School Proximity and Child Labor
Evidence from Rural Tanzania

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This paper uses micro data from the 2000/01 Tanzanian Household Budget Survey to study the effect of distance to school on school enrollment and work decisions of rural children. A simple theoretical model illustrates that school proximity creates an incentive for children to combine work with school. While this unequivocally raises school attendance, it does not necessarily lead to a fall in child labor. Indeed, the reverse might be true. Consistent with the predictions of the model, the empirical analysis shows that a rise in distance to school is associated to a fall in the proportion of children combining work with school and an approximately equal rise in the proportion of full-time workers. Overall school attendance falls, with no effect on children's employment rate.

Keywords: distance to school, child labor, school enrollment.
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INTRODUCTION

This paper studies the effect of distance from the closest primary school on children's work and school attendance in rural Tanzania. A simple theoretical model shows that a rise in distance to school pushes children to specialize into either full-time school or full-time work, hence lowering the probability that they will combine work with school. While the model predicts that as distance to school increases school attendance will unequivocally fall, child labor is unlikely to increase in this case. An analysis of the micro data from the Tanzanian National Bureau of Statistics Household Budget Survey 2000/01 yields results that are in line with these predictions. Making schools more accessible in developing countries will most likely lead to higher school enrollment but this will not necessarily lead to a fall in child labor.

A considerable amount of research has recently been produced on the phenomenon of child labor. A widely held view is that child labor is damaging insofar as it prevents children from attending school and accumulating human capital, hence perpetuating an intergenerational poverty trap (see Udry, 2003 for an exhaustive analysis of this phenomenon). Additional potential concerns arise from the possibility that labor early in life might undermine a child's physical, psychological or cognitive development, with potential detrimental effects on this child's earning capacity in adulthood. Child labor might even lead to higher morbidity and mortality rates, although what evidence there exists shows no appreciable short run health effects of child labor (Beegle *et al.*, 2004). In addition to issues of equity, efficiency reasons arise that might justify public policy intervention. Indeed, in the absence of positive bequests, contracts establishing that children will repay parents as they turn adult in exchange for parents investing in their human capital are non-enforceable by nature. This might lead to a sub-optimal level of human capital accumulation among low income households (Baland and Robinson, 2000). Similar results arise in the presence of credit constraints. Policies such as (conditional) cash transfers have been proposed and implemented as a way to relax these constraints (see for example the experience of Progresa in Mexico: Behrman *et al.*, 2005, Schultz, 2000). Others suggest that a legal ban on child labor might also be a viable policy option to the extent that, by limiting the supply of a labor input (child labor) that is substitute for adult labor, parents' wages might increase, hence lowering the household supply of child labor (Basu and Van, 1998).

Although it is undisputable that child labor and low school enrollment are both the result of extreme poverty (the luxury axiom', for evidence see for example Edmonds, 2005 and Manacorda, 2006) potentially coupled with credit market imperfections or hold-up problems, it is likely that other forces affect a child's incentive to attend school and, possibly, to enter the labor market. Factors such as the undersupply of educational establishments, the poor quality of schools, and high direct costs of schooling, all commonly observed in developing economies, might explain low school attendance.[1] There seems to be a widely held view that these same forces are also responsible for children's high labor force participation in these countries.[2] However, a closer look at the data suggests that this conclusion is far from warranted.

The widespread observation that a large proportion of children in several developing countries happens to be neither in school nor in work - technically 'idle'- (for evidence see for example Biggeri *et. al.*, 2003) suggests that work on its own is not entirely responsible for children's low school attendance (on this see also Ravallion and Wodon, 2000). Similarly, the observation that a large proportion of children combine work and school also suggests that the trade-off between these two activities is less clear-cut than one might in theory suspect (and is generally modeled in the economic literature). Policies aimed at improving the supply or accessibility of educational establishments might hence increase school participation among those out of work with no effect on child labor, or working children might decide to combine work and school as a result of these interventions, but not to withdraw from the labor market. Whether this is an undesirable outcome from the perspective of a

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[1] For evidence on issues of school quality, see for example Banerjee *et al.* (2005), Duflo and Rema (2005), and references therein. For the role of distance to school see for example Siddiqi and Patrinos (1995). For evidence on the direct costs of education on school enrollment in Tanzania, see Beegle and Burke (2004).

[2] Bhalotra and Tzannatos (2003) for example in an overview of current research on the causes of child labor conclude (p. 73) that "Distance to school typically increases child labor".

social planner is disputable. A moderate amount of child labor might potentially embody some form of human capital accumulation that will be valuable to children later in life (see Beegle *et al.*, 2004), with no detrimental effects on a child's health. At the same time this might potentially guarantee to a child and his household a level of current consumption greater than they would enjoy were the child prevented from working, and even enable this child to afford schooling.

In this paper we concentrate on the effect of distance to school on children's time use. Effectively we ask how children respond to variations in distance to school in terms of school investment and current work activity. This is not the first paper to examine the effect of changes in the availability of schools at the local level on individuals' schooling decisions and their educational attainment later in life.[3] While most of these studies suggest that school enrollment and educational attainment (and hence, implicitly, school attendance) rise when the supply of education establishment and/or school accessibility increase, little is known about the effect of such policies on child labor.

The contribution of this paper is two-fold. First, we use a very simple theoretical model to discuss the likely effect of an increase in distance to school on children's time use. If distance to school can be thought of as a fixed cost of acquiring education - i.e. this cost is the same whether individuals invest their time exclusively into education or split their time between school and work - the model predicts that a rise in distance to school pushes children to specialize into either full-time school or full-time work. An increase in distance to school might even lead to lower levels of child employment. The reason for this is simple: a rise in the fixed cost of attending school might push children who otherwise

[3] A number of studies analyze the contemporaneous correlation between school availability and school enrollment. Lavy (1996) for Ghana, Filmer (2004) for a sample of 21 developing countries, Beegle and Burke (2004) and Bommier and Lambert (2004) for Tanzania, and Handa (2002) for Mozambique study the effect of distance to schools (from the village) on enrollment. Foster and Rosenzweig (1996) examine the effect of school construction on enrollment in India. A number of additional studies examine the long term effects of variations in the supply of educational establishments on educational attainment. Card (1995) studies the effect of college proximity on college education in the US. Duflo (2001) investigates a large school infrastructure expansion for Indonesia. Moretti (2004), Currie and Moretti (2003) examine the long term effects of college opening in the USA. Almost invariably, these studies find a positive effect of school availability on enrollment and school attainment.

would have combined work with school into full-time school, hence leading them to withdraw from the labor market.

The second and most important contribution of the paper is empirical. We estimate how school attendance and work vary with school distance in rural Tanzania. The data provide information on distance to the closest primary school for all households. Since we have no credible instrument for assignment of children to schools at different distance, non-random sorting of households in the vicinity of schools is a potential threat to the consistency of the regression estimates. If distance to school is correlated with unobserved determinants of school attendance and child labor, this might lead to biased estimates of the effect of school distance on time use patterns. Typically micro data from developing countries (see for example Filmer, 2004, who uses DHS data from 21 countries) provide information on distance to school at the village level, so that one cannot separately identify the effect of school distance from other unobserved village effects. One first advantage of the data set is that it provides information on distance to school at the household level, which allows us to condition for village specific characteristics - whether observed or unobserved - that might contribute to explain children's time use while being simultaneously correlated with distance to school. A second advantage of the data is that they provide information on distance to a large array of facilities other than schools. By conditioning on these variables we attempt to capture the potential non-random location of households within villages in terms of their location next to the administrative center of the village or the closest urban center. This might lead to a spurious inference on the effect of distance to school if some systematic correlation exists between latent levels of children's labor or school attendance and their spatial distribution within the village. Third, we include in the model a number of household characteristics, such as demographics, measures of income and wealth. This allows to further control for potential non-random sorting of households in the same village at different distance from school. Fourth, the data provide information on both travel time and physical distance to school facilities. Because two (potentially error ridden) measures of school accessibility are available, this allows us to control for potential measurement error in the distance to school variable that will most likely lead to OLS estimates that are biased towards zero.

The empirical results illustrate that once (unobserved) differences across villages and controls for (observed) determinants of child labor (i.e. distance to other infrastructures and household observed characteristics) are accounted for, distance to school tends to have a significant effect on time use among rural children, especially boys. Consistent with the theoretical model, this largely manifests through a lower propensity to combine school with work and a higher propensity to engage in full-time work. Overall, higher distance to schools in rural areas leads to non-significant changes in work participation, but to a fall in school attendance, as individuals shift from school in combination with work to full-time work.

The structure of the paper is as follows. Section 1 presents the data and descriptive evidence on child labor and schooling in rural Tanzania. Section 2 presents a very stylized model of child labor and schooling with fixed costs of attending school. Section 3 discusses the specification and identification of the empirical model and presents the regression results. Section 4 discusses these results and concludes.

1. DESCRIPTIVE EVIDENCE

Tanzania is one of the most populous (population in 2001 was approximately 32 million) and poorest countries in Sub-Saharan Africa (annual GDP *per capita* in 2001 was in the order of US$ 540, only after Zaire, Sierra Leone, Chad and Niger). The poverty rate in 2001 was estimated to be as high as 31%. Like many other sub-Saharan African countries, the economy is largely based on agriculture, accounting for around 80% of employment and 60% of GDP (World Bank, 2005).

Although Tanzania was an early starter among countries in the region in prompting universal primary school enrollment, during the 1980s and 1990s enrollment stagnated or even fell. This was the result of government's underinvestment in education (Beegle and Burke, 2004) coupled with an exponential population growth. The adult literacy rate is nowadays below 80% and the gross enrollment rate in compulsory primary education (grades 1-7) in 2000 was in the order of 63% (UNESCO, 2005). Net enrollment is substantially lower and in the order of 49%. This is due to a combination of late entry, intermittent attendance, and widespread grade repetition.[4]

In order to document the incidence of child labor and school attendance in Tanzania we use micro data 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 socio economic characteristics of the household members, the survey collects information on income and housing characteristics. As already hinted at in the introduction, the survey also provides information on distance to a large number of infrastructures plus information on school enrollment and work in the week preceding the survey. The sampling scheme is stratified as follows. First, 1,158 Primary Sampling Units (PSUs) were identified 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 sometimes 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. In the following we restrict the sample to children aged 7-16 in rural areas.[5] [6]

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[4] This situation has changed considerably since 2000. In 2001 the Primary Education Development Programme (PEDP) was launched with the aim of achieving universal primary education by 2005 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 2 million pupils (Shitundu, 2005).

[5] Because we are interested in distance to primary school, one should in principle restrict the sample to children aged 7-14, corresponding to the theoretical ages for primary school (grades 1-7). In reality, school entry age is very delayed in Tanzania, and progression is slow due to both intermittent attendance and widespread grade failure (Bommier and Lambert, 2000). We restrict to individuals aged 7-16 to keep a reasonable sample size. Of these individuals, 95% have incomplete primary education (sixth grade or less).

[6] There are a number of reasons why we restrict the sample to rural children. First, it is in rural areas that school supply constraints are most likely to exist. Second, since there is no town identifier in the HBS data, we are unable to identify PSUs within the same town. This would imply treating individuals in two neighboring PSUs that live close-by as different entities, while treating individuals in the same PSU who live far apart as similar individuals, a rather unattractive option. Third, while rural children are disproportionately employed on the household farm, giving them the 'flexibility' to combine work

We also exclude from the sample children who are not relatives of the household head (domestic servants and non-relatives, accounting for less than 1% of the sample). We additionally drop from the sample 9 individuals for whom gender is not reported and 14 individuals who report being household heads. Overall, we have 10,543 children in 539 villages, with an average of 20 children and 9 households *per* village, implying on average slightly more than two children age 7-16 *per* household.

1.1. Children's Time Use

Table 1 reports information on time use of children. Column 1 reports the number of individuals in each cell. Column 2 reports information on those in work. Work refers to the activity in the week preceding the survey, and includes both paid market work and unpaid work in the household farm or enterprise, but excludes household chores. This includes individuals reporting work as either their primary activity or their secondary activity or both. Already, by age 7, almost half (around 44%) of both boys and girls in rural areas are in work. By age 16, around three fourths of both boys and girls are in work. The largest majority of these children work as unpaid family workers in the household farm. Although normal entry age in school is 7, school entry is very delayed in Tanzania, with attendance rates increasing up to age 13 and then falling (column 3). School attendance is also far from universal, with around 14% of boys and 19% of girls aged 14 or older reporting not having completed at least a school grade. Work in combination with school is also very widespread with about half of those in school also reporting some work activity (column 4). This proportion grows rapidly with age and it tends to stabilize around age 13. In general girls are slightly more likely to work while in school, despite no appreciable difference in the average proportion of boys and girls attending school. A non-negligible proportion of children also declare being idle, i.e. neither in work nor in school (column 5). Overall around 12% of boys in the age range 7-16 tend to be idle, although this largely appears

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with school, urban children might be subject to contractual arrangements and other labor market rigidities that would make part-time work a less viable option regardless of the local school supply.

ascribable to late school entry (coupled with non-universal work participation at very early ages) rather than inactivity among teenagers. The figures in column 6 illustrate that a substantial share of children who devote their time to household chores, such as food, water and wood collection for family consumption. The proportion of boys performing household chores is on average equal to 6%. Girls are more likely to engage in household chores, with an average incidence of 13%. When household chores are counted as economic activity, this leads to an inactivity rate (neither in work, neither in school, nor devoting their time to household chores) of around 11% for boys and 9% for girls. Weekly hours of work measured only for those who report positive hours are on average 28 for boys and 27 for girls (column 8). This is approximately equivalent to a part-time adult job. Involvement in household chores is also non-trivial, with an average work week of 19 hours for boys and 24 hours for girls (column 9).

Column 10 finally reports information on distance to primary school. School distance in the HBS data is reported in intervals, 0-1 kilometer, 1-2 kilometers, etc. We attribute to each individual the mid point of each interval (respectively 0.5 kilometers, 1.5 kilometers, etc.). Average school distance is around 3 kilometers for both boys and girls, and it does not show any clear pattern of variation with age. Such a distance does not appear irrelevant. Evidence later in the paper will show that this is associated to more than one hour daily travel time to school in each direction. This might in principle explain low school enrollment, especially among young children.

1.2. Distance to School

Although Table 1 provides evidence of considerable distance to school among households in the sample, this potentially hides substantial heterogeneity across households. Here we investigate the source of this variation, and in particular whether this is associated to some villages having a primary school while others not, or whether this is largely ascribable to the circumstance that the sampled households are rather widespread within villages. Although, as said, the data do not allow us to uncover the identity of villages, and hence to ascertain directly if a village has a primary school, one can still make some progress using the HBS data.

As a first step we have run a simple regression of distance to school on village fixed effects using all households in the sample, independent of whether they have children aged 7-16 or not. Village fixed effects account for around 20% of the variability in school distance, suggesting that the largest source of variation in the data (around 80%) is within villages.

In Table 2 we report additional information on the distribution of school distance. The first column of the table reports the cumulative frequencies associated to different distances (1 km., 2 km., etc.) calculated across all households in the sample. This is the unconditional distribution of school distance. About one third of households live at more than 3 kilometers from the closest primary school. The following columns report additional information on the distribution of distance within villages. In particular columns 2, 3, and 4 report respectively the proportion of villages with at least 25%, 50%, and 75% of the population within a certain distance from the closest primary school. Suppose that everybody in the same village lives at the same distance from the primary school. In this case there should be no difference, say, in the proportion of villages with at least 25% or at least 50% of households within 1 kilometer from the closest primary school. So if most of the variation in school distance is between villages, figures in each row will be roughly constant. Conversely the table shows substantial variation within rows, implying non-negligible variation in distance to school within villages, consistent with the analysis of variance above. Most important, the table illustrates that practically in each village there are households living in the vicinity of the primary school. Row 1 column 2 illustrates for example that, in more than 70% of villages, at least 25% of households live within one kilometer from the closest primary school. In sum, if school distance constitutes a constraint on children's time use in Tanzanian, this is not due to the absence of schools *per se* but rather to the circumstance that, within villages, households live in rather widespread areas around schools.

Although we have no way to ascertain how spread out the villages in the sample are, one can derive a measure of the distance between the two sampled households in each village that are the furthest away from each other, an admittedly imperfect measure of the village extension. Consider a facility whose catchment area extends over the entire village, so that all households in the same village report the distance to the same facility (things become more complicated if there is more than one facility of the same type that is accessed by different households in the same village). In this case the distance between any two households is at least equal to the difference in their distance to the closest facility.[7] This is precisely the case if these households lie on the same straight path to the closest facility. This seems a good approximation for facilities typically further away from the village, which are also more likely to be the ones whose catchment area extends over the entire village. The HBS provides information on distance to the following facilities: closest primary school, 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.[8] To get a sense of the extension of the villages in the HBS data, for each village we have computed the difference between the top and bottom deciles of the distance distribution to each type of facility and we have averaged this difference across villages. This difference varies between 2.9 kilometers for the closest shop to around 16 kilometers for the closest hospital. Distance to the closest bank or post office is in the order of 12 kilometers. Most likely all households in each village use the same hospital that is also located in the closest city, while the same is not true for shops. This suggests that households live on average in areas of a radius of around 8 kilometers. This is substantially higher than the average

[7] The distance between household 1 and household 2, respectively at distance d_1 and d_2 from a given facility, is $[d_1^2+d_2^2-2d_1d_2\cos(\alpha)]^{0.5}$, where α is the size of the angle formed by the two straight lines connecting each household to the facility. For α=0, this distance is simply $|d_1-d_2|$. This distance increases as α increases.

[8] Information is also available on distance to the closest pre-school. We exclude these facilities since these are likely to be located together with the primary school. We also do not use information on distance to the household's farm.

distance to school, implying that most villages have a primary school, and households must be more densely concentrated around it.

In sum, the definition of villages in the HBS encompasses areas that are rather large and this guarantees that substantial variation in distance to school exists within villages to identify the effect of interest.

We finally investigate the characteristics of those living at different distance from school. In Table 3 we report the univariate correlation between distance to the closest primary school and a number of other household characteristics. Rows 1 to 16 report information on distance to other facilities. Row 17 reports household log income and row 18 the household's head education level (as proxied by a dummy for completed primary education). We report two correlation coefficients: one that refers to the variables in levels and another that refers to the same variables expressed in deviation from the village mean. Rows 1 to 16 show a clear and significant positive correlation between distance to all other facilities and distance to the primary school. This suggests that proximity to schools proxies for accessibility to a number of other infrastructures and services. This remains true (with the exceptions of the place where the household collects wood and the closest bank) when we compare households from the same village: proximity to the primary schools is associated to the household being located close to the administrative center of the village. Rows 17 and 18 make the point that households closer to the primary school are also better-off: they have systematically higher income and the household head is systematically more educated. Again this is not simply due to differences across villages but these correlations still hold (and are very similar in magnitude) when we compare households in the same village.

In conclusion, distance to the primary school is far from randomly allocated across households. Not only do more affluent households tend to live in villages that have better availability of schools but within each village these households also tend to live closer to both the school and other infrastructures and services. We will need to bear this in mind in the empirical analysis.

2. A SIMPLE MODEL OF JOINT WORK AND SCHOOL

Having ascertained in the previous section that both child labor and school non-enrollment are widespread in rural Tanzania and that considerable variation exists in school accessibility across households, in this section we present a stylized model of child labor and schooling that will serve as guidance in the interpretation of the empirical results in the following section. The model is similar in spirit to the one proposed by Cigno and Rosati (2005).

Suppose that households maximize a utility function defined over current and future consumption. To keep things extremely simple, suppose that households have no ability to borrow against future income and that savings are not possible (say, because consumption is perishable). The only way for the household to warrant consumption tomorrow is through a single investment good: children's human capital. Finally, assume that households attach no utility to children's leisure. This implies that, at the optimum, children will never devote any time to leisurely activities.[9] In formulas, the household problem consists in maximizing the following well-behaved utility function:

(1) $U = U(E, S)$

where E is current consumption and S is the present discounted value of the flow of income accruing to the household from investing in their children's human capital.

Households maximize (1) subject to a budget constraint and a time constraint. The budget constrain is:

(2) $E = Y + w H$

where Y is income from sources other than child labor (including parental labor earnings), w is the child's wage rate and H is hours of work.

The time constraint is:

(3) $H + S + f\ I(S>0) = 1$

[9] This obviously rules out inactivity as a possible labor market state for children. Although it is known that in several developing countries inactivity rates appear high for children (see Biggeri *et al.*, 2003) the HBS data show that this is not a major source of concern (in rural areas). Imposing this restriction helps considerably simplify the analysis.

where the total time endowment is standardized to one and f ($0 \le f \le 1$) is travel time to school, and additionally we impose $0 \le H \le 1 - f\, I(S>0)$, $0 \le S \le 1-f$.

Children will either work full-time ($H=1$) or attend school full-time ($H=0$, in which case $S=1-f$) or combine the two. What is crucial to this model is that individuals will have to incur the fixed time cost of school f independent of whether they attend school part-time (i.e. in combination with work) or full-time.[10] Only if a child decides to withdraw completely from school will he forfeit this cost. Equation (3) also suggests that if a child works ($H>0$), this will come to the detriment of his human capital accumulation (i.e. $S<1-f$). This feature of the model picks up the potentially lower returns to education for working children.

In the following we present the comparative static of the model using simple graphical tools for a well behaved utility function. The Technical Appendix presents the analytical derivation of the equilibrium for a specific and easily tractable utility function.

To study the effect of changes in travel time we start from the case when where $f=0$. In this case three regimes are possible. These are depicted in Figure 1, where AC is the budget line. Children will be in full-time school ($H=0$) if the market wage is below the (absolute value of the) marginal rate of substitution between consumption and schooling evaluated at $E=Y$ and $S=1$ (their reservation wage). These individuals will locate at the endowment point A. Children will be in full-time work ($H=1$) if the market wage is above the (absolute value of the) marginal rate of substitution evaluated at $E=Y+w$ and $S=0$. These individuals will locate at C. For intermediate values of the wage rate individuals will combine work and school ($0<H<1-f$, $0<S<1-f$). These individuals will locate at point B.

Figure 2 shows the effect of a marginal rise in the fixed cost of attending school. The budget line shifts inward and the choice set shrinks. The maximum amount of school individuals can consume is now $1-f$. We refer to the case in which $H=0$ ($S=1-f$) as full-time school in this regime. Individuals can still work but at any level of hours they will invest less than before in human capital. The only

[10] The model is similar in spirit to Cogan's (1981) model of labour supply with fixed time costs of work.

exception consists of individuals in full-time work who see their opportunity set unchanged. So the budget line A'QC presents a kink at Q.

Let us first consider individuals originally in full-time school (A). If schooling is a normal good these individuals will have an incentive to cut both consumption and schooling following a rise in the time cost of attending school. This is an income equivalent fall of an amount *wf*. The income effect would push these individuals to locate somewhere to the South-East of A' on the new budget line, i.e. to split the income loss into some lower consumption and some lower investment in schooling (both assumed to be normal goods). However, since baskets to the right of A' are unattainable, these individuals will be forced to move to A', where utility is again maximized. As a result of the decreasing marginal rate of substitution between consumption and schooling, the reservation wage for those originally at A rises as they move to A'. These individuals will remain in full-time education ($H=0$) although they will now consume $1-f$ units of schooling as opposed to 1 unit. The incentive to remain out of the labor market hence will increase for these individuals.

Similarly, individuals originally in full-time work will remain at C. The reason for this is simple. If these individuals were in full-time work before, they will be *a fortiori* now that the set of alternative opportunities has shrunk.

Children originally combining work and school (B) will be affected. Some of these individuals (those closer to A) will move to full-time school (A'). Again these are individuals who experience a negative income effect and who would like to cut both consumption and schooling. The fall in schooling that is imposed by the new regime (i.e. the circumstance that schooling needs being not greater than $1-f$) will create an incentive for those who would choose more than $1-f$ in an unconstrained world to locate at A'. Other individuals (those closer to C) will also experience an income effect, hence making them consume less school, potentially dropping out. The circumstance that full-time work is still an option at zero fixed costs will create an additional incentive for these individuals to move away from part-time work (i.e. work in combination with school) and choose full-time work. The opportunity cost of choosing part-time work has increased. Finally, others will continue devoting their time to both activities but they will experience both a fall in schooling (and hours of work) and in consumption (B').

What this stylized model suggests is that a rise in fixed travel time to school will prompt individuals located at B to specialize in either full-time work (C) or full-time school (A). The proportion of those engaging in full-time work or school cannot decrease. The overall effect on total school attendance though will unequivocally be non-positive since the fall in school attendance among part-timers will at most be perfectly offset by an increase in full-time school. Similarly, work participation (whether full-time or part-time) will never fall and might potentially rise as some part-time workers now will devote all their time to work.[11]

The intuition for this result is that fixed travel time to school acts as a lump sum tax on schooling. In an attempt to offset the effect of this tax, individuals will either drop out from school (hence avoiding the tax *tout court*) or will tend to minimize the marginal impact of the tax by shifting to full-time schooling. School in combination with work becomes a relatively more expensive option. The implication of this stylized model is that increased accessibility to schools will lead to a rise in schooling but this will not necessarily translate into a fall in child labor. This policy change might even lead to a rise in child labor force participation, since some individuals might find it easier now to combine work and school.

[11] A sufficiently high level of f could push some individuals to move from A to C. In this case school attendance would still fall but child labor might indeed rise. This case is discussed in the appendix.

3. REGRESSION ANALYSIS

3.1 OLS Estimates

In this section we present the results of a number of regressions of children's time use on distance to primary school. The objective is to identify the 'causal' effect of changes in distance to school. Because the HBS data are cross-sectional and because we have no credible instrument for assignment of children to schools, we attempt to recover this parameter by controlling for observable households and unobservable village characteristics.

In practice we regress children's time use (*T*: work, school, etc.) on the household's self-reported travel distance to the nearest primary school measured in kilometers (*distance*) plus a set of controls (*X*). In formulas:

(4) $$T_{it} = \beta_0 + \beta_1\, distance_i + X_i'\, \beta_2 + u_i$$

where u is an error term and in some specifications the vector X includes village fixed effects.

Table 4 reports OLS linear probability estimates of equation (4) for rural children aged 7-16. The table reports separate results for boys in the left hand panel and for girls in the right hand panel. Each row refers to a different variable and each column to a different specification. All specifications in the table control for dummies for child's age and dummies for his/her relationship to the household head (spouse, child of head, child of spouse, grandchild, and other relative), plus month of interview dummies. Standard errors are clustered by household. Column 1 reports regressions with no additional controls. Rows 1 and 2 illustrate that one extra kilometer to the closest primary school is associated to a fall in school attendance (whether in combination with work or not) of 2.6 percentage points and a rise in work (defined with the exclusion of household chores) of 1.3 percentage points among boys.

Although these estimates are strongly suggestive of a correlation between school accessibility and children's time use, there are good reasons to be skeptical about their consistency. As already hinted at in the introduction, school attendance and distance to school might be correlated for reasons other than the causal effect of the latter variable on the former. For instance, it could be that in more affluent villages both the accessibility of schools and school enrollment are higher, leading to overstate the effect of school distance on school attendance. In order to purge the OLS estimates in column 1 from the effect of unobserved differences across villages, column 2 reports estimates with the inclusion of village fixed effects. As shown in section 1, most of the variation in school distance is within villages, warranting the identification of the model with village fixed effects. Interestingly, the coefficient on schooling remains negative and significant although it falls by about 15% (to -0.022) while the coefficient on work goes to zero (0.002). This suggests that unobserved determinants of child labor are correlated with distance to school across villages.

Estimates in column 2 exploit the differential school and work participation of households in the same village that are at different distance from the closest primary school. Again, some concerns might arise in relation to the consistency of these estimates. As shown in Table 3, school distance is correlated with the determinants of children's time use even within villages, leading to potentially biased estimates of the effect of such variable on children's time use. Such source of correlation stems from the circumstance that poorer households live further away from the village center (whether physical or *de facto*) and schools tend to be located in central areas. In an attempt to capture such differences across households, column 3 controls additionally for distance to the entire set of facilities (listed in Table 3). Point estimates are slightly lower than the ones in column 2, with one extra kilometer leading to a fall in school attendance of 1.4 percentage points and again no appreciable change in work participation. These results suggest that distance to school is largely picking up genuine variation in access to school rather than proxying for central location of the household relative to the administrative center of the village.

In column 4 we additionally include a number of arguably exogenous observed household characteristics: household head's sex, age and age squared, occupation (farmer, employee, non-agricultural self employed, unemployed), marital status (never married, married, divorced, widowed), log income, education (no education, incomplete primary, completed primary, incomplete secondary and complete secondary) and literacy status, dummies for the number of individuals in the household in different age cells (0, 1-6, 7-11, 12-16, 17-20, 21-45, 46-60, 61 and over), 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), and type of walls (poles, poles and mud, mud only, mud bricks, baked bricks, concrete, other). By controlling for observed household characteristics, we attempt to wash out the residual heterogeneity across households that might affect the consistency of the OLS estimates. Column 4 shows that – once this large array of observed household controls are included – the point estimate for the effect of school distance on school attendance falls further to about -1 percentage point, but remains negative and significant.

The following rows shed some additional light on the effect of school distance on boys' time use. Rows 3 and 5 illustrate that the fall in school attendance induced by a rise in travel distance is entirely due to a fall in part-time schooling. When all controls and village fixed-effects are included, one kilometer rise in school distance leads to a fall in the proportion of children combining work and school that is roughly equal to the effect on school attendance, as reported in row 1 (-0.010). This is consistent with the observation that the effect on full-time school is zero once village fixed effects and distance to other infrastructures are included (row 5). Similarly, although row 2 shows no variation in the probability of work as distance to school changes, this hides a substitution away from part-time work (in row 3) and a rise in full-time work (row 4, coefficient 0.007) that roughly compensate each other. We find a small and generally insignificant effect of distance to school on idleness (row 6). In sum, results in Table 4 suggest that, consistent with the theoretical model in the previous section, a rise in school distance tends to reduce boys' incentives to combine work and school. This leads to a fall in schooling and no appreciable change in work participation, although part-time work falls and full-time work rises. This suggests that children most affected by such variation are those at the margin between part-time work and full-time work (individuals who move from point B to point C in figure 2), i.e. individuals with a relatively high marginal utility of consumption relative to school.

Results with no additional controls for girls in column 5 are similar to the corresponding results for boys and do not do not vary when village fixed effects are included in column 6. The addition of controls for distance to other infrastructures in column 7 tends to lower the estimated coefficients following a pattern that is similar to the one found for boys. When we further include controls for household characteristics in column 8 this leads to OLS estimates that are close to zero and insignificant.[12]

3.2. First Stage Estimates

One concern that arises in connection to the estimates in Table 4 is that school distance might be affected by measurement error. If this is the case, the regression coefficients in Table 4 will most likely be biased towards zero (Angrist and Krueger, 1999). This might explain the predominance of zero effects found for girls in column 8. This problem is likely to be even more serious when village fixed effects are included. In order to account for measurement error, we instrument travel distance to school using the household reported travel time to the nearest school. Although this might also be an error ridden measure of school accessibility, 2SLS estimates of model (4) will be unbiased (if not for omitted variables) provided the measurement error in the two variables is uncorrelated.

In practice we estimate the following equation:

(5) $$distance_i = \gamma_0 + \gamma_1\, time_i + X_i'\, \gamma_2 + v_i$$

where *time* is the reported travel time to the closest school measured in hours. We use the prediction from model (5) to estimate equation (4) using 2SLS. In practice equation (5) estimates the average speed to school in the sample and predicts distance to school based on such average speed and reported travel time. By using average speed, this additionally abstracts from potential heterogeneity in speed to

[12] Such differences emerge only once controls for distance to other infrastructures are included (compare columns 5 and 8). There is a simple mechanical explanation for this. Girls happen to be more involved in household chores than boys (see Table 1). Because distance to other facilities is positively correlated with distance to school, girls who live at larger distance from school are also further away from other facilities required to perform their household tasks. Consistent with this explanation, distance to the market place, the mill and the community center tends to lower school attendance among girls but not boys.

school among children which, in turn, might be correlated with omitted determinants of children's time use, such as their health, inner motivation to learn or accessibility of their homes.

Table 5 reports the OLS estimates of the first stage equation for boys and girls separately. Column 1 reports the OLS estimates with no controls (other than age, relationship to household head and month of survey). One additional travel hour to school is associated to around 3.2 extra kilometers in distance to school for boys. The inclusion of village fixed effects tends to lower the estimated speed to around 2.9 kilometers *per* hour, suggesting that travel distance for two households reporting the same travel time to school but living in two different villages - one with low average travel time and one with high average travel time - is lower for the first household than for the second household. This implies that pooling households from different villages leads to overestimate speed to school. One reason why this might be the case is that in villages that are further away from school some arrangements might exist for children to reach school more speedily or simply that children might walk faster when schools are further away. The inclusion of distance to other facilities in column 3 lowers further the coefficient, suggesting an average speed of 2.3 kilometers *per* hour. The inclusion of household controls makes little difference to the estimated coefficients. Similar results emerge for girls, for whom average travel time is on average slightly lower than for boys. Regressions with the entire set of controls suggest an average speed of just above 2 kilometers *per* hour. Estimates for both girls and boys are rather precise, with t-statistics around 6.

3.3 2SLS Estimates

In Table 6 we then present 2SLS estimates of the effect of distance to school on children's time use where we instrument physical distance by travel time variable, using the results in Table 5. The structure of Table 6 is analogous to that of Table 4. Rather interestingly, regression coefficients are in absolute value generally higher than those in Table 4, suggesting some non-negligible measurement error in the reported measure of distance to school. Generally speaking, the inclusion of village fixed effects makes less difference to the results than in the case where simple OLS are used (Table 4), consistent with the notion that measurement error might be exacerbated by unobserved village characteristics. Results are qualitatively unchanged for boys. Regressions that control for village fixed effects, observable characteristics of the household and distance to other infrastructures lead to a significant estimated effect on school of -0.010 (the same as in Table 4), work and school of -0.020 (compared to an OLS estimate of -0.011). Similarly, the effect on work only is now 0.017 (compared with an OLS estimate of 0.007). For girls again patterns are similar to those in Table 4 and once measurement error is accounted for (and all controls are included, column 8) we find a small rise in the absolute value of all coefficients. The estimated coefficients have the same sign as the ones found for boys, but they are smaller and overall insignificant. However we can never reject the hypothesis that these coefficients are statistically undistinguishable from the ones for boys.[13]

3.4 Further checks

Table 7 further investigates the effect of distance to school on children's time use and other outcomes. For brevity, here we only report 2SLS estimates with all set of controls (village fixed effects, distance controls and household controls). One first concern that arises in the previous regressions is that the estimates of the effect of school distance on children's time use ignore children's participation in household chores. In particular the smaller effect on girls' probability of combining work and school in Table 6 (-0.007 for girls compared to -0.020 for boys with all controls included) might be the result of girls being more likely to be involved in home production. In row 1 of Table 7 we report 2SLS estimates of the effect of distance to primary school on the "work and school" variable, where an extensive definition of work is used: either market work or work in the household farm or household

[13] Notice that, although a significant effect of school attendance on boys' time use is found, overall this is unlikely to explain children's low school enrollment in Tanzania. Around 30% of children aged 7-16 in rural Tanzania live at more than 3 kilometers from the closest primary school implying an average travel time to school of at least one hour in each direction. The estimates in Table 6 imply that attendance rates among these children might rise by as much as 2 percentage points for boys and only about half a percentage point for girls if schools were in the radius of three kilometers from their residence.

chores. Results for boys are very similar to the ones in Table 6. For girls, the point estimate is slightly larger than the one in Table 6 (-0.011 as opposed to -0.007) and statistically significant at 10% level, suggesting that girls tend to be less likely to combine work and and/or household chores with school when travel distance to school increases. The lack of significant effects on girls' time use is in part explained by the circumstance that girls tend to be more likely than boys to be involved in household chores.

It still remains true that – relative to boys - we find a smaller and statistically insignificant effect of school distance on girls' school enrollment and full-time work. However, given the high standard errors, results across gender groups are hard to tell apart.

Row 2 investigates the effect of changes in school distance on total hours of work. We find no effect for either boys or girls. Possibly this is the combination of an increasing proportion of children working full-time as a result of increasing distance (hence leading to higher hours of work in the population), together with a reduction in hours for those in part-time work and schooling. Indeed, as distance increases, children in school have less time to devote to work.

Finally, rows 3 and 4 investigate how children's educational attainment is influenced by distance to school. We find a negative effect of school distance on the probability of ever having attended school for boys but not for girls. The 2SLS estimates suggest a reduction in the probability of ever having attended school in the order of 0.6 percentage points for boys and 0.3 percentage points for girls. These effects are similar to the ones found in row 1, Table 6, where the dependent variable is school attendance. It appears that school distance affects the probability of ever enrolling in school rather than discouraging school attendance among the ones who ever enrolled.

Similar results apply to the "maximum school grade achieved" variable, which tends to fall with school distance. The coefficient for boys is -0.034 and statistically insignificant, while for girls this is -0.040, and significant at conventional levels. Again these two coefficients are hard to tell apart. Although proximity to school leads to a higher proportion of children combining work with school, which might in turn negatively affect school progression, and hence the maximum grade completed, it appears that this effect is more than offset by the higher enrollment, so that at each age those living closer to a school have accumulated more education than those living further apart.

4. SUMMARY AND CONCLUSIONS

In this paper we present a simple model of children's time allocation between school and work. We show that travel time to school acts as a lump sum tax on schooling. In an attempt to offset the effect of this tax, individuals will either drop out of school (hence avoiding the tax *tout court*) or will tend to minimize the marginal impact of the tax by shifting to full-time schooling. School in combination with work becomes a relatively more expensive option when school distance increases.

We use this model to understand responses to variation in distance to school among children aged 7-16 in rural Tanzania using micro data from the HBS 2000/01. More than 60% of children in the sample are in work and, among them, about half are out of school. Distance to school is a potential constraint on these children's time use: around 30% of them live at more than 3 kilometers from the closest primary school. This results from the circumstance that households in the sample are rather dispersed within villages. This large geographical dispersion of households allows us to compare school attendance and work involvement of children in the same village, hence controlling for unobserved village differences that are common to all children in the same village and that might be correlated with both school accessibility and children's time use.

Even within villages, though, we find that school distance to the primary school is not randomly allocated. More affluent and educated households tend to live closer to both schools and other infrastructures and services, most likely a reflection of the circumstance that most facilities (including schools) are located around the village center. In an attempt to purge the OLS estimates of the effect of household quality and proximity to the village center, we present regressions that control for a large array of household characteristics plus distance to sixteen additional types of facilities.

Consistent with the predictions of the theoretical model, we find that higher distance to school leads a lower propensity to combine work with school, and to a higher propensity to devote to full-time work. Overall these two effects tend to compensate each other, so that children's employment rate is not affected by school distance. For boys, one additional kilometer to the closest school lowers the probability of combining work and school by about 1 to 2 percentage points, and increases full-time work by a similar amount. By simple virtue of the fact that fewer children combine work and school, this implies that overall school attendance tends to fall. Although these results are significant, it is worth emphasizing that high distance to school is unlikely to explain the bulk of children's non-enrollment in rural Tanzania.

Results for girls are generally smaller in magnitude and, in most cases, insignificant at conventional levels. In general, though, it is hard to reject the hypothesis that differences between boys and girls are statistically significant. In addition, we show that one reason why girls appear to be less reactive in terms of their labor force participation to variations in distance to school compared to boys is that they are more likely to be involved in household chores. Any definition of work that excludes domestic activities tends to conceal relevant adjustments in girls' time use.

Taken at face value, and contrary to what appears a 'general wisdom', our results suggest that policies aimed at increasing the supply of schools in rural areas of developing countries will most likely increase school attendance but are unlikely to lead to a fall in children's employment.

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Technical Appendix

In this appendix we derive the comparative static of the model under a simple parametric assumption for the utility function. We assume that:

(A1) $U(E, S) = E-(1-S)^2$

so that the marginal rate of substitution between consumption and schooling is $MRS = -2(1-S)$.

Individuals will attend school full-time ($S=1-f$) if their market wage is above the reservation wage w_1, where from the above it follows:

(A2) $w_1 = 2f$

We now derive the wage level that makes individuals indifferent between working full-time and combining work with school. We denote this by w_2. Note that, because of the discontinuity in the budget line, at this level of wages individuals will consume a strictly positive level of schooling. We denote this reservation level of schooling as S_2. It is easy to show that, if it exists, w_2 must satisfy two conditions. First, it must be such to yield the same level of utility in the case where the individual works full-time or part-time. Second, it must equate the marginal rate of substitution between consumption and schooling at the 'reservation' schooling level, denoted by S_2. This wage level is depicted in figure A1 as the slope of the dotted line stemming from point Q and tangent to the indifference curve going though point A (both of which being functions of w_2). In formulas, these two conditions imply that:

$$w_2 = 2(1-S_2)$$

$$E-(1-S_2)^2 = Y+w_2-1$$

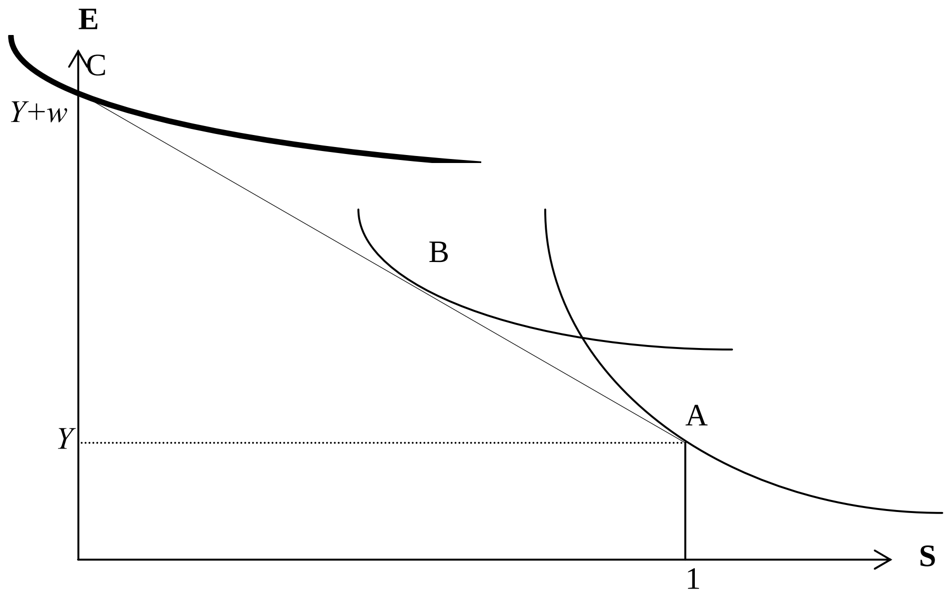
It is easy to prove that for $0 \leq S_2 \leq 1$, it must be the case that $f \leq 2^{0.5}-1 \approx 0.4$. In this case:

(A3) $w_2 =2(1+f)-2[f(2+f)]^{0.5}$

and $w_1 \leq w_2$. In practice, for not excessively high travel distance to school, individuals will chose full-time school if $w<w_1$, full-time work *if* $w>w_2$ and will combine work with school for values of the wage rate such that $w_1 \leq w \leq w_2$. Under the assumption that f is not too high, a marginal increase in f will tend to increase w_1 and to lower w_2. Unequivocally this will lead to increased specialization.

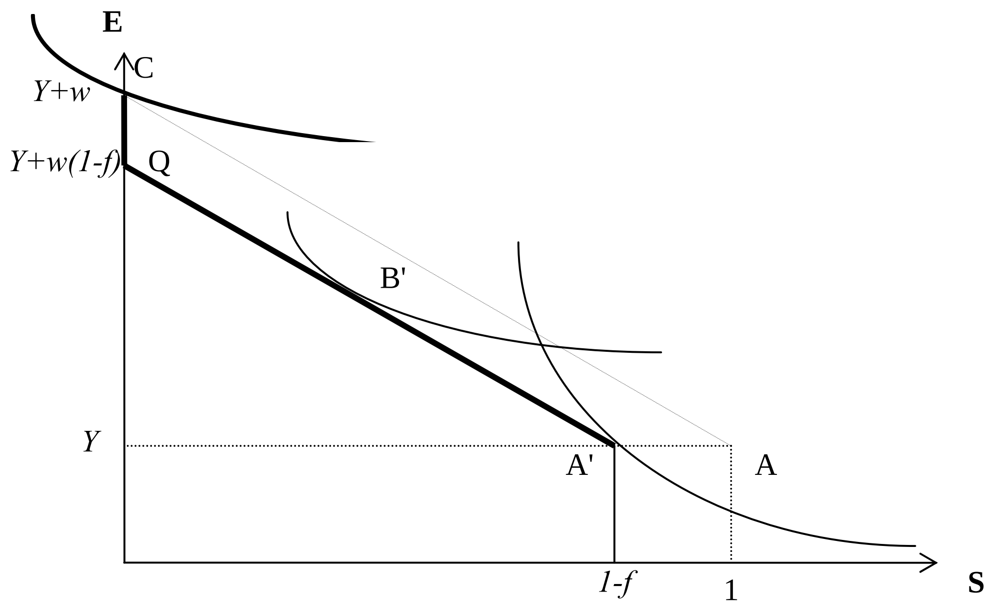
For high values of f ($f > 2^{0.5} - 1$) individuals will never combine work with school. They will either work full-time or attend school full-time. In this scenario a rise in f will still lead to a fall in schooling, but child labor will now unequivocally increase.

Figure 1
Optimal School and Consumption Decisions
with No Fixed Time Cost of Attending School



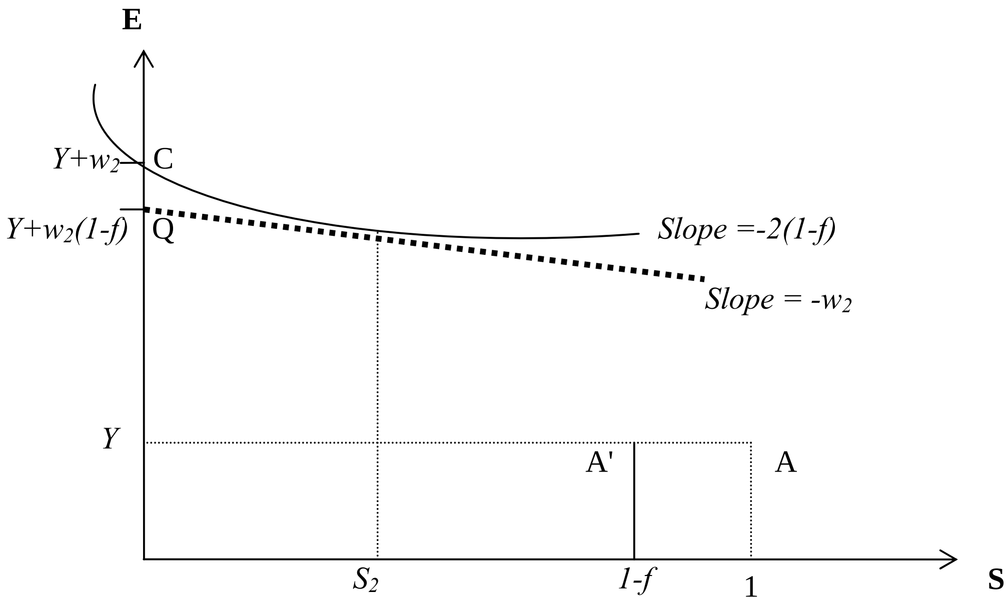
Notes. The figure depicts the optimal allocation of schooling (S, and hence work, defined as 1-S) and consumption (E) for three types of individuals, with high (A), medium (B) and low (C) marginal rate of substitution between current consumption and schooling.

Figure 2
Optimal School and Consumption Decisions
with Fixed Time Cost of Attending School



Notes. The figure depicts the optimal allocation of schooling and consumption for three types of individuals, with high (A'), medium (B') and low (C') marginal rate of substitution between current consumption and schooling when fixed cost of travel to school (f) are introduced. Individuals originally at B in figure 1 move to B' or A' or C'. Those originally at A move to A' and those at C in Figure 1 remain there.

Figure A1
Indifference Condition between Full-time and Part-time Work
with Fixed Time Cost of Attending School



Notes. The graph reports the wage level (w_2) that makes an individual indifferent between working part-time ($S=S_2$ and $H=1-S_2-f$) and working full-time ($S=0$, $H=1$) in the presence of fixed costs of attending school (f). This wage level is the (negative of the) slope of the dotted line in the Figure. See Technical appendix for details.

Table 1
Children's Time Use

age	(1) Sample size	(2) Work	(3) School	(4) Work & School	(5) Idle	(6) HH Chores	(7) Idle (excludes HH chores)	(8) Hours Work	(9) Hours HH Chores	(10) Distance to school
						Boys				
7	595	0.444	0.292	0.114	0.378	0.052	0.355	28.617	18.645	3.018
8	583	0.554	0.425	0.208	0.228	0.038	0.214	27.991	15.864	3.201
9	534	0.560	0.534	0.281	0.187	0.056	0.161	27.839	21.633	3.120
10	711	0.592	0.674	0.366	0.100	0.075	0.086	27.573	19.434	2.948
11	431	0.601	0.777	0.436	0.058	0.065	0.056	24.761	17.107	3.216
12	571	0.623	0.779	0.447	0.044	0.054	0.040	26.197	16.226	3.025
13	516	0.640	0.816	0.490	0.035	0.050	0.033	23.455	18.077	2.778
14	497	0.662	0.769	0.465	0.034	0.072	0.030	27.950	18.806	3.038
15	481	0.736	0.657	0.439	0.046	0.058	0.040	31.046	23.393	2.637
16	449	0.742	0.532	0.332	0.058	0.062	0.049	34.362	22.036	2.837
Total	5,368	0.609	0.619	0.351	0.123	0.058	0.112	28.035	19.192	2.985
						Girls				
7	524	0.447	0.298	0.115	0.370	0.088	0.323	27.047	24.152	3.119
8	560	0.561	0.480	0.254	0.212	0.082	0.180	27.106	21.870	3.125
9	529	0.614	0.648	0.382	0.119	0.083	0.093	23.926	20.932	2.848
10	609	0.634	0.744	0.452	0.074	0.103	0.051	25.177	22.333	3.179
11	396	0.639	0.747	0.449	0.063	0.119	0.043	23.258	20.085	2.848
12	631	0.647	0.786	0.490	0.057	0.132	0.038	24.975	26.084	2.930
13	504	0.688	0.806	0.534	0.040	0.143	0.024	24.220	22.250	2.932
14	517	0.698	0.700	0.455	0.056	0.180	0.035	27.075	23.108	2.834
15	458	0.740	0.600	0.410	0.070	0.179	0.037	31.501	24.378	3.020
16	447	0.747	0.461	0.304	0.096	0.219	0.045	38.200	28.602	2.984
Total	5,175	0.638	0.630	0.385	0.117	0.130	0.089	27.262	23.898	2.988

Notes. The table reports time use patterns of boys and girls in rural Tanzania by age. Column (1) reports the sample size. Column (2) reports the proportion of those in work in either the main or secondary activity, column (3) the proportion of those attending school, column (4) the proportion of those combining work and school, column (5) the proportion of those declaring neither school nor work, column (6) the proportion of those devoting their time to household chores, column (7) the proportion of those neither in work, nor in school nor engaging in household chores. Column (8) reports the average number of working hours in all work activities for those in work and column (9) hours devoted to household chores. Column (10) finally reports average distance to school. Source HBS, 2000/01.

Table 2
Distance to School

km.	(1) % households within given distance	(2) % villages with at least 25% of households within given distance	(3) % villages with at least 50% of households within given distance	(4) % villages with at least 75% of households within given distance
1	0.36	0.71	0.38	0.18
2	0.56	0.92	0.69	0.42
3	0.67	0.98	0.83	0.58
4	0.73	0.99	0.95	0.76
5	0.83	1.00	1.00	1.00

Notes. The table reports the cumulative frequency distribution of distance to the closest primary school. Column 1 reports the distribution across all households in rural Tanzania. Columns 2 to 4 report respectively the proportion of villages with at least 25%, 50% and 75% of households within each distance. Source: 2000/01 HBS.

Table 3

Correlation Between Distance to the Closest Primary School and Other Household Characteristics

		(1) total	(2) demeaned
	Distance to facilities		
1.	Police	0.1389*	0.0787*
2.	Traditional birth attendant	0.1671*	0.1455*
3.	Religious center	0.3679*	0.2814*
4.	Primary court	0.1537*	0.1135*
5.	Hospital	0.0918*	0.0838*
6.	Place for water	0.1160*	0.0608*
7.	Place for wood	0.0358*	-0.0206
8.	Market	0.2867*	0.2081*
9.	Shop	0.3779*	0.3563*
10.	Health center	0.2903*	0.2461*
11.	Secondary school	0.1649*	0.1281*
12.	Bank	0.0731*	0.0288
13.	Post office	0.0977*	0.0332*
14.	Transport	0.2106*	0.1839*
15.	Mill	0.2162*	0.1569*
16.	Community center	0.2806*	0.2394*
17.	Log household income	-0.0476*	-0.0463*
18.	HH head completed primary school	-0.0554*	-0.0436*

Notes. The Table reports univariate correlation coefficients between household distance to the closest primary school and a number of other household specific covariates. Rows 1 to 16 refer to the distance to a variety of other facilities. Row 17 refers to log household income and row 18 to a dummy for whether the household head has completed primary education. Column 1 reports correlation across all households in the sample while column 2 presents correlations between deviations of each variable relative to the village mean. * denotes significant at 1%. Source: 2000/01 HBS.

Table 4
Distance to Primary School and Children's Time Use

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	Boys				Girls			
1. School	-0.026***	-0.022***	-0.014***	-0.010***	-0.023***	-0.016***	-0.005*	-0.002
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
2. Work	0.013***	0.002	-0.004	-0.004	0.006***	0.004*	0.000	-0.001
	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)
3. Work & school	-0.012***	-0.016***	-0.014***	-0.011***	-0.014***	-0.011***	-0.005	-0.003
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)
4. Work only	0.025***	0.017***	0.010***	0.007**	0.020***	0.015***	0.005*	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
5. School only	-0.014***	-0.006**	-0.001	0.001	-0.010***	-0.006**	0.000	0.002
	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)
6. Idle	0.001	0.005**	0.005**	0.003	0.003**	0.001	-0.000	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Village FE	no	yes	yes	yes	no	yes	yes	yes
Distance controls	no	no	yes	yes	no	no	yes	yes
HH controls	no	no	no	yes	no	no	no	yes

Notes. The table reports the OLS coefficient on distance to primary school. Each cell of the table refers to a separate regression. Rows refer to different dependent variables while columns to different specifications. The left hand side panel refers to boys and the right hand panel to girls. All regressions control for age dummies, dummies for relationship to the household head (spouse, child of head, child of spouse, grandchild, other relative) and dummies for month of observations. Distance controls include primary school, 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. Household controls include household head's sex, age and age squared, occupation (farmer, employee, non-agricultural self employed, unemployed), marital status (never married, married, divorced, widowed), log income, education (no education, incomplete primary, complete primary, incomplete secondary and complete secondary) and literacy status, dummies for the number of individuals in the household in different age cells (0, 1-6,7-11, 12-16, 17-20, 21-45, 46-60, 61 or over) 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). Number of observations for boys: 5,368 and for girls: 5,175. Standard errors clustered by household in brackets. ***: significant at 1%, ** significant at 5%, *: significant at 10%.

Table 5
Average Speed to School
First Stage Regression
Dependent variable: Travel Distance to Primary School (km.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Boys				Girls			
Travel time (hours)	3.201***	2.871***	2.313***	2.284***	3.148***	2.848***	2.293***	2.275***
	(0.421)	(0.388)	(0.359)	(0.363)	(0.549)	(0.391)	(0.380)	(0.378)
Village FE	no	yes	yes	yes	no	yes	yes	yes
Distance controls	no	no	yes	yes	no	no	yes	yes
HH controls	no	no	no	yes	no	no	no	yes

Notes. The table reports the OLS coefficient of a regression of distance to primary school on travel time to primary school. See also notes to Table 4.

Table 6
Distance to Primary School and Children's Time Use
2SLS estimates

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Boys				Girls			
1. School	-0.035***	-0.033***	-0.014***	-0.010***	-0.025***	-0.018***	-0.007	-0.003
	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
2. Work	0.021***	0.003	-0.003	-0.005	0.009**	0.005	-0.001	0.000
	(0.004)	(0.004)	(0.006)	(0.007)	(0.004)	(0.004)	(0.006)	(0.005)
3. Work & school	-0.012***	-0.022***	-0.014***	-0.020***	-0.013***	-0.013***	-0.009	-0.007
	(0.004)	(0.005)	(0.004)	(0.008)	(0.004)	(0.004)	(0.006)	(0.006)
4. Work only	0.033***	0.025***	0.026***	0.017**	0.023***	0.018***	0.009**	0.007
	(0.004)	(0.005)	(0.008)	(0.007)	(0.005)	(0.004)	(0.005)	(0.005)
5. School only	-0.023***	-0.011***	-0.007	-0.001	-0.011***	-0.005	0.000	0.002
	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)	(0.004)	(0.003)	(0.003)
6. Idle	0.002	0.008***	0.009**	0.003	0.002	-0.000	-0.000	-0.003
	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Village FE	no	yes	yes	yes	no	yes	yes	yes
Distance controls	no	no	yes	yes	no	no	yes	yes
HH controls	no	no	no	yes	no	no	no	yes

Notes. the table reports the 2SLS coefficient on distance to primary school, where distance to school is instrumented by travel time to school. See also notes to Tables 4 and 5.

Table 7
Distance to Primary School, Children's Time Use and School Outcomes
Additional Regressions
2SLS estimates

	(1)	(2)
Dependent variable	Boys	Girls
1. Work & school	-0.018***	-0.011*
(includes HH chores)	(0.006)	(0.006)
2. Hours	-0.089	0.386
	(0.158)	(0.315)
3. Ever enrolled	-0.006*	-0.003
in school	(0.003)	(0.005)
4. Max. grade	-0.034	-0.040**
completed	(0.029)	(0.016)
Village FE	yes	yes
Distance controls	yes	yes
HH controls	yes	yes

See notes to Table 6.