1+t)))/(1+a)\right]+a\ln(a/w)+b\bar{E}$$

while for a child in school but not in work this is:

$$\text{(A2)} \quad U(I,1-\bar{E}(1+t),\bar{E})=\ln(I)+a\ln\left[1-\bar{E}(1+t)\right]+b\bar{E}$$

Assuming $E=0$, a child is in work if $I<w/a$ and the optimal hours of work are: $M_0=(w-aI)/[w(1+a)]$.

The indirect utility function for a child in work but not in school is:

$$\text{(A3)} \quad U(I+wM_0,1-M_0,0)=(1+a)\ln\left[(I+w)/(1+a)\right]+a\ln(a/w)$$

while for a child neither in school nor in work this is:

(A4) $U(I,1,0) = \ln(I)$

One can compare the indirect utilities (Equations A1 to A4) to derive the optimal solution. With some algebra, it can be shown that:

(1) A child is in work and school if:

$I < [w\ (1 - \bar{E}(1+t))]/a$ and $I > w/(k-1)[1 - k(1 - \bar{E}(1+t))]$,
where $k = \exp[b\bar{E}/(1+a)]$

(2) A child is in school but not in work if:

$I > w/a$ and $t < (1 - z\text{-}\bar{E})/\bar{E}$, with $z = \exp(-b\bar{E}/a)$

or if:

$w[1 - \bar{E}(1+t)]/a < I < w/a$ and $t < (1 - m - \bar{E})/\bar{E}$,
with $m = \exp[((1+a)\ln((I+w)/(1+a)) + a\ln(a/w) - \ln(I) - b\bar{E})/a]$.

(3) A child is neither in work nor in school if:

$I > w/a$ and $t > (1 - z - \bar{E})/\bar{E}$.

The conditions for work and no school can be obtained residually. The optimal time use as a function of I and t is depicted in Figure 2.

Table A1
Distance to Primary School and Child Labor (dependent variable: work)

	(1)	(2)	(3)	(4)
Distance to primary school	0.422***	0.184	−0.131	−0.258
	(0.140)	(0.225)	(0.231)	(0.229)
Girl	8.0042***	8.4642***	8.2562***	5.1992***
	(1.852)	(1.972)	(1.943)	(1.753)
Age 8	11.482***	11.462***	11.432***	9.1402***
	(1.947)	(2.063)	(2.051)	(1.881)
Age 9	14.632***	14.362***	14.062***	11.302***
	(1.982)	(2.025)	(2.006)	(1.833)
Age 10	18.912***	19.182***	19.382***	17.062***
	(1.877)	(1.897)	(1.873)	(1.718)
Age 11	19.612***	19.492***	19.162***	18.012***
	(2.116)	(2.171)	(2.154)	(1.945)
Age 12	20.882***	−5.7892***	−6.5702***	−3.7622**
	(1.918)	(1.709)	(1.704)	(1.663)
Age 13	24.242***	−2.564	−2.874	—
	(2.006)	(1.909)	(1.895)	—
Age 14	26.832***	—	—	2.985*
	(2.006)	—	—	(1.726)

(continued)

Table A1 *(continued)*

	(1)	(2)	(3)	(4)
Daughter of head	−0.866	−1.570	−1.295	2.015
	(2.112)	(2.225)	(2.191)	(1.988)
Child of spouse	6.066*	5.623	6.725*	6.4022**
	(3.298)	(3.515)	(3.490)	(3.129)
Grandchild of head/spouse	1.369	0.458	0.244	0.703
	(1.886)	(2.546)	(2.520)	(2.193)
Other relative	2.248	2.726	2.949	2.306
	(2.064)	(2.398)	(2.375)	(2.079)
Other nonrelative	20.49*	16.832**	17.702**	7.718
	(11.55)	(7.140)	(6.908)	(7.571)
Age of the head		−0.0359	−0.0249	−0.00619
		(0.0778)	(0.0765)	(0.0628)
Age of the head's spouse		−0.0521	−0.0577	0.0433
		(0.0913)	(0.0906)	(0.0742)
Gender of the head		1.708	0.824	−3.941
		(2.768)	(2.724)	(2.412)
Owns land		0.07082***	0.06232**	0.0172
		(0.0274)	(0.0263)	(0.0328)
Number of rooms		0.0437	0.0984	0.00937
		(0.312)	(0.307)	(0.288)
Number of cattle owned		−0.00974	−0.0212	−0.0281
		(0.0430)	(0.0440)	(0.0405)
Number of sheep owned		0.00788*	0.009032**	0.01502***
		(0.00442)	(0.00455)	(0.00482)
Head had fewer meals than usual		−3.3052**	−2.866*	−0.776
		(1.546)	(1.539)	(1.403)
Number of meals per day		3.2712**	3.3342***	−0.924
		(1.273)	(1.267)	(1.326)
Has electricity		3.486	3.049	5.387*
		(3.773)	(3.666)	(3.095)
Head's highest completed grade (excluding no education)				
Standard 1		10.47	9.203	7.914
		(6.458)	(6.637)	(6.672)
Standard 2		6.831	6.857	8.433*
		(5.038)	(4.765)	(4.498)
Standard 3		−2.767	−2.951	−2.116
		(5.483)	(5.495)	(4.042)
Standard 4		−1.216	−1.428	−2.357
		(2.456)	(2.403)	(2.051)
Standard 5		6.210	5.692	−0.762
		(5.516)	(5.438)	(5.054)

(continued)

Table A1 *(continued)*

	(1)	(2)	(3)	(4)
Standard 6		−0.352	−0.440	−3.701
		(4.339)	(4.316)	(3.739)
Standard 7		−1.347	−1.451	0.922
		(1.956)	(1.933)	(1.689)
Standard 8		−1.753	−1.866	−6.673
		(4.449)	(4.443)	(4.261)
Post-primary course		10.562**	10.942**	9.022*
		(5.103)	(4.981)	(4.637)
Formal 1		19.722**	20.332***	19.602***
		(8.579)	(7.721)	(6.341)
Formal 2		−29.362**	−25.73*	−27.192***
		(14.19)	(15.47)	(8.468)
Formal 3		21.29	16.95	13.38
		(16.11)	(16.25)	(22.02)
Formal 4		−12.452***	−11.212**	−6.470*
		(4.441)	(4.379)	(3.750)
Post-secondary course		10.26	10.16	9.383*
		(6.798)	(6.666)	(5.084)
Formal 5		23.78	23.22*	18.89*
		(15.20)	(13.48)	(10.16)
Formal 6		−2.471	0.171	7.449
		(14.53)	(13.81)	(9.145)
Post formal 6 course		1.289	−0.906	−14.86
		(18.09)	(18.52)	(18.35)
Diploma course		−8.174	−7.238	−3.831
		(9.829)	(10.22)	(8.321)
Other certificate		10.57	11.21	2.710
		(8.870)	(8.455)	(7.082)
University degree		15.48	13.50	14.57
		(11.02)	(11.05)	(12.10)
Adult education only		2.008	2.270	0.230
		(3.425)	(3.386)	(2.751)
Owns land		0.07082***	0.06232**	0.0172
		(0.0274)	(0.0263)	(0.0328)
Number of rooms		0.0437	0.0984	0.00937
		(0.312)	(0.307)	(0.288)
Number of cattle owned		−0.00974	−0.0212	−0.0281
		(0.0430)	(0.0440)	(0.0405)
Number of sheep owned		0.00788*	0.009032**	0.01502***
		(0.00442)	(0.00455)	(0.00482)
Head had fewer meals than usual		−3.3052**	−2.866*	−0.776
		(1.546)	(1.539)	(1.403)
Number of meals per day		3.2712**	3.3342***	−0.924
		(1.273)	(1.267)	(1.326)

(continued)

Table A1 *(continued)*

	(1)	(2)	(3)	(4)
Has electricity		3.486	3.049	5.387*
		(3.773)	(3.666)	(3.095)
Type of Toilet (excluding no toilet)				
Flush toilet		− 13.20*	− 13.50*	− 2.197
		(7.402)	(7.614)	(6.965)
Pit latrine		− 8.5682***	− 8.1552***	3.186
		(2.455)	(2.569)	(2.594)
VIP		− 21.782**	− 19.25*	7.071
		(9.871)	(9.822)	(8.151)
Other		17.892***	16.832***	4.120
		(5.745)	(5.963)	(7.421)
Type of floor (excluding earth)				
Concrete/Cement		− 2.576	− 2.323	− 0.446
		(2.333)	(2.319)	(1.945)
Other		4.505	4.866	1.869
		(5.812)	(5.767)	(5.053)
Type of walls (excluding poles)				
Poles and mud		3.941*	4.032*	5.1492**
		(2.068)	(2.075)	(2.033)
Mud only		2.395	2.507	1.911
		(2.252)	(2.268)	(2.455)
Mud bricks		0.459	1.379	0.0337
		(2.107)	(2.145)	(2.244)
Backed/burnt bricks		− 1.865	− 1.210	0.989
		(2.558)	(2.570)	(2.811)
Concrete/cement		− 3.029	− 3.066	− 0.689
		(4.110)	(4.091)	(3.492)
Other		4.965	4.150	− 3.843
		(7.004)	(7.174)	(7.715)
Type of roof (excluding grass/leaves)				
Mud and grass		− 2.192	− 3.024	− 1.886
		(2.247)	(2.252)	(2.869)
Metal sheets		− 2.019	− 2.674	− 1.121
		(1.773)	(1.753)	(1.633)
Asbestos sheets		− 13.74	− 18.05	− 10.03
		(13.28)	(13.36)	(14.07)
Tiles		20.83	19.38	− 0.643
		(19.86)	(20.19)	(22.12)
Other		4.577	1.916	− 15.582**
		(6.965)	(6.867)	(6.718)

(continued)

Table A1 *(continued)*

	(1)	(2)	(3)	(4)
Type of water access (excluding private, in house)				
Private, outside		2.950	1.943	−7.128
		(6.225)	(6.138)	(5.809)
Neighbor		−3.928	−5.396	−8.000
		(6.799)	(6.715)	(6.154)
In community		−0.892	−1.022	−3.624
		(5.666)	(5.628)	(5.488)
Rain catchment		−16.38	−16.22	−9.327
		(12.65)	(13.67)	(12.41)
Public well protected		−3.893	−3.824	−6.477
		(5.814)	(5.779)	(5.894)
Public well unprotected		−2.720	−3.054	−3.806
		(5.703)	(5.664)	(5.753)
Private well protected		−8.569	−7.654	−7.419
		(7.375)	(7.303)	(6.904)
Private well unprotected		−6.164	−6.808	−8.575
		(6.665)	(6.672)	(6.704)
Spring protected		8.559	6.523	−5.194
		(6.635)	(6.616)	(7.088)
Spring unprotected		2.881	2.051	−1.245
		(5.787)	(5.726)	(5.745)
River/dam/lake		−5.095	−4.319	−6.283
		(5.774)	(5.742)	(5.926)
Other		1.719	1.584	3.438
		(11.84)	(10.47)	(10.11)
Distance to nearest facilities				
Police			0.0358	0.0267
			(0.0366)	(0.0386)
Traditional birth attendant			0.4052***	0.296
			(0.107)	(0.187)
Religious center			0.422	−0.142
			(0.295)	(0.268)
Primary court			0.1992***	0.0808
			(0.0480)	(0.0834)
Hospital			0.0188	−0.09292**
			(0.0344)	(0.0381)
Water source (dry season)			0.2452**	−0.0436
			(0.119)	(0.0757)
Firewood source			0.0639	−0.0944
			(0.0694)	(0.0826)
Market			0.3722***	−0.0197
			(0.126)	(0.171)

(continued)

Table A1 *(continued)*

	(1)	(2)	(3)	(4)
Shop			0.0682	0.167
			(0.197)	(0.212)
Health center			− 0.106	− 0.0382
			(0.110)	(0.117)
Secondary school			− 0.2372***	0.0111
			(0.0471)	(0.0757)
Bank			− 0.0107	0.08922**
			(0.0346)	(0.0434)
Post office			− 0.0499	− 0.0462
			(0.0384)	(0.0504)
Public transport			− 0.142*	0.00304
			(0.0841)	(0.117)
Milling machine			0.3252**	0.7262***
			(0.138)	(0.262)
Community center			− 0.0296	− 0.107
			(0.105)	(0.110)
Cooperative society			− 0.0601	− 0.1632**
			(0.0490)	(0.0649)
Seasonal dummies (excluding January)				
February	− 3.601	− 1.659	− 2.546	− 1.037
	(3.913)	(4.636)	(4.581)	(4.303)
March	− 10.302**	− 9.0732**	− 9.6222**	− 9.8042**
	(4.258)	(4.567)	(4.537)	(4.377)
April	− 0.364	− 0.0376	− 0.614	0.355
	(4.154)	(5.288)	(5.118)	(4.528)
May	− 5.566*	− 3.297	− 2.805	− 0.484
	(3.326)	(4.193)	(4.088)	(3.880)
June	− 0.126	− 1.050	− 0.776	− 1.210
	(4.610)	(5.842)	(5.673)	(5.448)
July	− 4.942	− 4.672	− 4.536	− 3.238
	(3.070)	(3.991)	(3.862)	(3.668)
August	− 2.038	− 0.366	− 0.0347	0.823
	(3.076)	(4.052)	(3.921)	(3.682)
September	0.883	1.562	1.524	3.612
	(3.087)	(4.057)	(3.937)	(3.700)
October	− 0.509	− 0.124	− 0.265	1.489
	(3.073)	(4.023)	(3.895)	(3.678)
November	1.088	0.539	0.496	2.832
	(3.091)	(4.069)	(3.941)	(3.685)
December	2.728	1.965	1.629	2.562
	(3.243)	(4.245)	(4.119)	(3.813)

(continued)

Table A1 *(continued)*

	(1)	(2)	(3)	(4)
Household composition				
3 members		2.530	2.275	2.839
		(4.973)	(5.017)	(5.010)
4 members		3.804	3.220	3.300
		(4.816)	(4.865)	(4.930)
5 members		5.146	4.771	2.578
		(4.750)	(4.797)	(4.870)
6 members		8.313*	7.356	4.611
		(4.768)	(4.818)	(4.883)
7 members		6.338	5.720	2.404
		(4.785)	(4.840)	(4.930)
8 members		6.029	4.880	2.402
		(4.852)	(4.901)	(4.963)
9 members		8.989*	7.904	4.410
		(4.936)	(4.986)	(5.026)
10 members		10.802**	9.503*	3.640
		(5.242)	(5.288)	(5.237)
11 members		11.682**	10.802**	4.626
		(5.473)	(5.489)	(5.443)
12 members		13.442**	12.602**	5.378
		(5.607)	(5.671)	(5.639)
13 members		9.979*	8.905	0.0986
		(5.706)	(5.725)	(5.768)
14 members		4.511	4.581	0.220
		(6.360)	(6.422)	(6.050)
15 members		14.27*	11.53	3.797
		(7.671)	(8.066)	(7.510)
16 members		10.74*	8.649	−0.331
		(6.088)	(6.074)	(5.956)
17 members		11.48	6.456	−6.648
		(9.334)	(10.02)	(11.61)
18 members		−16.822**	−16.502**	−21.842**
		(7.489)	(7.277)	(8.914)
19 members		12.63	11.69	9.325
		(7.853)	(7.742)	(7.489)
20 members		34.612***	34.612***	26.40
		(11.69)	(12.17)	(16.62)
21 members		34.28	33.30	6.522
		(24.50)	(25.52)	(20.08)
22 members		45.202***	39.232***	21.792***
		(16.35)	(12.33)	(8.180)
23 members		28.672***	28.052***	−20.57*
		(5.684)	(5.790)	(11.84)
24 members		−2.906	−5.324	−5.197
		(6.022)	(5.735)	(10.20)

(continued)

Table A1 *(continued)*

	(1)	(2)	(3)	(4)
25 members		55.482***	58.852***	43.682***
		(12.77)	(14.56)	(10.62)
26 members		20.15	21.92	4.043
		(16.73)	(16.96)	(9.042)
28 members		57.842***	54.272***	16.812**
		(5.428)	(5.615)	(8.539)
29 members		−23.312**	−20.37*	−37.992**
		(10.54)	(11.78)	(14.83)
30 members		15.59	13.86	18.07
		(23.11)	(23.39)	(13.26)
31 members		44.632***	44.462***	21.502**
		(10.78)	(10.77)	(10.91)
32 members		17.242**	19.532**	−0.707
		(7.736)	(8.387)	(15.56)
40 members		22.922***	18.322***	15.72
		(5.549)	(6.305)	(11.32)
Village fixed effects	no	no	no	yes

Notes: The table reports the OLS coefficient on distance to primary school (multiplied by 100, in Row 1) and a number of observable characteristics of a regression on work. Rows refer to different dependent variables while columns to different specifications. Number of observations: 8,642. Standard errors clustered by household in brackets. *** significant at 1 percent, ** significant at 5 percent, * significant at 10 percent.

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