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Child Labor and Household Wealth: Theory and Empirical Evidence of an Inverted-U *

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Abstract: Some studies on child labor have shown that, at the level of the household, greater land wealth leads to higher child labor, thereby casting doubt on the hypothesis that child labor is caused by poverty. This paper argues that the missing ingredient may be an explicit modeling of the labor market. We develop a simple model which suggests the possibility of an inverted-U relationship between land holdings and child labor. Using a unique data set that has child labor hours it is found that, controlling for child, household and village characteristics, the turning point beyond which more land leads to a decline in child labor occurs around 4 acres of land per household.

Key words: child labor, land-holding, labor markets

JEL Classification numbers: D13, J20, O12

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1 Introduction

There is now a substantial body of literature that argues that the main cause of child labor is poverty. This is not to deny that there can be other causes as well. The availability of good schools, and simple incentives, like a meal for children at school or a subsidy to parents who send their children to school, can make a difference to child labor. But the fact remains, this literature would argue, that the primary cause of child labor is poverty. Barring rare cases of parents who are compulsively abusive, parents do not like to send their children to work *if they can afford not to*. This is often treated as an axiom in this literature and there is a lot of evidence that supports this view (for discussion see Basu and Van, 1998; Basu 1999; Ray, 2000; Basu and Tzannatos, 2003; Emerson and Souza, 2003; Edmonds, 2005; Edmonds and Pavcnik, 2005).

However, some recent evidence has cast doubt on this explanation of child labor. Bhalotra and Heady (2003) have shown that in some developing countries - Ghana and Pakistan in their study - the amount that the children of a household work increases with the amount of land possessed by the household (see also Menon, 2005; Dumas, 2007). Since land is usually strongly correlated with a household's income, this finding seems to challenge the commonly held presumption that child labor involves the poorest households.

Given the growing global concern about and the urgent need to end child labor, it is important for us to get the details of the causes of child labor right. Hence, the above dispute deserves serious scrutiny. The present paper builds on the above-cited prior research by developing a rigorous theoretical model, which is then used to motivate an empirical analysis based on a new data set from Northern India collected by one of us (Das).

The view that we take in this paper is that the challenge to the assumption that poverty is the primary cause of child labor does not stand up to closer examination. We argue that in developing countries labor markets are usually quite imperfect. This means that there may be poor households that want to send their children to work (in order to escape extreme poverty) but are unable to do so simply because they have no access to labor markets close to their home. The assumption of imperfect labor markets, for *child* labor[1] and for adult labor, seems to be valid (see Jacoby, 1993; Foster and

[1]Even child labor laws or social norms against child labor can create barriers to children

Rosenzweig, 1994, 2004; Jayaraj and Subramanian, 2007), since most parents would feel apprehensive about sending their children to work in distant farms or factories. In this situation, if the household comes to acquire some wealth, say land, its children will get to work more because they *can* now do what they earlier *wished* to do but could not. Hence, we argue that this seemingly perverse response to greater wealth is a consequence of labor market imperfection. This possibility is also suggested by the evidence discussed by Edmonds and Turk (2004) that, in Vietnam, households that have their own businesses are more likely to have their children do labor.

But this in turn has another interesting implication. If the household's land-ownership continues to rise then surely beyond a point the household will be so well-off that it will not want to make its children work, even though it has plenty of land to work with. This is a consequence of the luxury axiom. This intuitive claim is theoretically established as plausible in the paper and is further explored empirically: As a household's land ownership rises, does child labor first rise and then decline, in the manner of an inverted-U.

It is worth stating that our argument is predicated on the assumption of less-than-fully flexible land markets. This is a natural assumption that is implicitly present in most models of the agrarian economy and tallies well with the fact that much peasant land is inherited property. If land were fully mobile, then it is not clear if the labor market could be described as imperfect in any meaningful sense, because, even if laborers refused to go and work on on other people's land, the land could come to the workers. This relates to some early abstract writings on firm behavior, which suggested that, if only one factor were immobile, that would not hurt efficiency since the owner of that factor would then be the entrepreneur who would hire in all other factors. Without going into the details of this debate, we will here simply assume that there exists assests like land that cannot freely go to where the labor is. With this in the background we will study the cases of efficient and inefficient labor markets.

The underlying theoretical model is described in section 2. Then in section 3 we use a unique data set from the Himachal Pradesh and Uttaranchal states of India that has information on the hours of work done by children, unlike data sets from most countries including the nationally representative Indian datasets such as those of the National Sample Survey and the National

participating in labor markets (Manacorda, 2006). Children can be employed with much less notice on one's own land than in other people's farms or factories.

Family Health Survey, which only have binary indicators for child labour. As pointed out by Edmonds and Pavcnik (2005), domestic work done by children is often neglected by official statistics and empirical studies. Hence the detailed data on hours worked in various activities has the major advantage of allowing us to include domestic work done by children in their own homes as child labor. Indeed, this turns out to be the largest component. The question of whether or not to include domestic work in measuring child labor has proved to be controversial. It is possible to argue that domestic work is often light and can entail learning essential skills. On the other hand, some domestic work such as cooking (usually over open fire) or taking care of younger siblings can be dangerous and exhausting. Further, not to include domestic work in child labor creates the false impression that girls do less work than boys (Burra, 1997; Cigno and Rosati, 2005, Chapter 5). Most often, domestic work is not included in child labor simply because of the lack of data on domestic work. Fortunately, our data are complete in this sense.

In fact, if we did use the definition commonly used in the literature, namely market work, occasionally adding in work on the farm or a family business (and, usually, excluding domestic work), the major part of child labor would be ignored. This is not surprising because we have largely agrarian households. Adult wage labor is very limited. Self-employment is the dominant form of adult labor. The main form of wealth in this region is land, which is largely inherited. Household enterprise primarily consists of agriculture or horticulture, which are land-dependent. We analyze the inverted-U relationship between land and child labor and find strong empirical corroboration for this.

2 The Theory

2.1 Basic Structure

Let us consider an economy in which households treat non-work on the part of children to be a luxury good. That is, they would not think of indulging in this if the household's income happened to be very low. This is the so-called 'luxury axiom'– the assumption that poverty is the cause of child labor. Now suppose that this household has k units of wealth - let us assume land. It will be shown that if the economy has a perfectly functioning labor market, then, as k rises, child labor has to fall. But, the situation is not as

straightforward once we consider labor markets to be imperfect. For suppose a household is very poor and with virtually no land. Then, although the household may want to send its cildren to work, there may not be available employment. However, as landholding rises, the land itself generates employment possibilities. So, as k rises, child labor can rise. However, beyond a threshold level of landholding, households may be rich enough to do away with the need to depend on child labor. So, the incidence of child labor will eventually begin to fall as k continues to rise.

To model this as simply as possible let us assume each household is endowed with the utility function

$$u = u(x, e) \tag{1}$$

where x is the total consumption of the household and $e \,\epsilon\, [0, 1]$ is the amount of work the children of the household do. We will assume that each household has 1 adult and the adult finds it worthwhile to work no matter what the wage or, equivalently, the adult finds leisure to be of no worth and so always prefers to work.

To keep the subsequent algebra simple let us build the luxury axiom into (1) by taking it to be quasi-linear as follows:

$$u = \phi(x) - c \cdot e \tag{2}$$

where $\phi'(x) \geq 0$ and $\phi''(x) \leq 0$, for all x, and both these inequalities are strict for all values of x up to some $X > 0$. And c is a positive real number.

It is easy to verify that if this household's income doubles, child leisure or non-work, $1 - e$, will more than double, thereby showing that it is a luxury good.

2.2 The Perfect Labor Market Case

Perfect labor market means that each household faces a market wage, w, and it can buy or sell as much labor as it wishes. We are assuming that adults and children earn the same wage. Introducing an adult equivalence correction, as is standard in this literature, does not really make a difference here, and is therefore ignored.

Given that the household owns k units of land and there is a perfect labor market, it can earn a profit of $\pi(k, w)$ from this land. Of course $\pi_k(k, w) > 0$. If this household supplies e units of child labor to the labor market we have

$$x = \pi(k, w) + w + ew. \tag{3}$$

Recall that the household has 1 adult who always works.

From (2) and (3) we can write the household's problem to be:

$$\max_e \phi(\pi(k,w) + w + ew) - ce.$$

This gives us the first-order condition

$$\phi'(\pi(k,w) + w + ew) = \frac{c}{w}.$$

Differentiating implicitly with respect to k and rearranging terms we get

$$\frac{de}{dk} = -\frac{\pi_k(k,w)}{w}.$$

Hence, since $\pi_k > 0$, as k rises, child labor has to fall.

If we are to understand the Bhalotra and Heady (2003) empirical finding, clearly the perfect labor market assumption has to go. This is what we proceed to do in the next section and derive further implications of such a model, which is then explored using household data from Northern India.

2.3 The No Labor Market Case

For reasons of simplicity we shall deal with the polar case of labor market imperfection - an economy where each household has to fend entirely for itself. This can happen for various reasons. It could be that workers find it onerous to work on other people's land and so choose not to do so. On the other hand, it could be that an employer finds that the moral hazard problem with outside labor is so big that it is preferable to rely entirely on domestic labor. One could write elaborate models where these causes are brought explicitly into the picture. But, if these barriers or preferences are high enough, then, for the most part, what causes the labor market to fail will not impact on how each household behaves on its own farm and it is the latter that we are about to model.

We now need to be a bit more explicit about where the profit, π, came from in Section 2.2. Suppose each household has a production function, f, such that

$$q = f(k,\, e+1) \tag{4}$$

where q is output produced, k is land owned and $e+1$ is the amount of labor used - e from the children and 1 from the adult. We make usual

assumptions on f, namely, $f_k,\ f_e > 0$; $f_{kk},\ f_{ee} \leq 0$; and $f_{ek} > 0$. The crux of our argument hinges on the this last assumption that greater land increases the productivity of labor. That other household assets can raise the productivity of labor is a familiar claim from early research in agrarian economics and to take this over to the domain of child labor seems natural (see Mueller, 1984; Chernichovsky, 1985).

As stated in the introduction, we are assuming that land is immobile. Each household simply owns a certain amount of land. The decision to sell this is not considered. This seems like a natural assumption. The ability to sell land is associated with the ability to freely move, for no one will want to buy land from a peasant who then stays on on the land. While there are no doubt situations where peasants sell their land *and* move, these are rare and it seems harmless to rule this out by assumption.[2]

Since there is no labor market in this economy, the household consumes what it produces. Hence $x = q$.

Therefore, the household's optimization problem using (2) and (4) is as follows:

$$\max_e \phi(f(k,\, e+1)) - ce. \tag{5}$$

Hence, we have the first-order condition:

$$\phi_x \cdot f_e = c. \tag{6}$$

Taking total differentials with respect to k and e and re-arranging terms we get:

$$\frac{de}{dk} = -\frac{f_e \phi_{xx} f_k + \phi_x f_{ek}}{f_e^2 \phi_{xx} + \phi_x f_{ee}} \tag{7}$$

It is easy to verify that the denominator is always negative. Hence, the sign of $\frac{de}{dk}$ is the sign of $[f_e f_k \phi_{xx} + f_{ek}\phi_x]$. Since this can have different signs, all we know now is that with imperfect labor market, a rise in the household's wealth *can* lead to a rise or fall in child labor. That both *can* happen in a realistic setting is itself an interesting observation. What we do next is to show that such an at-first-sight unexpected non-monotonic relation between land and child labor is theoretically *possible* (and actually occurs under some special functional forms, as we are about to demonstrate) and then we go on to check what the relation is like in reality.

[2]It turns out that in our data set as much as 94% of land owned is actually inherited.

Equations 6 and 7, actually, enable us to say a little bit more about the relation between land and labor. From equation 6, we know that, given a level of k, say k^0, the household chooses e so that $\phi_x = \frac{c}{f_e}$. Let the optimum be e^0. Now suppose the household's wealth increases. Since $f_k > 0$, the increase in wealth results in an increase in output (and hence x) if $e = e^0$. The increased level of x lowers ϕ_x, the extent of the reduction depending upon the degree of concavity of ϕ. However, since $f_{ek} > 0$, the higher level of k also increases f_e, and so lowers $\frac{c}{f_e}$. Of course, the extent of the increase in f_e depends upon the value of f_{ek}.

Hence, the effect of an increase in household wealth on child labor depends both upon the specification of the utility function and production function. In particular, an increase in household wealth is likely to increase (decrease) child labor if

(i) f_{ek} is "large" ("small"),
(ii) f_e and f_k are "small"("large"),
(iii) ϕ_x is "large" ("small"),
(iv) the absolute value of ϕ_{xx} is "small" ("large").

To demonstrate this formally, let us specialize the model a bit more. Assume

$$\phi(x) = \begin{cases} Ax - \frac{Z}{2}x^2, & \text{if } x < \frac{A}{Z} \\ \frac{A^2}{2Z}, & \text{if } x \geq \frac{A}{Z} \end{cases} \tag{8}$$

Figure 1 plots $\phi(x)$ as a function of x. Next assume that the production function takes the following Cobb-Douglas form,

$$f(k,\, 1+e) = mk(e+1) \tag{9}$$

Using (2), (7) and (8), we see that the household's aim is to choose e so as to maximize

$$u = \begin{cases} Amk(e+1) - \frac{Z}{2}[mk(e+1)]^2 - ce, & \forall e+1 < \frac{A}{Zmk} \\ \frac{A^2}{2Z} - ce, & \forall e+1 \geq \frac{A}{Zmk} \end{cases} \tag{10}$$

Since the household incurs a positive disutility of $c > 0$ from sending a child to work, the household will never choose a level of e if this results in $\phi_x = 0$. That is, the optimum level of e will be such that $\phi(x) < Ax - \frac{Z}{2}x^2$. We record this observation as Lemma 1.

Lemma 1 *The value of e that optimizes (10) is always such that $e + 1 < A/Zmk$.*

In the light of Lemma 1, we can solve the household's problem by using the first line of (10) to represent u and deriving the first-order condition.

$$Amk - Zm^2k^2(e + 1) = c$$

or,

$$e = \left[A - \frac{C}{mk}\right] \frac{1}{Zmk} - 1 \tag{11}$$

From (10) it is obvious that as k rises e will first rise and then fall. The turning point occurs where $k = 2C/Am$. This is illustrated in Figure 2. It is interesting to observe that, if we flipped the two axes around, the curve would look like a backward-bending supply curve. And, in a sense, that is what it is. As land ownership increases, the marginal product of labor rises, and, initially, in response to this, child labor increases. However, as land keeps increasing, the household becomes well-off, the marginal utility of consumption drops and child labor declines.

In the present paper the inverted-U shape occurs because of the luxury axiom. While this seems to us to be a reasonable and realistic assumption, it is possible that there are other plausible models which do not make use of the luxury axiom and yet derives this kind of a relation between land and child labor. Hence, in the empirical exercise, while we do manage to establish the shape of the relation fairly clearly, there remains an identification problem vis-a-vis the luxury axiom that will be worth investigating in the future.

So far, we have analysed the two polar cases of "perfect" labor market and "no" labor market. It is easy to extend the analysis to the more general case of an imperfect labor market. For instance, we could assume that a transaction cost of $d \geq 0$ has to be incurred by any laborer who wants to work on someone else's plot, while no such cost is incurred if he works on his own plot. Then, the two cases we have modeled so far correspond to $d = 0$ and $d = \infty$. The more general case would complicate the algebra without adding any conceptual insight. We would find that the behavior of households would begin to look like that of households in the "no labour market" case as d approaches infinity. In fact as soon as d exceeds some critical value $d^*(> 0)$ the labor market will look like exactly the one modeled in this sub-section.

Another way to generalize the above model is to allow for a general adult labor market, while assuming that children can work only on their own farms. This could be simply because parents do not feel secure to let their children work in other people's farms and factories. At first sight it may appear that such a model will function just like the perfect labor market case described in section 2.2, since households can simply substitute adults for children in the labor market. Interestingly that is not so. If the domestic marginal product of labor is less than the wage rate that prevails on the market, then households will strictly prefer to let the adults work outside and have the children work at home. If land increases, this will result in a higher marginal productivity of labor, and this will cause child labor to increase, unlike what happens in the case with perfect labor market mobility.

The aim in the next section is to investigate the general relationship between e and k and see if it is indeed an inverted-U, in reality.

3 Empirical Analysis

3.1 Nature of the Data

The data used in this paper is part of a larger data set on households, villages and surrounding forests [3] in the mid-Himalayan region of Himachal Pradesh and Uttaranchal at an altitude of 1800-3000 metres and with an average distance of 3.8 kilometers to a jeepable road. The data were chosen by a two-stage stratified random sampling. On the basis of Census of India village location maps and the corresponding topographical maps of the Survey of India, a random sample of 83 villages in Uttaranchal and 82 villages in Himachal Pradesh were chosen. The stratification was based on three criteria: altitude, number of households, and distance to the nearest town. For each criteria the strata were formed so that equal number of villages belonged to each stratum. Then the sample of villages were chosen so as to be representative of the population joint distribution of the three criteria in each state.

In the second stage, a random sample of 25 households was chosen in each village so as to be representative of the village joint distribution of household landholding and caste. Three of these households were chosen close to a small

[3]For details see http://povertylab.org/data/browse data collection/local goverance, poverty and local forest resources/ household information.

town and 2 of them close to a big town. In this region land is the main form of wealth. Around 94% of land is inherited while 2% is purchased. Gifts (from government and possibly dowry), share-cropping and encroachment of village commons or forests are other minor ways of obtaining land. Out of a total of 4116 households in this data set, for the first set of 1969 households only average child labour information by gender was collected to minimize survey time. Later it was realized that the marginal cost of collecting details on each child is not too high. From this point on, the remaining 2147 households (which include at least 5 households from each of the 165 villages) were asked about the average number of hours per day in a year spent by each child in each of the various activities they indulge in. These latter households have 4162 children– 2129 boys and 2033 girls, between the ages of 6 and 14 years, that we study. These data help us to control for age effects of the children.

As mentioned earlier, our definition of child labor will include domestic work that consists of chores done inside the house as well as work done for the household but outside the home such as livestock grazing, collection of goods for household use, e.g., firewood, fodder, mushrooms, medicinal herbs, and other forest products. Inclusion of domestic work is important because one way for households to respond to imperfections in the adult labor markets, which makes hiring of outside labour difficult, is to make the easy substitution of adult labour by child labour for domestic purposes. Table 1 shows the distribution of daily hours worked in various activities. "Domestic work" refers to the first two rows of Table 1 and, therefore, constitutes the sum of 'domestic chores' and 'domestic labor'. In this Table a child is described as "working" if he/she is engaged in any of the four activities listed in the first four rows of Table 1. It shows that 96.8% of all children aged 6-14 years are involved in positive amounts of child labor. Further, 92% of all children aged 6-14 go to school, which is much higher than the national average. Hence it is obvious that schooling and work are not substitutes. Time allocation details suggests that there is hardly any studying done at home. So schooling hours and total studying hours are about the same and the former depends on the class a child goes to. Since most children go to school we do not focus on schooling decision. The important decision for time allocation (with residual time outside of school) is work versus leisure.

Table 1 - Daily Hours Worked on an Average Day						
Activity	No.	Hrs	Male		Female	
			No.	Hrs	No.	Hrs
Age Group - 6 to 14 Years						
Domestic Chores	4000	1.5	2037	1.4	1963	1.7
Domestic Labour (outside home) (livestock rearing, collection of fodder, fuelwood, medicinal herbs, mushrooms and other forest products)	2619	2.3	1300	2.13	1319	2.5
Unpaid family enterprise (agriculture/horticulture)	1932	1.7	952	1.8	980	1.7
Work for wage	6	2.3	4	3	2	1
Working	4012	3.9	2046	3.6	1966	4.21
Number of Children	**4162**	**3.8**	**2129**	**3.5**	**2033**	**4.10**
Age Group - 10 to 14 Years						
Domestic Chores	2386	1.6	1235	1.4	1151	1.83
Domestic Labour (outside home) (livestock rearing, collection of fodder, fuelwood, medicinal herbs, mushrooms and other forest products)	1807	2.58	903	2.33	904	2.82
Unpaid family enterprise (agriculture/horticulture)	1425	1.82	719	1.84	706	1.79
Work for wage	4	2.75	3	3.3	1	1
Working	2392	4.67	1239	4.2	1153	5.1
Number of Children	**2445**	**4.6**	**1265**	**4.14**	**1180**	**5.02**

Clearly, work in the first two categories is by far the most significant in all the age as well as gender groups. Hence the usual exclusion of these as part of child labor grossly under estimates its extent. Table 1 also shows that older children and girls tend to work more. For girls of all ages and boys above 10 years of age the daily average hours of work is more than four hours a day. This is a high value since most of them also go to school.

In Table 2, which reports the summary statistics of the data, we see that the daily average hours worked for all categories of work is 3.76 hours whereas for market work (exclusing the first two categories), the daily average is only 0.82 hours, less than a quarter of all work done.

Table 2 - Description of Variables used in Regressions					
Variable	Obs	Mean	Std. Dev.	Min	Max
Hours worked	4162	3.76	2.50	0	15
Hours worked excluding domestic work	4162	0.82	1.11	0	10
Age (in years)	4162	10.10	2.53	6	14
Female dummy	4162	0.49	0.50	0	1
Low caste (dummy)	4162	0.20	0.40	0	1
(Cultivable) Land (in acres)	4162	0.98	0.99	0	9.46
Inherited Land (in acres)	4162	1.17	1.19	0	11
Number of children	4162	3.31	1.47	1	12
Number of adult males	4162	1.38	0.84	0	11
Number of adult females	4162	1.53	0.82	0	6
Schooling of adult males (in years)	4162	6.81	4.09	0	17
Schooling of adult females (in years)	4162	3.80	3.55	0	16

We now explore the bivariate relationship in the raw data between the two measures of child labor (that include and exclude domestic work) and wealth measures, using nonparametric regression. In particular, we use Gaussian kernel regressions in which the bandwidth is chosen by starting with a low value that gives a jagged curve and slowly increasing the value until we get a smooth curve without wiggles. Since land is the main form of wealth in this region we focus on it first. As mentioned earlier, most land in our sample is inherited. Further, in this region, parental land is divided equally among the sons whether they stay in the village or not. Land is given to the daughter(s) when there is no son or when a daughter demands her share, which happens rarely. Hence inherited land is likely to be more exogenous than total land owned, so we use inherited land as the exogenous measure of land in all our analysis.

Henceforth land means inherited land. Figure 3 and Figure 4 respectively present the relationship of land with total labor and labor excluding domestic work (market work). Both of them are inverted-U shaped with a stationary point between 3 and 4 acres, which is well above the mean but well within the maximum. Total labor is more responsive to land than market work. This suggests that as land increases, a child's employment is likely to increase on the family farm (part of market work) as well as on the domestic front, perhaps due to the substitution of child labor for adult labor at home.

This inverted-U is not present in the relationship of child labor and adult education.

For the older children in the age group of 10-14 years the relationship of land and labor given in figure 5 is almost flat until 7 acres, which is the 99th percentile of data in this age-group. In other words, our data do not provide any evidence of an inverted-U for the older children. This lack of evidence also holds for market work in this age group.

Although these regressions are consistent with our model it is not clear if they will continue to hold in the presence of other control variables. This is now explored further below.

3.2 Estimable Equation

Age and gender are two child characteristics that may be important. With regard to household characteristics, we consider household age and gender composition, caste, land and adult education. Since it is likely that gender bias, if any, may change with age (as older girls take care of siblings) and caste (low caste may be more discriminatory against girls) we use interactions of female dummy with age and with low caste (non Brahmins and non Rajputs) dummy. Given the inverted-U shape obtained of the kernel regressions we use a quadratic function with respect to land only in the regressions.

Let the dependent variable y_{ih} be the daily hours worked by the ith child in the hth household. The vector of characteristics of the ith child is denoted by X_i while that of a household is denoted by X_h. The estimable equation that is similar to the forms used in the literature can now be written as:

$$y_{ih} = \alpha_v + X_i\beta_i + X_h\beta_h + \epsilon \tag{12}$$

We estimate the above equation separately for younger and older children for both measures of child labor. Environmental factors are swept out via village fixed-effects. This is a parsimonious way of controlling for all possible (adult and child) labor market factors at the village level while exploring the relationship of land and child labor. The standard errors are robust and account for correlation within village clusters.

Table 3 - Village Fixed-Effects Regressions for Child Labor				
Variable	All Labor	Labor Without Domestic Work	Labor for 10 to 14 years	Labor Without Domestic Work for 10 to 14 years
Female dummy	0.450***	-0.008	0.870***	0.036
	(0.079)	(0.039)	(0.112)	(0.056)
Low caste * Female * Age	0.103***	0.017*	0.048*	0.0003
	(0.027)	(0.009)	(0.027)	(0.009)
Inherited land	.0.707***	0.281***	0.912***	0.367***
	(0.085)	(0.041)	(0.093)	(0.049)
Inherited land square	-0.087***	-0.038***	-0.101***	-0.045***
	(0.016)	(0.006)	(0.015)	(0.006)
Low caste	-0.294*	-0.013	0.135	0.117
	(0.153)	(0.075)	(0.183)	(0.109)
Number of children	-0.163***	-0.053***	-0.117***	-0.039*
	(0.037)	(0.018)	(0.042)	(0.022)
Number of adult females	-0.046	0.039	-0.145*	0.017
	(0.074)	(0.037)	(0.084)	(0.047)
Number of adult males	-0.035	-0.015	-0.018	-0.039
	(0.060)	(0.032)	(0.070)	(0.038)
Schooling of adult males	-0.076***	-0.012*	-0.074***	-0.012
	(0.015)	(0.007)	(0.018)	(0.009)
Schooling of adult females	-0.110***	-0.045***	-0.142***	-0.049***
	(0.017)	(0.008)	(0.020)	(0.010)
Constant	4.409***	0.975***	4.924***	1.132***
	(0.186)	(0.094)	(0.220)	(0.123)
Number of observation	4162	4162	2445	2445
R2 within	0.119	0.056	0.181	0.065
Note: * denotes significance at 10%, ** at 5% and *** at 1%				

In Table 3, qualitatively the results are similar across both measures of child labor. First of all, the inverted-U shape with respect to land that was observed in the raw data for all children is again confirmed in the presence of other controls. For the older children also this relationship holds in the presence of other controls though we did not observe it in the raw data. Table 4 reports the turning points of land and its marginal effect for all the four regressions.

Table 4 - Turning Point and Marginal Effect of Inherited Land				
Variable	All Labor	Labor Without Domestic Work	Labor for 10 to 14 Years	Labor Without Domestic Work for 10 to 14 Years
Turning Point in Raw Data	3-4	3-4		
Turning Point in Regression	4.075	3.68	4.522	4.08
Derivative in Regression (at mean)	0.504	0.192	0.676	0.262

It shows that, on average, the turning point occurs around 4 acres of land per household for all children irrespective of whether domestic work is included. For older children the turning point shifts to the right by half an acre. The turning point in each case is far below the maximum but around three times the mean. Hence most households face the upward sloping part of the relationship.

The derivative with respect to land, at mean land holding, implies that child labor for all children increases by approximately 0.5 hours per day for every acre of land. This value increases to 0.7 hours for older children. For market work, the corresponding response is much lower.

We now summarize the results for non-land factors that are of interest. We observe bias against girls more in the older children and in the low caste. Child labor that excludes domestic work under-estimates this bias. As far as household composition (labor stock) is concerned, the number of children in a household makes the most difference. Each additional child reduces the hours worked by another child by 0.1 hours when domestic work is included and by about half of it in case of market work. These estimates may be biased if households decide to have more children motivated by the return from child labor (see Rosenzweig and Evenson (1977), Bardhan and Udry (1999)and Baland and Robinson (2000)). Since the return from child labor has a long gestation period, in the short run it may be reasonable to treat fertility as exogenous.

With regard to household human capital, the education of the adult *females* in the household helps reduce the incidence of child labor by at least one and half times the magnitude of reduction due to the education of its adult *males*. This negative impact is in contrast to the positive derivatives with respect to land in Table 4. Even though human capital is wealth enhancing it does not improve the employment prospects of children.

As the theoretical model makes clear, different forms of wealth have dif-

ferent employment potentials and hence will have different effects on child labor. Land was of particular interest to us here because it is such a critical complement of labor in the rural areas of developing countries and also because much of the prior work on child labor and wealth, focused on land.

Our results have an interesting policy implication. The *channel* through which poverty is reduced is important. If monetary transfers are given to every poor households to reduce poverty, and these transfers are in turn used to increase their levels of agrarian assets, child labor may in fact increase. On the other hand, policies which improve education levels especially female education are more likely to reduce poverty *and* the incidence of child labor. Poverty reduction along with institutional reforms that remove adult labor market imperfections will go a long way towards reducing the incidence of child labor.

4 Concluding Remarks

This paper examined the impact of wealth on child labor using a unique data set that provides information on hours worked by each child as opposed to a dummy that indicates whether a child works or not. The major advantage is that the detailed activity information allowed us to include domestic work done by children inside their own homes as well as outside such as livestock grazing and collection of firewood, fodder, herbs, mushrooms and other forest products. Domestic work is by far the largest component of child labor in the region under study. Using our all-inclusive work definition whether it is for wage or not, we find that children work, on an average 3.8 hours per day, which is close to half-time work. This is more than four times the market work definition typically used. Domestic work is likely to be the channel through which adult labor market imperfections may be working as our estimates suggest an expected increase in domestic work by children due to increase in land is far higher than the increase in market work by children.

In particular, it was found that, child labor increases with land way past the average value of land-holding and declines well before the observed maximum land holding. This is consistent with the view that labor market imperfections may be significant enough to hinder the expected monotonically declining relationship of wealth and child labor. In addition, our data also indicate that adult female education is perhaps more effective than adult

male education in reducing child labor.[4] All this is not to deny that there are contexts where simple legal restrictions may be the right intervention. But in reality the interventions themselves may be products of the wider political and economic environment (Doepke and Zilibotti, 2005). Moreover, as this paper tried to show, there are unexpected intricacies in the way different forms of wealth impact on child labor and we need to understand these, theoretically and empirically, before we can design effective policies. The present paper is meant to be a contribution towards such an understanding.

[4]We hasten to add that we have not identified any causal effect of education on child labor.

References

[1] Baland, J.-M., and Robinson, J. (2000). "A Model of Child Labor, " *Journal of Political Economy*, 108(4), pp. 663-679.

[2] Bardhan, P.K. and Udry, C. (1999). *Development Economics.* Oxford: Oxford University Press.

[3] Basu, K. (1999). "Child Labor: Cause, Consequences and Cure, With Remarks on International Labor Standards, " *Journal of Economic Literature*, 37(3), pp. 1083-1119.

[4] Basu, K., and Tzannatos, Z. (2003). "The Global Child Labor Problem: What do we Know and What can we Do?," *World Bank Economic Review*, 17(2), pp. 147-173.

[5] Basu, K., and Van, P. H. (1998). "The Economics of Child Labor, " *American Economic Review*, 88(3), pp. 412-27.

[6] Bhalotra, S., and Heady, C. (2003). "Child Farm Labor: The Wealth Paradox," *World Bank Economic Review*, 17(2), pp. 197-227.

[7] Burra, N. (1997). *Born to Work: Child Labor in India*, New Delhi: Oxford University Press.

[8] Chernichovsky, D. (1985). "Socioeconomic and Demographic Aspects of School Enrollment and Attendance in Rural Botswana," *Economic Development and Cultural Change*, 33, pp. 319–332.

[9] Cigno, A. and Rosati, F. (2005). *The Economics of Child Labor*, New York: Oxford University Press.

[10] Doepke M. and Zilibotti, F. (2005). "Macroeconomics of Child Labor Regulation." *American Economic Review*, 95(5), pp. 1492-1524.

[11] Dumas, C. (2007). "Why do Parents make their Children Work? A Test of the Poverty Hypothesis in Rural Areas of Burkina Faso," *Oxford Economic Papers,* 59, pp. 301-329.

[12] Edmonds, E. (2005). "Does Child Labor Decline with Improvements in Economic Status ? " *Journal of Human Resources*, 40(1), pp. 77-89.

[13] Edmonds, E., and Turk, C. (2004). "Child Labor in Transition in Vietnam," in P. Glewwe, N. Agrawal and D. Dollar (eds), *Economic Growth, Poverty and Household Welfare in Vietnam*, Washington DC: World Bank, pp. 505-550.

[14] Edmonds, E., and Pavcnik, N. (2005). "Child Labor in the Global Economy," *Journal of Economic Perspectives*, 18(1), Winter 2005, pp. 199-220.

[15] Emerson, P. and Souza, A. (2003). "Is There a Child Labor Trap? Intergeneration Persistence of Child Labor in Brazil, " *Economic Development and Cultural Change*, 51(2), pp. 375-398.

[16] Foster, A. D. and Rosenzweig, M. R (1994). "A Test for Moral Hazard in the Labor Market: Contractual Arrangements, Effort, and Health," *Review of Economics and Statistics,* 76(2), pp. 213-227.

[17] Foster, A. D. and Rosenzweig, M. R (2004). "Technological Change and the Distribution of Schooling: Evidence from Green Revolution India," *Journal of Development Economics,* 74(1), pp. 87-112.

[18] Jacoby, H. (1993). "Shadow Wages and Peasant Family Labor Supply: An Econometric Application to the Peruvian Sierra," *Review of Economic Studies*, 60(4), pp. 903-921.

[19] Jayaraj, D. and Subramanian, S. (2007), "Out of School and (Probably) in Work: Child Labour and Capability Deprivation in India," *Journal of South Asian Development*, forthcoming.

[20] Manacorda, M. (2006). "Child Labor and the Labor Supply of Other Household Members: Evidence from 1920 America," *American Economic Review*, 96(5): 1788-1801.

[21] Menon, N. (2005). "Why Might Credit Used to Finance Investments Increase Child Labor?," Brandeis Universtiy, Working Paper.

[22] Mueller, E. (1984). "The Value and Allocation of Time in Rural Botswana," *Journal of Development Economics*, 15, pp. 329-360.

[23] Ray, R (2000). "Child Labor, Child Schooling and Their Interaction with Adult Labor: Empirical Evidence for Peru and Pakistan," *World Bank Economic Review*, 14(2), pp. 347-367.

[24] Rosenzweig, M. R. and Evenson, R. (1977). "Fertility, Schooling, and the Economic Contribution of Children in Rural India: An Econometric Analysis," *Econometrica*, 45(5), pp. 1065-1077.

Figure 1

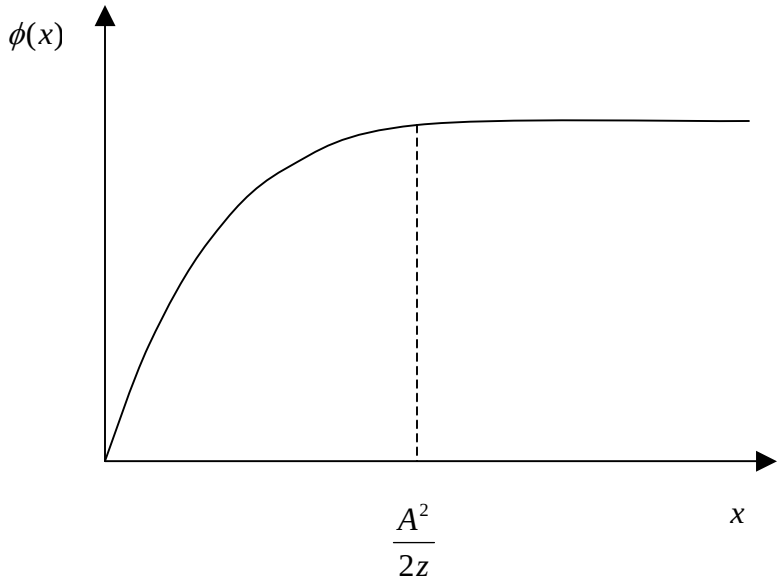


Figure 2

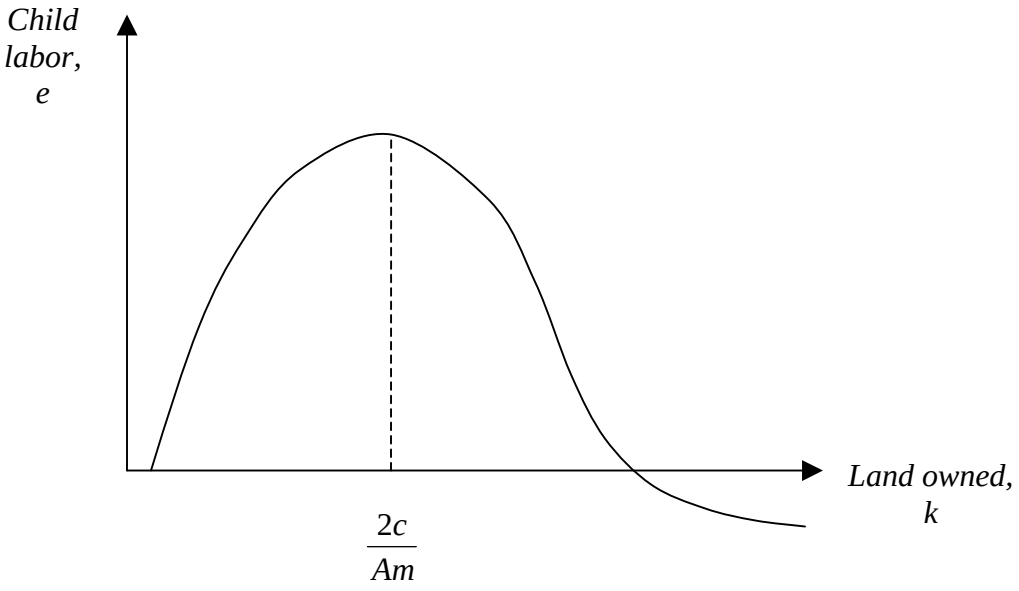


Figure 3: Inherited Land & Child Labor

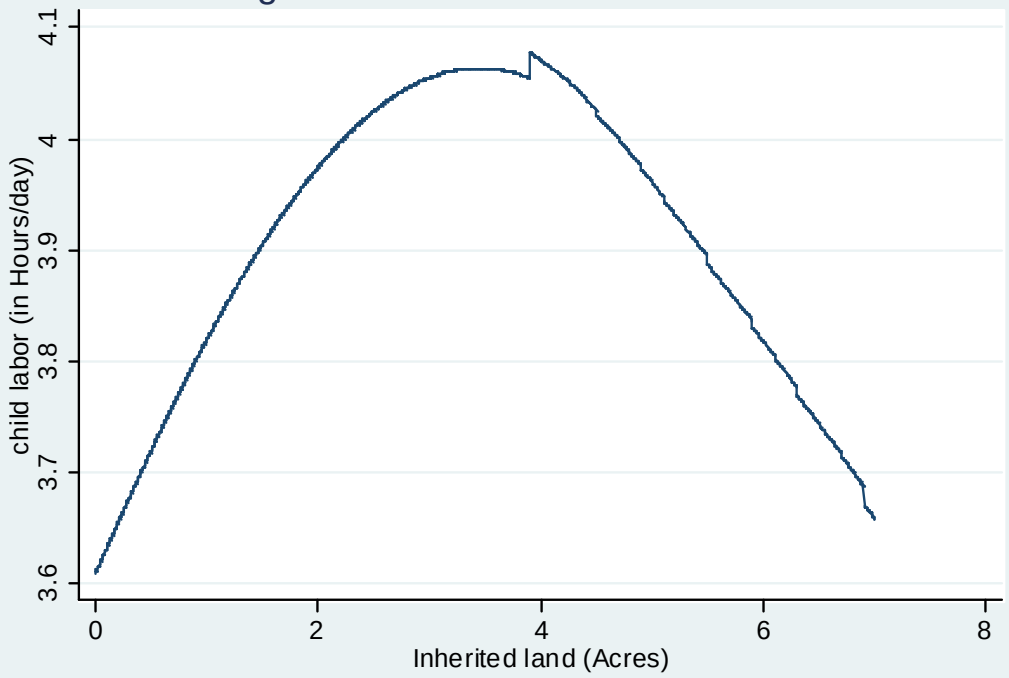
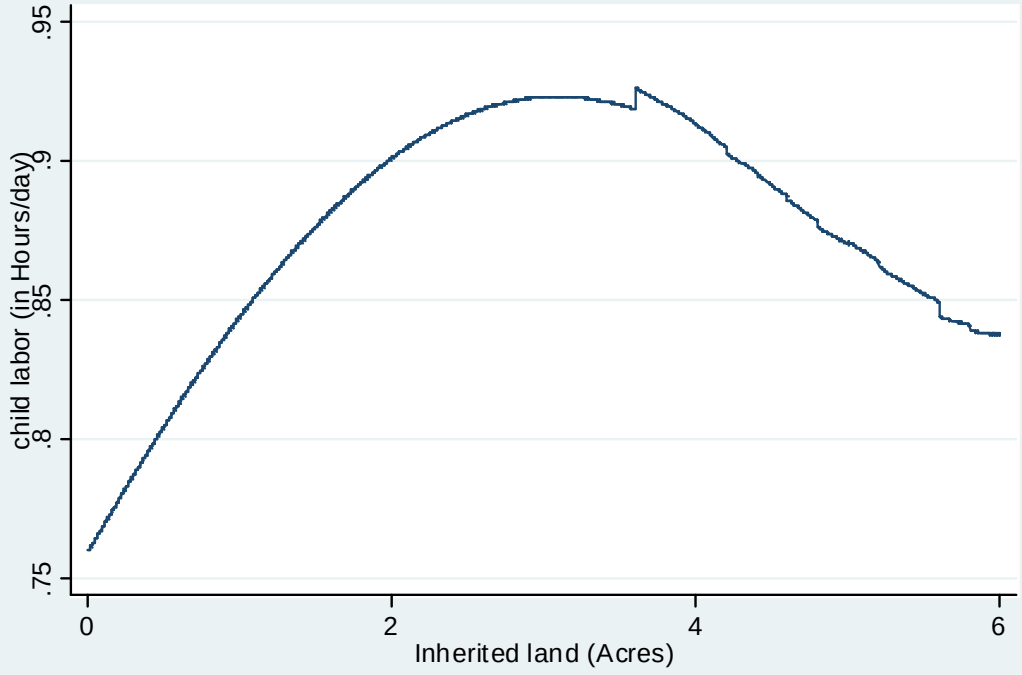


Figure 4: Inherited Land & Child Labor without Domestic work



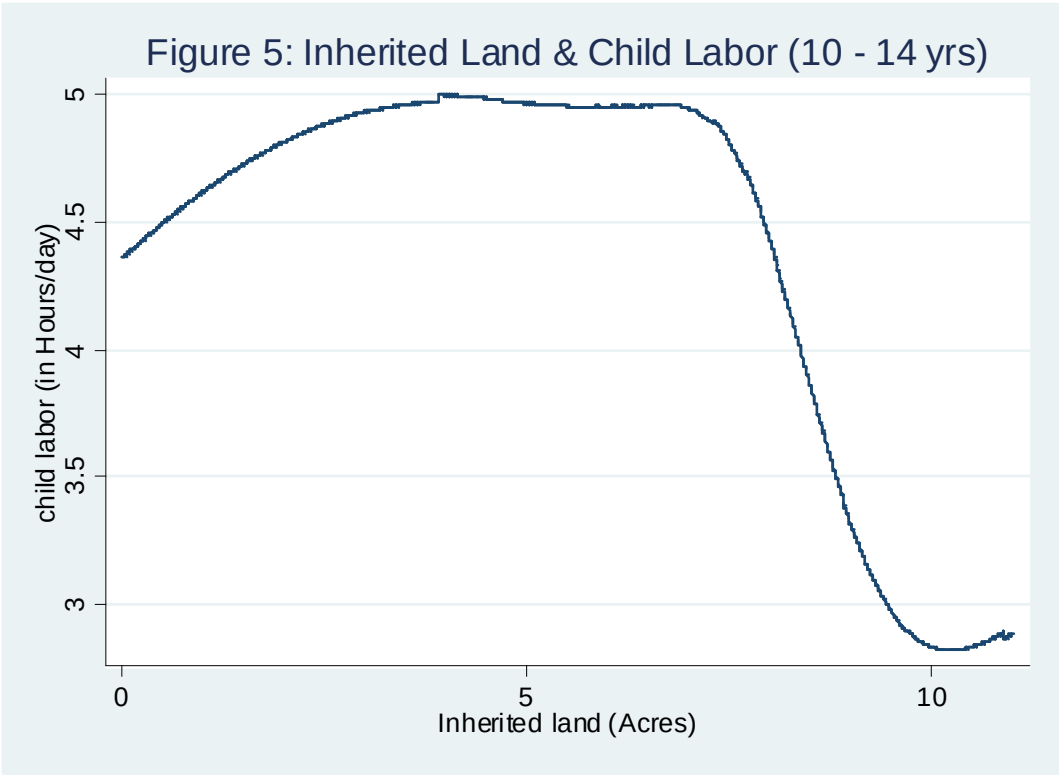


Figure 5: Inherited Land & Child Labor (10 - 14 yrs)
child labor (in Hours/day)
3
3.5
4
4.5
5
0
5
10
Inherited land (Acres)