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The Determinants of Rural Child Labor: An Application to India.

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Abstract

There are several factors that may contribute to the decision to send a child to work, such as poverty, market imperfections and parental preferences. The aim of this paper is to determine empirically the relative importance of these diverse factors on the incidence of child labor in rural India. In order to examine several potentially influential factors separately, we outline a theoretical model of child labor in a peasant household based on the model presented in Bhalotra and Heady (2003) with modifications to allow for the child to participate in different types of labor. We then use the theoretical model to specify and estimate an empirical model of rural child labor participation. Our results indicate that parental education and household income appear to play the most important role in determining whether a child works, attends school or is idle. Market imperfections, on the other hand, only play an important role in determining whether the child participates in family labor.

Keywords: child labor, school attendance, market imperfections, India

JEL Codes: J13, J21, I20

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1 Introduction

Why do some households choose to send their children to work rather than school? The answer to this question is not straightforward, as there are several factors that may contribute to this decision. The aim of this paper is to construct a theoretical model that allows for the interplay of several potential determinants of child labor, and to test this model empirically. Identifying the main determinants of child labor is important, as policy prescriptions intended to eliminate child labor will only be effective if they target the root cause of the phenomenon; otherwise, they risk doing more harm than good. Further, if there is not one but rather several factors that contribute significantly to child labor, then several policies may be necessary to address the issue.

In recent years, a growing number of authors have turned their attention to the question of why children work. One line of research seeks to address this question by applying the theory of educational demand put forth by Becker (1991). In this case, the demand for education is based on the optimization of the trade-off between the costs of schooling and the future returns to schooling. If the costs outweigh the benefits, the child will not attend school. Similarly, if the returns to child labor outweigh the costs, the family will send the child to work. Another line of research has focused on the effects of constraints, incentives and agency on the incidence of child labor. The constraint placed on the household by "subsistence poverty" has tended to receive the most attention in the literature (Basu and Van, 1998; Basu, 2000; Bhalotra, 2004), while credit market imperfections constitute another important constraint on the household that may contribute to child labor (Ranjan, 1999; Baland and Robinson, 2000; Dehejia and Gatti, 2002).[1] The role of incentives in child labor has been analyzed in the context of work taking place on the family farm or enterprise. Land and labor market imperfections may result in a higher marginal product of child labor if the household is not able to adjust either its land holdings or the amount of labor employed on the family farm or enterprise, thus increasing the opportunity cost of schooling and providing an incentive to put one's child to work (Bhalotra and Heady, 2003; Dumas, 2004). Finally, agency has been shown to have an effect on the incidence of child labor, as parents may have heterogeneous preferences and unequal intra-household bargaining power and may or may not act altruistically towards

[1] "Subsistence poverty" refers to the case where the household is unable to meet subsistence consumption needs with adult labor income alone, and as such depends on the additional income generated by child labor for survival.

their children (Basu and Ray, 2001; Bhalotra, 2001).

In order to incorporate and examine several potentially influential factors separately, we outline a theoretical model of child labor in a peasant household based on the model presented in Bhalotra and Heady (2003), with modifications to allow for the child to participate in different types of labor. This model is particularly useful when market imperfections are expected to play a role in determining child labor force participation, as well as allowing for the effects parental preferences and household income on child labor. The model predicts that children will be more likely to work in households with low levels of income, and less likely to work in households where the parents exhibit a high preference for schooling. If land/asset and labor markets are imperfect, land and productive assets have a substitution effect that increases the likelihood that children participate in family work. If the credit market is also imperfect, land and productive assets have a credit market effect that make participation in any form of work less likely. Therefore, the predicted effect of land and productive assets on child labor is ambiguous, and depends on the type of work in which the child participates and whether or not market imperfections are present.

Many theoretical models of child labor (most notably the seminal paper by Basu and Van (1998)) assume that both adult and child laborers receive wages from an outside employer and that the labor market functions perfectly (as the results rely upon labor market equilibria and competitive wage setting). This is often not the case. The labor force participation rate of children in rural areas tends to be higher than that in urban areas, resulting in the majority of working children being involved in agricultural work, often on the family farm (ILO, 1996). As a result, models that focus on market wage work will only be relevant to a minority of working children. This is important to keep in mind, as trade sanctions are often mentioned as a means of eliminating child labor in developing countries and bans on child labor in the export sector are unlikely to make much of an impact on the total incidence of child labor. The same is likely to be true of adult minimum wage legislation, which would be of little relevance in the rural areas of most developing countries where self-employment is pervasive (Bhalotra and Tzannatos, 2003). This suggests that a focus on child labor in rural areas may yield important insights into the causes of child labor.[2] As a result, the focus of this paper will be on

[2]Indeed, Andvig (1999) finds a weak relationship between GDP and child labor participation rates in Africa, while the relationship between child labor participation and the percentage of the population in rural areas is significantly positive.

child labor in a rural setting. Further, in contrast to several previous studies, the model presented in this paper allows for an analysis of both family and non-family labor.

The main predictions of the theoretical model are analyzed empirically for children aged 7-14 using data drawn from the Human Development Profile for India, collected by the National Council of Applied Economic Research (NCAER) in 1994. This is a household survey that is representative of the rural population for all of India.[3] Children are classified by activity based on their main occupation, i.e. the activity they take part in for at least half the year. While this is a very strict definition that potentially underestimates the scope of child labor, it is also useful in many respects. One advantage is that the children classified as working become a much more homogeneous group. It may not be the case that children working a few hours a month are affected by the same factors as children who have work as their main occupation. Further, it is not obvious that all child labor is harmful or undesirable; working on the family farm or enterprise under parental supervision for a few hours a week, for example, may be considered beneficial to the child in terms of socialization and skill acquisition. Child labor can be considered harmful, however, in the case of children whose main occupation is work insofar as working significantly hinders, and in many cases prevents, these children from receiving an education.[4]

The results of the empirical analysis indicate that household income and parental education are significant determinants of child labor. Further, market imperfections contribute significantly to child labor, particularly in the case of family work. Therefore, policies aimed at raising household income may be successful in reducing child labor and increasing school attendance in the short-run, while policies aimed at improving access to and the quality of schooling may be more successful in the long-run.

The remainder of the paper is organized a follows. Section two outlines a theoretical model of child labor. Descriptive statistics of child labor in rural India by gender and land ownership are given in Section three. Section four presents the empirical specification and discusses some estimation issues, the

[3] While the rate of participation in child labor in India may not be particularly high, especially compared to sub-Saharan African countries, the absolute number of children participating in some form of labor is substantial due to India's large population.

[4] Child labor may be harmful in several other respects, especially when working conditions are hazardous or children are mistreated by their employers. However, as the survey does not contain information on the conditions under which children work, the only form of harm that can be demonstrated is the deprivation of educational opportunities.

results of which are discussed in Section five. Section six concludes the paper.

2 The theoretical model

The theoretical model developed in this section is taken from Bhalotra and Heady (2003) with some modifications. In keeping with Bhalotra and Heady, we specify a two period model of a peasant household, and for simplicity we assume that each household contains one parent and one child. We maintain the assumption that the parent always works, and that the child does not bargain with its parent, i.e. the parent decides how the child's time is allocated.[5] While Bhalotra and Heady assume that households do not hire out labor, we assume that households may hire out child labor. The parent produces output in each period using their own labor, owned and rented land, owned productive assets, hired labor and potentially their child's labor as inputs. Children who do not participate in family work in the first period may work as wage laborers outside the family or they may attend school, but we assume that they do not combine any of these activities. It is also possible that the child participates in none of these activities in the first period, in which case the child is idle.

The first period household production function is given by:

$$f\left(A_o, A_{r1}, K_o, L_{p1}, L_{cf1}, L_{h1}\right) \tag{1}$$

where A_o and A_r are owned and rented land, K_o is owned productive capital, L_p and L_h are parent and hired labor and L_{cf} is child family labor ($= 0$ if the child does not participate in family work). Hired labor is not a perfect substitute for family labor when the labor market is imperfect, just as rented land is not a perfect substitute for owned land when the market for land is imperfect. Further, we assume that child labor is not a perfect substitute for adult labor.[6] Therefore, each type of land and labor used to produce output enters the production function as a distinct input. We assume that there are decreasing marginal returns to all inputs, so that the first derivative of the production function with respect to any of the inputs is positive, while the

[5] See Basu (1999) for an overview of models of child labor with intra-household bargaining. The assumption that children do not bargain with their parents is quite reasonable, as the only recourse a young child would have is to leave the household, which is not likely an attractive alternative. Bhalotra and Heady point out that this option becomes even less attractive for children who can expect to inherit the family farm.

[6] This is a common assumption in the literature; see Basu and Van (1998), Ranjan (2001), for example.

second derivative is negative. Finally, we assume that total land, total labor and capital enter the production function multiplicatively.

In the case where the child participates in family work, first period net household income, Y_1, is a function of the household production function as follows:

$$Y_1 = f\left(A_o, A_{r1}, K_o, L_{p1}, L_{cf1}, L_{h1}\right) - w_{h1}L_{h1} - p_{r1}A_{r1} \tag{2a}$$

whereas in the case where the child works as a wage laborer, net household income in the first period is given by:

$$Y_1 = f\left(A_o, A_{r1}, K_o, L_{p1}, L_{h1}\right) + w_{cw1}L_{cw1} - w_{h1}L_{h1} - p_{r1}A_{r1} \tag{2b}$$

and in the case where the child attends school or is idle, net household income in the first period is given by:

$$Y_1 = f\left(A_o, A_{r1}, K_o, L_{p1}, L_{h1}\right) - w_{h1}L_{h1} - p_{r1}A_{r1}. \tag{2c}$$

In the above equations, w_{cw} and w_h are wages paid to child and hired labor and p_r is the price of rented land.

In the second period the child has become an adult and may or may not continue to live in the family household, but it is assumed that their income and consumption remain part of the household total. Therefore, the child's contribution to household income in the second period enters the income equation separate from the household production function (which maintains the same characteristics as in the first period in all other respects). Second period household income is given by:

$$Y_2 = f\left(A_o, A_{r2}, K_o, L_{p2}, L_{h2}\right) + w_{c2}\left(ACT_1\right)L_{c2} - w_{h2}L_{h2} - p_{r2}A_{r2} \tag{3}$$

where $ACT_1 = L_{cf1}, L_{cw1}, S, I$ depending on whether the child worked, attended school or was idle in the first period. Further, w_{c2} is not necessarily an explicit wage; it may be the marginal product of the child's own farm labor, for example. Thus we assume that the child's second period wage is a function of the first period activity in which the child participated. This allows for a dynamic effect for the choice of activity in the first period.

We assume that the household can either save or borrow in the first period, so that first period consumption is not bound by first period income. Further,

the household is assumed to inherit some initial financial wealth (which can be either positive or negative) from period zero. First period net financial wealth, ω_1, is thus given by:

$$\omega_1 = \omega_0 + Y_1 - X_1 - C(S) \tag{4}$$

where ω_0 is initial financial wealth, $C(S)$ is the direct cost of schooling ($= 0$ if the child does not attend school) and X_1 is first period consumption (the price of which is normalized to unity).

When the credit market is imperfect the interest rate, r, available to the household becomes a function of wealth. Hence, second period financial wealth is a function of both first period wealth and the interest rate. If $\omega_1 < 0$, i.e. if the household is in debt and requires a loan, then the interest rate will also depend on the personal characteristics of the loan-taker, Z, as well as the amount collateral the household can supply. In the case of rural households, collateral will most likely take the form of owned land, A_o, making the interest rate a function of A_o, Z and ω_1 when the household takes a loan.[7] Consequently, second period net financial wealth is given by:

$$\omega_2 = Y_2 - X_2 + \omega_1 (1 + r(\omega_1)) \tag{5a}$$

when $\omega_1 > 0$, and by:

$$\omega_2 = Y_2 - X_2 + \omega_1 (1 + r(\omega_1, A_o; Z)) \tag{5b}$$

when $\omega_1 < 0$. Simplifying this expression somewhat, we can express the corresponding second period budget constraint as:

$$X_2 = Y_2 + \omega_1 (g(\omega_1)) \tag{6a}$$

when the household saves in the first period, and as:

$$X_2 = Y_2 + \omega_1 (g(\omega_1, A_o; Z)) \tag{6b}$$

when the household borrows in the first period. We will assume that $\left(\frac{\partial g}{\partial \omega_1}\right) >$

[7] Swain (2001) provides evidence of the important role of land ownership in credit markets in the Puri district of Orissa in India. She finds that the amount of land owned is positively related to access to loans. Further, when a loan is granted the amount of land owned has a significant influence on the rate of interest paid.

0 and $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) < 0$ when the household saves and that $\left(\frac{\partial g}{\partial \omega_1}\right) < 0$, $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) > 0$, $\left(\frac{\partial g}{\partial A_o}\right) < 0$ and $\left(\frac{\partial^2 g}{\partial A_o^2}\right) > 0$ when the household borrows.

The household now endeavors to maximize its utility function, which is assumed to be time separable and is given by:

$$U = U_1\left(X_1, L_{p1}, ACT_1\right) + \delta U_2\left(X_2, L_{p2}, L_{c2}\right) \tag{7}$$

where $\delta \leq 1$ is the inverse of the time discount factor, ρ, (i.e. $\delta = \frac{1}{\rho}$) and ACT_1 is as defined above. The utility function is assumed to be a twice differentiable positive concave function of consumption and leisure, so that the marginal utility of consumption is positive while the marginal utility of labor and schooling is negative (i.e. the marginal utility of leisure is positive). Thus, the parent is faced with the following maximization problem:

$$\begin{aligned} \max\ U \qquad & \text{subject to } \omega_1 - \omega_0 - Y_1 + X_1 + C\left(S\right) = 0 \text{ and} \\ & X_2 - f\left(A_o, A_{r2}, K_o, L_{p2}, L_{h2}\right) - w_{c2}\left(ACT_1\right) L_{c2} \\ & + w_{h2} L_{h2} + p_{r2} A_{r2} - \omega_1 g\left(\omega_1, A_o; Z\right) = 0 \end{aligned} \tag{8}$$

where Y_1 is given by (2a), (2b) or (2c) above.

By setting up a Lagrangian function Γ with multipliers λ_1 and λ_2, we can derive the first order conditions relevant to the child labor/schooling decision:

$$\frac{\partial \Gamma}{\partial X_1} = \left(\frac{\partial U_1}{\partial X_1}\right) - \lambda_1 = 0 \tag{9}$$

$$\frac{\partial \Gamma}{\partial X_2} = \delta\left(\frac{\partial U_2}{\partial X_2}\right) - \lambda_2 = 0 \tag{10}$$

$$\frac{\partial \Gamma}{\partial \omega_1} = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1\right)\right)\lambda_2 - \lambda_1 = 0 \tag{11a}$$

if the household saves in the first period, or

$$\frac{\partial \Gamma}{\partial \omega_1} = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1, A_o; Z\right)\right)\lambda_2 - \lambda_1 = 0 \tag{11b}$$

if the household borrows in the first period.

$$\frac{\partial \Gamma}{\partial L_{cf1}} = \left(\frac{\partial U_1}{\partial L_{cf1}}\right) + \left(\frac{\partial f}{\partial L_{cf1}}\right)\lambda_1 + L_{c2}\left(\frac{\partial w_{c2}}{\partial L_{cf1}}\right)\lambda_2 \leq 0 \tag{12}$$

$$\frac{\partial \Gamma}{\partial L_{cw1}} = \left(\frac{\partial U_1}{\partial L_{cw1}}\right) + w_{cw1}\lambda_1 + L_{c2}\left(\frac{\partial w_{c2}}{\partial L_{cw1}}\right)\lambda_2 \leq 0 \tag{13}$$

$$\frac{\partial \Gamma}{\partial S} = \left(\frac{\partial U_1}{\partial S}\right) - \left(\frac{\partial C}{\partial S}\right)\lambda_1 + L_{c2}\left(\frac{\partial w_{c2}}{\partial S}\right)\lambda_2 \leq 0. \tag{14}$$

Equation (12) tells us that the child will participate in family labor if the value of the marginal product of first period family labor plus the value of the increase in the second period wage due to family work experience is equal to the marginal disutility of family labor. The decision to send the child to participate in wage labor hinges on (13), which states that the child will participate in wage labor if the first period wage plus the value of the increase in the second period wage due to wage work experience is equal to the marginal disutility of wage labor. Finally, (14) gives the condition necessary for a parent to send their child to school and states that the value of the increase in the second period wage due to schooling minus the marginal cost of schooling must be equal to the marginal disutility of schooling. These results can be summarized in the following Lemma:

Lemma 1 *The maximization problem in (8) has four potentially unique solutions for child activity:*

$$ACT_1\text{:}\begin{cases} = L_{cf1} & \textit{if (12) holds with equality} \quad \textit{and (13), (14) hold with strict inequality.} & \textit{(i)} \\ = L_{cw1} & \textit{if (13) holds with equality} \quad \textit{and (12), (14) hold with strict inequality.} & \textit{(ii)} \\ = S & \textit{if (14) holds with equality} \quad \textit{and (12), (13) hold with strict inequality.} & \textit{(iii)} \\ = I & \textit{if (12), (13) and (14) all hold with strict inequality.} & \textit{(iv)} \end{cases}$$

where

$$\lambda_1 = \left(\frac{\partial U_1}{\partial X_1}\right) = W\delta\left(\frac{\partial U_2}{\partial X_2}\right) \tag{15}$$

and

$$\lambda_2 = \delta\left(\frac{\partial U_2}{\partial X_2}\right) \tag{16}$$

with $W = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1\right)\right)$ *when the household saves in the first period and* $W = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1, A_o; Z\right)\right)$ *when the household borrows in the first period.*

If more than one of the equations (12), (13) and (14) hold with equality, then the parent will be indifferent between the respective activities and we are unable to predict which activity will be chosen.

Proof. These results follow directly from the first order conditions pre-

sented above. ■

From the results in Lemma 1, we can derive the following propositions:

Proposition 1 *Land and productive assets have a substitution effect on the child's participation in family work, making participation in family work more likely as the household's land and productive asset holdings increase.*

Proof. From (12), it is clear that the child will be more likely to participate in family labor as $\frac{\partial f}{\partial L_{cf1}}$ increases. It follows from (1) and our assumptions that land and assets enter the production function multiplicatively and that the production function is positive and concave that as the household's holding of land and productive assets increase, the marginal productivity of child family labor increases, holding all else constant. This in turn increases the incentive to employ the child in family work. ■

Proposition 2 *Land has an income effect that decreases the likelihood that the child participates in any form of work and increases the likelihood that the child attends school as land holdings increase.*

Proof. See Appendix 1. ■

Proposition 3 *When the credit market is imperfect and the household borrows, there is a credit market effect of holding land that makes the child less likely to participate in any form of work and more likely to attend school as land holdings increase.*

Proof. See Appendix 1. ■

Proposition 4 *When the credit market is imperfect and the household saves, there is a credit market effect of holding land that makes the child less likely to participate in any form of work and more likely to attend school as land holdings increase, when first period wealth is sufficiently large. This effect is smaller, however, than in the case when the household borrows, and may even be reversed if first period wealth is small.*

Proof. See Appendix 1. ■

Propositions 1 to 4 demonstrate the different effects land and productive asset holdings can have on participation in child labor. Proposition 1 illustrates the substitution effect of land and productive assets on child family work, which is the incentive aspect of the model. The substitution effect

arises from land and labor market imperfections, i.e. the household is unable to adjust its land holdings and the number of workers outside the family it employs. The result is that as the household's holding of land and productive assets increase, the marginal productivity of child family labor increases, and the incentive to employ the child in family work becomes greater. The substitution effect is only relevant for family work, as an increase in land and productive asset holdings will not affect the wage received when the child participates in wage labor and will not have a direct impact on the decision whether or not to send the child to school.

Proposition 2 illustrates the income effect of land on child labor. While this is related to the poverty constraint that is present in other theoretical models, the income effect here cannot be seen as compelling poverty. The effect of land and productive assets in this case is indirect, and works through the production function. Households with larger land and productive asset holdings will produce more output in both periods, and will hence have a higher net income from which they can consume. This is turn will increase the likelihood that the parent will be able to forgo the extra income that could be earned by the child through either family or wage labor. Therefore, we would expect an income effect from holding land and productive assets that would act to lower the incidence of child labor. In the case of family labor, the wealth effect may be partially or even wholly offset by the substitution effect of land and productive assets, which acts to increase the incidence of child family labor.

Propositions 3 and 4 illustrate the credit effect of holding land. When the credit market is imperfect, the interest rate paid on loans is a negative function of first period wealth and the amount of land held by the household. First period wealth, in turn, is a positive function of land holdings. Therefore, as land holdings increase, the rate of interest the household has to pay on its loan decreases, and it becomes more likely that the household can forgo the income that the child could earn through participating in some form of labor. The result is that land holdings are expected to be negatively related to child labor. When the household saves, the interest rate paid on savings is a positive function of first period wealth. Therefore, while land holdings are generally expected to lower the incidence of child labor, there is an incentive to increase first period wealth, and hence increase the interest rate earned in the first period. If this incentive is sufficiently large, the household may actually have an incentive to send the child to work. We believe, however,

that this scenario is improbable. Therefore, credit market imperfections are expected to lead to a negative relationship between land holdings and child labor.

While propositions 2 to 4 have only explicitly considered the effects of land holdings on the child's participation in work and school attendance, it is straightforward to confirm that the results hold for productive asset holdings as well. In this case, we would include the additional assumption that the effect of asset ownership on the interest rate is identical to the effect of land on the interest rate in the case where the household requires a loan.

Controlling for the income effect of land and productive asset holdings, there are two opposing effects of land and asset holdings on child participation in family work: the substitution effect and the credit market effect. If land and assets have a positive effect on child family labor, then we can assume that the land and labor markets are imperfect, while we cannot say anything about the credit market. If the effect of land and assets on child family labor is zero, then either all markets are perfect, or the effect of the land and labor market imperfections is exactly offset by the effect of the credit market imperfection. Finally, if land and assets have a negative effect on the child's participation in family work, then we can conclude that the credit market is imperfect. Similarly, if the effect of land and assets on child non-family work is zero, then we can assume that the credit market is perfect, while a negative effect of land and assets indicates that the credit market is imperfect.

Proposition 5 *Children will be more likely to participate in some form of work if their parents exhibit a greater preference for child labor (i.e. if they experience a smaller disutility of sending the child to work). Conversely, children will be more likely to attend school if their parents exhibit a greater preference for schooling (i.e. if they experience a smaller disutility of sending the child to school).*

Proof. From (12), (13) and (14) above, it is clear that these equations are more likely to hold with equality as $\left(\frac{\partial U_1}{\partial L_{cf1}}\right)$, $\left(\frac{\partial U_1}{\partial L_{cw1}}\right)$ and $\left(\frac{\partial U_1}{\partial S}\right)$ become less negative. ■

Proposition 5 demonstrates the role of parental preferences in the choice of activity in which the child will participate, and represents the agency aspect of the model. Parental preferences will affect the relative marginal disutility of child family labor, child wage labor and schooling. One could easily imagine that wage labor would yield the highest level of disutility, followed by family

labor and schooling. If parents do not value schooling at all, however, then one would expect that schooling would yield a relatively high level of marginal disutility. Similarly, some parents may exhibit a small distaste for child labor if they believe that child labor has some beneficial effects on the child in terms of socialization and experience (that does not necessarily translate directly into higher future wages). Additionally, the degree of parental altruism will affect the preferences for schooling versus child labor.

The cost of schooling will have an effect on whether or not the child attends school, as can be seen from (14). Parents may choose not to send their children to school if the marginal cost of school attendance (i.e. $\left(\frac{\partial C(S)}{\partial S}\right)$) is high. This will be the case even when the parent does not have the incentive to send the child to work (in which case the child will be idle in the first period). Further, as the benefits of sending the child to school do not materialize until the second period (as the child does not generate any income in the first period), parents who have a high discount rate (i.e. small δ) will not be adequately compensated for the marginal cost and disutility of schooling and as such will choose not to send their children to school.

From (12), (13) and (14) it is apparent that the effect of first period child activity on second period wages will play an important role in determining the activity in which the child will participate. The effect of child labor/schooling on future wages will depend on a number of factors. For example, if the child is expected to inherit the family farm, the return to child family labor may be much higher than the return to wage labor or even schooling. While empirical evidence has shown that the returns to schooling are generally quite high on an aggregate (national) level, the quality of local schools may be such that the benefit in terms of increased future wages is negligible or even zero.[8] Even if the schools are of high quality, low demand for high skilled labor will result in schooling having a small impact on second period wages. The same will hold true if the child belongs to a group that is economically discriminated against (for example women or members of minority groups), resulting in a limited number of job opportunities for the child in the second period. Finally, while we have not distinguished between boys and girls in the theoretical model, the assumption that the child pools its second period income with the household may be less likely to hold in the case of girls, further weakening the incentive to send girls to school.

[8] For example, Psacharopoulos (1994) provides macroeconomic evidence that shows that the returns to education are higher than the returns to physical capital in all parts of the world, indicating that education should be profitable in many cases.

3 Data and descriptive statistics

The data used in this paper are drawn from the Human Development Profile for India, collected by the National Council of Applied Economic Research (NCAER) in 1994. The sample is representative of the rural population at the level of all India, and includes 33,229 households spread over 1,765 villages in 16 states. A child is defined in the survey as a person under the age of 15. For the purposes of this study, we will focus on children ages 7-14, in keeping with the definition of a child commonly used by the International Labor Organization (ILO, 2002), for example.[9] Further, the survey follows the definition of work as set out by the ILO. Children are considered economically active if they participate in market production and paid work or if they participate in certain unpaid non-market production, such as production of goods for own use or work on a family operated enterprise. As such, economic activity is not confined to the formal sector, but rather encompasses the informal sector and illegal activities as well. Children who perform domestic chores in their own household, however, are not considered to be economically active and are therefore not considered to be engaged in child labor.

We have data on the primary and secondary occupational status of the children in the sample. The primary occupation of the child is defined as the activity that the child is engaged in for at least half the year, while the secondary occupation of the child is any activity that the child participates in additional to the primary occupation (Shariff, 1999). Classifying the children according to activity is relatively straightforward. However, in the case where the primary occupation of the child is not stated, or given as "child under 15 years", we assign the child to the category stated as their secondary occupation. If no secondary occupation is given, the child is considered idle.

Classifying the children based on their primary occupation is a very restrictive measure of child labor and, to a somewhat lesser extent, school attendance. One striking feature of the data is that only about 0.5% of the children sampled report that they combine school and work of one form or another. The reason for this is that there are very few children who report both a primary occupation and a secondary occupation. As a result, the analysis will be focused on children's participation in the activity that they are engaged in for at least half of the year. This is a very strict definition of

[9] The ILO tends to focus on children between the ages of 5-14. We limit our analysis to children 7-14, however, due to the fact that almost all children ages 5-6 are idle, with the second largest group attending school. It is reasonable to assume that in most cases, five and six year old children are too young for any activity other than idleness.

child labor/school attendance that carries with it both advantages and disadvantages. The obvious disadvantage is that children who only work for part of the year and attend school or are idle for the rest of the year are not included as child laborers. It is reasonable to expect that this category of child laborers is quite substantial. The advantage, however, is that the categories we analyze are considerably more homogeneous than would otherwise be the case (the exception to this case being idle children). Indeed, one could reasonably expect significant difference between children who work at least half of the year and children who work a few hours a week. This is not to say that the latter group is not of interest; however, children in the former group share the characteristic that they are engaging in work to the extent that it significantly hinders, and in many cases prevents, them from receiving an education. Further, a number of previous studies have measured child labor based on the number of hours the child worked in the week previous to the survey (see Bhalotra (2004), Dehejia and Gatti (2002) and ILO (1996), for example) These results may be sensitive to the time of the year that the survey is carried out. Our data, on the other hand, uses an annual measure of child labor.

We can divide children's occupational status into four categories: student, family worker, non-family worker, and idle. Family work includes all productive work done within the household, while non-family work refers to economic activities that the child takes part in outside of the household, such as wage labor. A problem arises in how we treat a fifth category of children, namely those who list their primary occupation as "own household work", which is defined as unpaid household work that does not contribute to household income. As mentioned above, the ILO does not consider household chores and similar non-productive activities to be work. As such, one alternative is to include these children in the category of idle children, as they are not economically active. However, these children may be contributing to household income indirectly; by carrying out domestic chores, they may allow another member of the household (the mother, for example) to participate in productive work. Further, if the child had been carrying out the same duties in another household, they would qualify as a domestic servant and would be considered economically active. Therefore, we choose to assign these children to their own category, as domestic workers.

Tables 1 and 2 contain correlation coefficients for some variables of interest. Table 1 present the correlation coefficients for household size and

Table 1: Correlation coefficients for household size and composition, land, assets and income, pooled sample.

	Household size	Land	Prod. assets	ln(hh income)	ln(pc income)	Average age	Prop. children in hh
Household size	1.0000						
Land in acres	0.2358	1.0000					
Index of productive assets	0.3033	0.2307	1.0000				
ln(household income)	0.3993	0.3291	0.3878	1.0000			
ln(per capita income)	-0.0298	0.2559	0.2857	0.8949	1.0000		
Average age of household members	-0.0224	0.0591	0.0861	0.1385	0.1740	1.0000	
Proportion of children in household	0.2642	0.0034¤	0.0086¤	-0.0273	-0.2000	-0.7020	1.0000

Note: The superscript ¤ indicates that the correlation coefficient is not significantly different from zero.

Table 2: Correlation coefficients for parental education and household size and composition, pooled sample.

	Father illiterate	Mother illiterate	Father prim. ed.	Mother prim. ed.	Father mid. ed.	Father sec. ed.	Mother mid./sec. ed.	Household size	Prop. children in hh
Father illiterate	1.0000								
Mother illiterate	0.4077	1.0000							
Father primary ed.		-0.0289	1.0000						
Mother primary ed.	-0.2839		0.1471	1.0000					
Father middle ed.		-0.1336		0.1367	1.0000				
Father secondary ed.		-0.3058		0.0773		1.0000			
Mother middle/secondary ed.	-0.2478		-0.1079		0.0640	0.4119	1.0000		
Household size	-0.0596	-0.0009¤	-0.0016¤	0.0132	0.0356	0.0830	0.0085¤	1.0000	
Proportion of children in the household	0.0630	0.1098	-0.0007¤	-0.0279	-0.0087	-0.0363	-0.0879	0.2642	1.0000

Note: The superscript ¤ indicates that the correlation coefficient is not significantly different from zero.

composition, land, income and assets for the pooled sample. Household size is strongly positively correlated to land and productive asset holdings, total household income and the proportion of children in the household, while it is negatively correlated with the average age of the household members and per capita income, where the latter is simply total household income divided by household size. Further, while the proportion of children in the household is negatively correlated with both total household income and per capita income, the coefficient is significantly greater in the latter case.

Table 2 present the correlation coefficients for parental education and household size and composition for the pooled sample. The correlation coefficients between mothers' and fathers' education seems to indicate that parents often have similar educational levels. Higher levels of parental education is negatively correlated with the proportion of children in the household and positively correlated with household size.

3.1 Activity rates

In Table 3 we present the percentage of children participating in each activity by gender and land ownership, household income and parental education, and give the average age of children by gender and occupation. Perhaps not surprisingly, school attendance is higher among children from households that own land than children from those that do not. When looking at child labor, we see that more boys are engaged in family work in the land owning households than in the households that do not own land. The opposite is true of the relationship between land ownership and family labor for the girls in the sample. The percentage of children who are idle and the percentage of children who participate in non-family and domestic work are lower in households that own land, regardless of gender. Finally, the percentage of children who attend school is higher in households that own land, again regardless of gender. Therefore, when comparing land owning households with landless households, it appears as if the wealth paradox is only relevant for boys.

Focusing solely on the differences between households that own land and that do not own land may obscure important differences within the group of land owning households that vary with respect to the size of land holdings. Examining the data by farm size reveals variation in all participation rates. The wealth paradox becomes apparent for both girls and boys in family work; for girls there is a positive linear relationship between farm size and participation in family work, while for boys the relationship appears to be nonlinear.

Table 3: Participation rates (%) of children 7 – 14 in primary occupation categories by land owned, household income and parental education.

	Primary Occupation Category									
	School		*Family work*		*Non-family work*		*Domestic work*		*Idle*	
Land ownership by household:	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Does not own land	70.27	57.46	0.94	2.83	5.89	5.45	1.61	9.29	21.29	24.97
Owns land	78.10	63.89	2.01	2.52	2.47	1.83	1.19	7.95	16.22	23.81
Acres of land (> 0):										
Up to 15 acres	75.45	62.24	1.51	2.34	3.70	2.21	1.43	8.29	17.91	24.91
15 – 30 acres	77.11	61.92	2.35	2.57	2.38	2.44	1.22	8.34	16.93	24.73
30 – 60 acres	78.70	63.71	2.08	2.50	2.21	1.89	1.01	8.18	16.01	23.71
Over 60 acres	81.67	68.16	2.16	2.70	1.41	0.66	1.08	6.89	13.69	21.59
Household income:										
Up to 10,000 INR	67.63	50.55	1.74	4.07	4.81	3.98	1.82	9.92	24.00	31.48
10,001 – 20,000 INR	71.19	55.79	1.62	2.48	4.53	3.95	1.65	9.82	21.01	27.96
20,001 – 30,000 INR	77.26	62.90	1.77	2.78	3.63	3.07	1.01	8.52	16.33	22.73
Over 30,000 INR	84.62	75.13	1.62	1.70	1.65	1.26	0.84	5.74	11.28	16.16
Father's education:										
Illiterate	59.87	41.21	2.44	3.72	5.59	4.73	2.10	11.86	30.00	38.49
Primary	84.11	69.49	1.50	2.49	2.78	2.65	1.05	7.17	10.56	18.20
Middle	89.24	78.31	0.74	1.52	1.06	0.60	0.29	4.57	8.67	15.00
Secondary	93.75	88.86	0.27	0.38	0.43	0.49	0.47	2.69	5.09	7.58
Mother's education:										
Illiterate	69.66	52.25	1.99	3.06	4.28	3.70	1.58	9.88	22.50	31.11
Primary	93.95	88.62	0.94	1.38	1.34	1.17	0.44	3.11	3.33	5.73
Middle/ Secondary	96.21	95.59	0.06	0.26	0.35	0.13	0.35	0.91	3.03	3.11
Average age of the child (in years):	10.37	10.22	12.36	11.86	12.36	12.12	11.60	12.10	9.93	9.72

Note: INR = Indian rupee.

Girls' school attendance exhibits a nonlinear relationship with farm size, while boys' school attendance exhibits a linear positive relationship with farm size. Participation in non-family labor declines linearly with farm size for boys, while it exhibits a nonlinear relationship for girls. Finally, the percentage of children who are idle varies negatively and linearly with farm size.

School participation for both boys and girls increases with household income, while participation in all other activities except family work decreases with household income. The non-linear relationship between household income and family work for both boys and girls may depend on the relationship between land holdings and household income. Finally, an increase in parental education has the effect of increasing school participation and decreasing participation in all other activities for both boys and girls.

Idle children are younger, on average, than children participating in any activity while working children are older on average than children attending school.

3.2 School attendance in India

Article 45 of India's constitution calls for the State to provide free and compulsory schooling for all children up to age 14. This article falls within the Directive Principles of the constitution, however, and as such is not formal law (Sripati and Thiruvengadam, 2004). Therefore, free schooling is not always provided, and compulsory attendance is not always enforced; both accessibility and enforcement varies from state to state.

Children typically begin primary school at age 6 and are considered to have primary education after completing classes one through five. Classes six through eight are taught in middle schools and are generally attended by children aged 11-14, while secondary school pupils are typically between ages 14 and 17 and attend classes nine through twelve. Thus, all of the children in our sample are old enough to have begun attending primary school.

4 The empirical model

From the theoretical model in section 2 above, the participation equations for farm work, wage work, idleness and schooling can be expressed as:

$$ACT_{c1} = g\left(A_o, \omega_0, w_{h1}, w_{h2}, p_{r1}, p_{r2}, C(S); Z, e\right) \tag{17}$$

where ACT_{c1} is the child's activity in period one and e represents optimization errors and other unobservable variables of influence. An immediate problem

with the above equation is that ω_0 is unobservable. However, ω_0 can be written as a function of Y_1, and as Y_1 is observable it can be substituted for ω_0 in (17).[10] Further, we do not have information on the wages paid to hired labor (w_{h1}, w_{h2}), the rental price of land (p_{r1}, p_{r2}) or the direct cost of schooling $(C(S))$, although in the latter case we can include a proxy for indirect costs $(C'(S))$, which are discussed below.[11] Taking these changes into account, we obtain the following expression for the participation equation:

$$ACT_{c1} = g_1\left(A_o, Y_1, K_o, C'(S); Z, e\right). \tag{18}$$

Due to the rather large observed differences in the participation rates of male and female children, separate equations are estimated for boys and girls.[12] As there are potentially several observations from the same household, the standard errors are adjusted to allow for correlation between observations within clusters. The dependent variable consists of five unique outcomes as defined above, with children participating in "own household work" categorized as participating in domestic work. In the cases where a child both works and attends school we will assign them to the activity they have listed as their primary occupation.[13] Due to the nature of the dependent variable, we estimate the model using multinomial logit regression.[14]

The amount of land owned by the household (A_o) is measured in acres, and we include dummy variables for different sizes of land holdings to allow for a nonlinear relationship. The amount of land owned is typically treated as exogenous, given that land is usually inherited and land markets tend to be weak (Bhalotra and Heady, 2003; Swain, 2001). Leased land, however, may be endogenous in the case of family work, i.e. a family may lease in because they

[10] The relationship between Y_1 and ω_0 may be somewhat tentative; however, substituting household income for initial wealth is preferable to not including the variable at all, as we wish to separate out the substitution and credit market effects of land from the income effect.

[11] We do have information on the village level agriculture and non-agriculture wages for men, women and children. We choose not to use these, however, as they are correlated with household income, and may better reflect village level productivity than the wages paid by an individual household to hired labor.

[12] Further, a likelihood ratio test performed after multinomial logit estimation rejects the null hypothesis that boys and girls have the same likelihood ratio function.

[13] This is in keeping with the theoretical model, where it was assumed that children do not combine activities. Further, it is reasonable to assume that the primary occupation is the most relevant one for analysis.

[14] If we had allowed for children to combine activities, the model would have to be estimated using multinomial probit regression. In this case, however, we do not believe that multinomial probit is appropriate, given the tiny percentage of children reported to combine activities and the presumably large degree of measurement error of combining activities.

have child labor readily available. Therefore, we include a dummy variable to determine if a household leases in land. This variable is expected to have a coefficient of zero if leased land is not endogenous, while the coefficient is expected to be positive if it is endogenous.

The amount of owned productive capital (K_o) is measure by a weighted index of productive assets owned by the household. Total household income, which includes the imputed value of agricultural output, serves as our measure of Y_1. As mentioned above, we do not have any information on the direct costs of schooling ($C(S)$), but we proxy this by including dummy variables which measure whether or not a primary school is in the village, a middle school is within 2km of the village and a high school is within 4km of the village.[15] As we only have data from a single cross-section, it is not possible to include any second period variables. Taken together, these variables constitute the variables of importance given in (18).

Of the above variables, household income may be problematic. Indeed, there is a risk of a simultaneity bias when children contribute to household income either through unpaid family work or through wage labor. Therefore, we choose to instrument household income. Household size and composition, the primary occupation and education level of the father and mother as well as a weighted index of non-productive assets owned by the household are used as instruments. Further, we include village level variables such as the condition of the road leading to the village, the distance from the village to the nearest bus stop, the presence of a market in or within 3km of the village and the proportion of irrigated land. State control dummies are also included.

As for child specific characteristics, we include the child's age as a regressor in the estimation. This follows from Becker's human capital theory, which predicts that both education and experience will increase the marginal product of labor. While we do not have information on the number of years of schooling the child has, we can use age as a proxy for experience. We also include the birth order of the child among all members of the household up to 18 years of age. Further, we include a dummy variable indicating whether or not the child is the biological child of the household head in the regression. We include this for three reasons. The first two have to do with parental agency. First, the household head may act more altruistically towards their own child than towards other children in the household. As a result, we expect the chil-

[15] While we do have data on total expenditure on education for the households, this is not the same as the direct cost of schooling, and is clearly highly endogenous. Hence, we choose to utilize the indirect measures of cost of schooling mentioned above.

dren of the household head to be more likely to attend school and less likely to work. However, if the household head is more likely to exert control over the income generated by own child labor, then there is an incentive to send own children to work.[16] Finally, if the child of the household head is expected to inherit the family land, their may be more incentive to employ the child in family work, as the future returns to such experience may outweigh the increase in future wages expected from schooling. Therefore, we cannot be certain of the effect of being the child of the household head on participation in work versus schooling.

The education level of each parent is also included as regressors in the estimation. These are dummy variables measuring primary, middle and secondary education, with the base category being illiteracy. Primary education means that the parent is literate, but that the highest level of education attained is primary or lower. Middle education means that the parent has attained an educational level above primary but less than matriculation, while secondary education includes educational attainment of matriculation and higher. The latter two categories are combined in the case of mothers, as the low incidence of mothers with secondary education or higher leads to collinearity in the results otherwise. These variables are included as a measure of parental preferences, as parents with higher education are expected to exhibit a greater preference for schooling. Further, including mother's and father's education separately allows for a degree of preference heterogeneity, as observed empirically by Basu and Ray (2001). The same is true of including the gender of the household head as a regressor, however this may also act as a measure of household insecurity.

Dummy variables indicating that the child's mother or father is absent from the household are also included, as absent parents do not necessarily influence the incidence of child labor to the same degree (U.S. Department of Labor, 2000). Unfortunately, we do not have data indicating why the parent is absent, which may play an important role in how these variables affect child activity. For example, a parent may be absent because he or she has migrated in order to take a job. They may, however, be absent because they are deceased. The reason for the parent's absence may have very different effects on child labor and schooling. Further, the effects may be gender specific with respect to both the missing parent and the child.

[16] This possible effect is supported by the theory and results presented in Basu and Ray (2001).

Table 4: Definitions and summary statistics of the variables.

Variable	Definition	Full Sample		Boys		Girls	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
School	Dependent variable=0 if child's primary or secondary occupation is school attendance.	0.6909	0.4621	0.7560	0.4295	0.6183	0.4858
Idle	Dependent variable=1 if child does not have a primary or secondary occupation.	0.2084	0.4061	0.1784	0.3828	0.2418	0.4282
Domestic work	Dependent variable=2 if child's primary or secondary occupation is own household domestic work.	0.0466	0.2108	0.0133	0.1144	0.0838	0.2771
Family work	Dependent variable=3 if child's primary or secondary occupation is family work.	0.0212	0.1441	0.0167	0.1282	0.0262	0.1597
Non-family work	Dependent variable=4 if child's primary or secondary occupation is non-family work.	0.0329	0.1784	0.0356	0.1853	0.0299	0.1703
ln(household income)	The log of total household income.	9.9015	0.8669	9.9004	0.5310	9.9027	0.5380
Household owns land	Dummy=1 if the household owns land.	0.6806	0.4663	0.6810	0.4661	0.6801	0.4665
Household owns 15 to 29 acres of land[d)]	Dummy=1 if the household owns 15 to 29 acres of land.	0.1478	0.3549	0.1446	0.3517	0.1514	0.3584
Household owns 30 to 59 acres of land[d)]	Dummy=1 if the household owns 30 to 59 acres of land.	0.1849	0.3882	0.1889	0.3915	0.1804	0.3845
Household owns 60 or more acres of land[d)]	Dummy=1 if the household owns 60 or more acres of land.	0.1821	0.3859	0.1807	0.3847	0.1837	0.3873
Household leases in land	Dummy=1 if the household leases in land.	0.0682	0.2520	0.0667	0.2496	0.0698	0.2548
Household owns productive assets	Dummy=1 if the household owns any productive assets.	0.3499	0.4770	0.3481	0.4764	0.3520	0.4776
Index of productive assets	Weighted index of productive assets owned by the household.	2.6806	5.2753	2.6761	5.3034	2.6856	5.2438
No anganwandi in village	Dummy=1 if there is no anganwandi in the village.	0.5002	0.5000	0.5059	0.5000	0.4939	0.5000
No primary school in village	Dummy=1 if there is no primary school in the village.	0.1155	0.3196	0.1157	0.3199	0.1152	0.3192
No middle school w/in 2km	Dummy=1 if there is no middle school within 2km of the village.	0.3003	0.4584	0.3049	0.4604	0.2952	0.4562
No high school w/in 4km	Dummy=1 if there is no high school within 4km of the village.	0.2400	0.4271	0.2478	0.4317	0.2313	0.4217
Child's age	The age of the child in years.	10.39	2.29	10.4156	2.2876	10.3569	2.2882
Child's age squared	The age of the child in years, squared.	113.14	48.12	113.72	48.17	112.50	48.07
Birth order	Age-rank among individuals aged up to 17 in the household.	2.1208	1.1325	2.1043	1.1300	2.1391	1.1350
Child of the household head	Dummy=1 if child is the child of the household head.	0.7822	0.4128	0.7851	0.4108	0.7790	0.4149
Father primary education	Dummy=1 if child's father has primary education.	0.2483	0.4320	0.2421	0.4283	0.2552	0.4360
Mother primary education	Dummy=1 if child's mother has primary education.	0.1584	0.3651	0.1540	0.3610	0.1633	0.3696

Father middle education	Dummy=1 if child's father has middle education.	0.1258	0.3317	0.1265	0.3324	0.1251	0.3308
Father secondary education	Dummy=1 if child's father has secondary education or above.	0.1541	0.3611	0.1557	0.3625	0.1524	0.3594
Mother middle/secondary education	Dummy=1 if child's mother has middle education or above.	0.0888	0.2845	0.0887	0.2844	0.0889	0.2847
Mother absent	Dummy=1 if the child's mother is not present in the household.	0.0338	0.1807	0.0329	0.1783	0.0348	0.1833
Father absent	Dummy=1 if the child's father is not present in the household.	0.0632	0.2433	0.0600	0.2375	0.0667	0.2496
Household size	Number of individuals in the household.	7.4457	3.4295	7.3085	3.3894	7.5988	3.4673
Number of males 60+	Number of males aged 60 and over in the household.	0.2043	0.4132	0.2063	0.4154	0.2021	0.4107
Number of females 60+	Number of females aged 60 and over in the household.	0.1872	0.4013	0.1889	0.4016	0.1854	0.4009
Number of females 15-59	Number of females aged 15 - 59 in the household.	1.7914	1.1740	1.7802	1.1588	1.8040	1.1907
Number of males 0-3	Number of males aged 0 - 3 in the household.	0.2820	0.5555	0.2570	0.5339	0.3098	0.5774
Number of females 0-3	Number of females aged 0 - 3 in the household.	0.2665	0.5444	0.2509	0.5298	0.2840	0.5596
Number of males 4-6	Number of males aged 4 - 6 in the household.	0.3232	0.5562	0.3038	0.5477	0.3449	0.5647
Number of females 4-6	Number of females aged 4 - 6 in the household.	0.3011	0.5443	0.2832	0.5304	0.3212	0.5588
Number of males 7-14	Number of males aged 7 - 14 in the household.	1.2423	0.9529	1.6993	0.8120	0.7326	0.8323
Number of females 7-14	Number of females aged 7 - 14 in the household.	1.1615	0.9988	0.6571	0.8212	1.7239	0.8705
Female household head	Dummy=1 if the household head is female.	0.0401	0.1963	0.0394	0.1947	0.0409	0.1981
Bank/coop in village	Dummy=1 if there is a bank or co-op in the village.	0.1979	0.3984	0.1967	0.3975	0.1991	0.3994

Variables measuring household composition and size are used as regressors, with the number of females aged 15 - 59 as the comparison category. Finally, we include two additional village level regressors: a dummy taking the value of one if there is no anganwandi in the village and a dummy variable taking the value of one if there is a bank or cooperative present in the village. An anganwandi is a child care center for children under the age of six. It also provides services to pregnant and nursing mothers. hence, this variable is intended to capture access to child care. The second variable is intended to provide a proxy for the household's access to credit.

Religion and ethnicity dummies are included (but not reported) to capture differences in preferences between these groups, but also to capture the potential effects of discrimination in the case of the scheduled tribes and scheduled castes. Dummy variables indicating which state the household is located in are also included as controls, and are also not reported. Table 4 reports the summary statistics for the independent variables of interest to the analysis.

5 Results

As mentioned in section 4 above, household income is potentially endogenous in the cases of family and non-family work. When we run our regressions including non-instrumented log household income, we find that the variable is negative and insignificant in the case of boys' family work participation, while it is positive and insignificant in the case boys' non-family work participation. In the girls' regression, non-instrumented log household income is positive and significant in the case of participation in non-family work. These results indicated that household income is indeed endogenous, at least in the case of non-family work. Therefore, we include instrumented household income as an independent variable in our regressions through a non-simultaneous two-stage process. The natural log of total household income is first instrumented by means of an OLS regression on the variables listed in section 4. The predicted values from this regression are then included as an independent variable in the multinomial logit regressions. The standard errors of the predicted values of household income will be smaller than would be the case with a simultaneous estimator, and the results must be interpreted with this in mind (Wooldridge, 1999). Another alternative is to estimate the regressions using instrumental probit to obtain a simultaneous estimator for household income. This is possible in Stata; however, in this case the standard errors cannot be adjusted for clustering by household. The results of the instrumental pro-

bit regressions (not reported) yield nearly identically significant household income coefficients, indicating that the non-simultaneous method does not introduce a significant bias.

Wald tests run for both regressions rejected the hypothesis that two or more categories had equal coefficients on the independent variables. This result supports our decision to separate child work into different categories.

One assumption of the multinomial logit model is that of the irrelevance of independent alternatives (IIA). In order to test this assumption, a generalized Hausman test is run on the regression results. The results of the test reveal that the assumption of IIA is violated in both regressions. Specifically, the category idle is problematic in both the boys' and girls' regressions, while the category domestic work is problematic in the girls' regression. One option would be to use nested logit to estimate the empirical model. The disadvantage of this method is that it does not allow for clustering by household. Further, attempts to use nested logit showed that the results were unstable and often did not converge. With this in mind, we choose to rely on the multinomial logit results.

Table 5 and table 6 present the multinomial logit estimation of boys' and girls' participation in primary occupation categories, respectively.

5.1 Household income, land and productive assets

Household income has a strongly significant negative effect on participation in all non-school activities. While this result may seem intuitively apparent it is not self-evident, especially considering the weak relationship between household income and child labor reported in other studies (see Bhalotra and Tzannatos (2003) for an overview).[17] A strong negative effect of household income on work participation should not be interpreted as support for the hypothesis of compelling poverty, however, as a negative effect rather indicates that consumption of schooling acts as a normal good, or it may indicate a credit constraint.[18]

[17] To further investigate whether or not log household income is endogenous, we include the residuals from the OLS regression along with unistrumented household income as an independent variables in the multinomial logit regression. If household income is truly exogenous, we would expect the coefficient on the residuals to be zero (Bhalotra and Heady, 2003). For both boys and girls, however, the coefficient is positive and significant in all cases.

[18] The only tests of compelling poverty that we are aware of are the ones developed and tested by Bhalotra (2004) and Dumas (2004). Using data on children engaged in wage labor from rural Pakistan, Bhalotra finds strong evidence supporting the hypothesis for boys, while the hypothesis is weakly supported for girls. Dumas uses data on children engaged in farm labor in Burkina Faso, and does not find support for the hypothesis of

Table 5: Multinomial logit estimation of boys' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-0.7759***	-0.9488***	-0.9778***	-1.4036***
	(0.1167)	(0.3487)	(0.2719)	(0.2152)
Household owns land[d)]	-0.1843**	-0.0233	0.7889***	-0.1394
	(0.0759)	(0.1981)	(0.2201)	(0.1342)
Household owns 15 to 29 acres of land[d)]	0.0274	0.0110	0.2842	-0.2837*
	(0.0888)	(0.2470)	(0.2139)	(0.1699)
Household owns 30 to 59 acres of land[d)]	0.1133	-0.0615	0.6282***	-0.2255
	(0.0876)	(0.2502)	(0.2079)	(0.1655)
Household owns 60 or more acres of land[d)]	0.2245**	0.0986	0.9512***	-0.5874***
	(0.0972)	(0.2467)	(0.2332)	(0.2153)
Household leases in land [d)]	0.0367	-0.1695	0.6191***	-0.2980
	(0.0933)	(0.2826)	(0.2023)	(0.2155)
Household owns productive assets [d)]	-0.2567***	-0.4445*	-0.4697**	-0.2158
	(0.0778)	(0.2404)	(0.2095)	(0.1656)
Index of productive assets	-0.0148*	0.0012	0.0165	-0.0145
	(0.0084)	(0.0248)	(0.0197)	(0.0201)
School availability:				
No primary school in village [d)]	0.0959	-0.0937	0.1452	0.4101***
	(0.0800)	(0.2327)	(0.2219)	(0.1592)
No middle school w/in 2km [d)]	0.1202**	-0.0713	-0.0712	-0.2034*
	(0.0605)	(0.1752)	(0.1590)	(0.1149)
No high school w/in 4km [d)]	0.0464	0.0828	-0.0056	0.0072
	(0.0662)	(0.1952)	(0.1800)	(0.1282)
Child characteristics:				
Child's age	-0.0770***	0.2648***	0.5002***	0.4694***
	(0.0124)	(0.0363)	(0.0376)	(0.0296)
Birth order	0.0803**	-0.0336	0.0098	-0.1345*
	(0.0316)	(0.0898)	(0.0966)	(0.0725)
Child of the household head [d)]	-0.0692	0.0356	0.2215	0.4691**
	(0.0806)	(0.2257)	(0.2238)	(0.1909)
Parental characteristics:				
Father primary education [d)]	-0.9725***	-0.6484***	-0.7150***	-0.6887***
	(0.0659)	(0.1716)	(0.1622)	(0.1204)
Mother primary education [d)]	-1.1739***	-0.7793**	-0.5669**	-0.7373***
	(0.1198)	(0.3147)	(0.2341)	(0.1946)
Father middle education[d)]	-1.1349***	-1.7973***	-1.1154***	-1.2379***
	(0.0944)	(0.4145)	(0.2657)	(0.2187)
Father secondary education [d)]	-1.3597***	-0.9517**	-1.5062***	-1.4870***
	(0.1124)	(0.3841)	(0.4276)	(0.3348)
Mother middle/secondary education [d)]	-0.7022***	-0.3304	-2.5149**	-1.0231**
	(0.1780)	(0.5505)	(1.0440)	(0.4375)

Mother absent [d)]	0.3265***	0.6435**	-0.0951	0.6552***
	(0.1261)	(0.3129)	(0.3072)	(0.2142)
Father absent [d)]	-0.6691***	-0.8021**	-0.1138	-0.5581**
	(0.1378)	(0.3694)	(0.3388)	(0.2603)
Household characteristics:				
Household size	0.1585***	0.2162**	0.0920	0.2143***
	(0.0338)	(0.0889)	(0.0898)	(0.0666)
Number of males 60+	0.0378	0.1787	0.0369	0.2542
	(0.0749)	(0.2035)	(0.1905)	(0.1564)
Number of females 60+	-0.3456***	-0.3231	-0.0886	-0.3773**
	(0.0801)	(0.1993)	(0.1768)	(0.1648)
Number of females 15-59	-0.2468***	-0.2283*	-0.3273**	-0.3508***
	(0.0554)	(0.1355)	(0.1326)	(0.1005)
Number of males 0-3	-0.0727	0.1815	0.1286	0.1881
	(0.0592)	(0.1681)	(0.1678)	(0.1217)
Number of females 0-3	0.0095	0.0297	0.1648	-0.1564
	(0.0589)	(0.1613)	(0.1624)	(0.1289)
Number of males 4-6	-0.1007*	-0.1255	0.1710	-0.2610**
	(0.0559)	(0.1533)	(0.1581)	(0.1194)
Number of females 4-6	-0.1494**	-0.2698*	0.1738	-0.2027*
	(0.0585)	(0.1535)	(0.1417)	(0.1144)
Number of males 7-14	0.0049	-0.1166	-0.1280	0.0049
	(0.0455)	(0.1213)	(0.1156)	(0.0927)
Number of females 7-14	-0.2093***	-0.1578	-0.1127	-0.1425*
	(0.0451)	(0.1117)	(0.1109)	(0.0860)
Female household head [d)]	0.2949*	0.4709	0.1957	0.8541***
	(0.1507)	(0.3820)	(0.3869)	(0.2595)
Village characteristics:				
Bank/coop in village [d)]	-0.1032	-0.3282	-0.2396	-0.0804
	(0.0645)	(0.2127)	(0.1658)	(0.1294)
No anganwandi in village [d)]	0.1504***	0.1408	-0.1517	0.0124
	(0.0550)	(0.1515)	(0.1364)	(0.1042)
N	19318			
Pseudo-R^2	0.2016			

Note: Primary occupation category ”school” is the comparison group. Standard errors are adjusted for clustering by household and in parentheses. Coefficients with the superscript *** are significant at the 1% level, **are significant at the 5% level, *are significant at the 10% level. The superscript (+) indicates that the variable is a non-simultaneous instrumental variable, and that the standard errors are not strictly accurate. The superscript d) indicates a dummy variable. Control variables for religion, ethnicity and state as well as an intercept are included, but the results are not reported here.

Table 6: Multinomial logit estimation of girls' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-1.3007***	-1.4405***	-1.2103***	-2.1059***
	(0.1159)	(0.1583)	(0.2416)	(0.2648)
Household owns land[d)]	-0.0586	-0.0490	-0.1313	-0.4529**
	(0.0775)	(0.1081)	(0.1803)	(0.1760)
Household owns 15 to 29 acres of land[d)]	0.1697*	0.2719**	0.1648	0.1339
	(0.0872)	(0.1222)	(0.2111)	(0.2034)
Household owns 30 to 59 acres of land[d)]	0.2239**	0.2971**	0.3330*	-0.2229
	(0.0877)	(0.1218)	(0.1983)	(0.2200)
Household owns 60 or more acres of land[d)]	0.3349***	0.3493***	0.6046***	-0.5489*
	(0.0995)	(0.1336)	(0.2197)	(0.2871)
Household leases in land [d)]	0.2309**	0.1923	0.4844**	0.0703
	(0.0934)	(0.1270)	(0.2132)	(0.2245)
Household owns productive assets [d)]	-0.1455*	-0.3346***	-0.0161	-0.1411
	(0.0803)	(0.1068)	(0.2041)	(0.2101)
Index of productive assets	-0.0148*	0.0233**	-0.0035	0.0105
	(0.0081)	(0.0100)	(0.0249)	(0.0278)
School availability:				
No primary school in village [d)]	0.0437	0.0656	-0.0443	-0.0993
	(0.0816)	(0.1192)	(0.2247)	(0.2371)
No middle school w/in 2km [d)]	0.1449**	-0.0266	-0.1549	-0.1429
	(0.0632)	(0.0861)	(0.1433)	(0.1432)
No high school w/in 4km [d)]	0.1184*	0.1482	0.1448	0.2293
	(0.0701)	(0.0952)	(0.1608)	(0.1544)
Child characteristics:				
Child's age	-0.0670***	0.4691***	0.4248***	0.5107***
	(0.0135)	(0.0192)	(0.0311)	(0.0323)
Birth order	0.0501	0.0002	-0.0257	-0.1784**
	(0.0319)	(0.0468)	(0.0927)	(0.0803)
Child of the household head [d)]	0.0166	0.1414	0.4723**	0.4461*
	(0.0823)	(0.1210)	(0.2155)	(0.2344)
Parental characteristics:				
Father primary education [d)]	-0.7850***	-0.6048***	-0.7309***	-0.6789***
	(0.0633)	(0.0851)	(0.1361)	(0.1343)
Mother primary education [d)]	-1.0356***	-0.8613***	-0.8847***	-0.7946***
	(0.0989)	(0.1376)	(0.2005)	(0.2220)
Father middle education[d)]	-0.9904***	-0.9820***	-0.8900***	-1.5579***
	(0.0894)	(0.1356)	(0.2087)	(0.3139)
Father secondary education [d)]	-1.4412***	-1.1272***	-1.7944***	-1.0028***
	(0.1108)	(0.1637)	(0.3804)	(0.3662)
Mother middle/secondary education [d)]	-1.1486***	-1.5647***	-1.6866***	-2.2263***
	(0.1756)	(0.3039)	(0.6315)	(0.7245)

Mother absent [d)]	0.2037	1.0181***	0.8144***	0.6315**
	(0.1349)	(0.1526)	(0.2701)	(0.2738)
Father absent [d)]	-1.0552***	-0.6535***	-0.4157	-0.6066**
	(0.1391)	(0.1781)	(0.2881)	(0.2907)
Household characteristics:				
Household size	0.1658***	0.1585***	0.0689	0.2891***
	(0.0351)	(0.0471)	(0.0820)	(0.0767)
Number of males 60+	-0.0658	-0.0580	0.0726	0.1880
	(0.0773)	(0.1051)	(0.1822)	(0.1841)
Number of females 60+	-0.3042***	-0.1945*	-0.0089	-0.5285***
	(0.0781)	(0.1089)	(0.1806)	(0.1946)
Number of females 15-59	-0.1749***	-0.1840**	-0.1609	-0.3042**
	(0.0545)	(0.0749)	(0.1204)	(0.1204)
Number of males 0-3	0.0770	0.0558	0.2385*	0.0486
	(0.0604)	(0.0849)	(0.1412)	(0.1336)
Number of females 0-3	-0.0398	0.0685	0.1610	-0.0346
	(0.0595)	(0.0833)	(0.1377)	(0.1423)
Number of males 4-6	-0.0124	-0.0128	-0.1783	-0.1495
	(0.0549)	(0.0853)	(0.1447)	(0.1315)
Number of females 4-6	-0.0267	-0.0334	0.1170	-0.1736
	(0.0564)	(0.0821)	(0.1345)	(0.1454)
Number of males 7-14	-0.0368	-0.0605	-0.0333	-0.0734
	(0.0451)	(0.0604)	(0.1061)	(0.1012)
Number of females 7-14	-0.1176**	-0.0818	0.0507	-0.0237
	(0.0463)	(0.0586)	(0.1053)	(0.0982)
Female household head [d)]	0.0350	-0.0531	-0.1653	0.1810
	(0.1607)	(0.2115)	(0.3366)	(0.2924)
Village characteristics:				
Bank/coop in village [d)]	-0.1768***	-0.0895	-0.0954	-0.1724
	(0.0657)	(0.0936)	(0.1545)	(0.1622)
No anganwandi in village [d)]	0.2444***	0.1334*	0.0549	0.1753
	(0.0561)	(0.0787)	(0.1224)	(0.1242)
N	17325			
Pseudo-R^2	0.2515			

Note: Primary occupation category "school" is the comparison group. Standard errors are adjusted for clustering by household and in parentheses. Coefficients with the superscript *** are significant at the 1% level, **are significant at the 5% level, *are significant at the 10% level. The superscript (+) indicates that the variable is a non-simultaneous instrumental variable, and that the standard errors are not strictly accurate. The superscript d) indicates a dummy variable. Control variables for religion, ethnicity and state as well as an intercept are included, but the results are not reported here.

Turning to the land variables, we see that the wealth paradox exists for boys participating in family work, and that the relationship between the amount of land owned by the household and family work is positive and nonlinear for both boys and girls. As discussed above, market imperfections will influence the relationship between land holdings and child family labor in two ways. If the credit market is imperfect, then increased land holdings are expected to decrease the incidence of child family labor. The opposite is true in the presence of land and labor market imperfections. Therefore, the observation that land has a significantly positive effect on child participation in family work indicates that the land and labor markets are imperfect. We cannot conclude, however, that the credit market is perfect; it could be the case that the effect of the credit market imperfection is overwhelmed by the incentive created by the land and labor market imperfection.

Boys are significantly less likely to be idle in households that own land, while the effect of owning land on participation in non-family work is significantly negative in the case of girls. Similarly, there is a significant and negative relationship between the amount of land owned by the household and participation in non-family work. This may indicate a credit market imperfection, but may also reflect income effects of land if our measure of household income does not fully capture these effects. The relationship between the amount of land owned by the household and child idleness is positive and nonlinear for girls.

When the household leases in land, girls are significantly more likely to be idle, and both boys and girls are significantly more likely to participation in family work. This would seem to indicate that households that lease in land do so taking into account that they can employ the child on the land. Finally, the land variables have no effect on the participation of boys in domestic work.

Children in households that own productive assets are significantly less likely to be idle or participate in domestic work, and boys in these households are less likely to participate in family work. The amount of productive assets owned is significantly negatively related to child idleness, while it is positively and significantly related to girls' participation in domestic work. Clearly, productive assets do not exhibit the same effect as land on family labor. This may be due to a smaller substitution effect of productive assets than land. If the productive assets require more skills to operate, then child labor might not be a viable substitute for adult labor. In this case, credit market imperfections

compelling poverty.

may dominate.

5.2 School availability

There is a positive and significant relationship between child idleness and the absence of a middle school within 2 km of the village, and girls are more likely to be idle if there is no high school within 4 km of the village. The absence of a primary school in the village is positively and significantly related to boys' participation in non-family work, while the absence of a middle school is negatively and significantly related to boys' participation in non-family work. While the first result is reasonable, the second result is counter-intuitive, and may indicate that the distance to middle school is not a significant obstacle to school attendance, and that this variable is capturing other village level effects.

5.3 Child characteristics

The relationship between age and child participation in any form of work is significant and positive, while it is significant and negative for child idleness. These results are in line with human capital theory. Birth order is significant in the case of idle boys and children participating in non-family work. In the former case the relationship is positive, while in the latter it is negative. Finally, the dummy variable indicating the child of the household head is significant and positive for girls participating in family work and children participating in non-family work. This may reflect that the household head is more likely to control the income generated from the labor of their own children rather than other children, in which case the incentive to send their own children to work is stronger.[19]

5.4 Parental characteristics

The educational attainment of both fathers and mothers exhibits a significantly negative relationship to participation in all forms of non-school activity, with the only exception being mothers with middle/secondary education in the case of boys' participation in domestic work. This lends support to the hypothesis that educated parents have a stronger preference for schooling.

An absent mother is significantly and positively related to participation in all forms of non-school activity with the exception of idle girls and boys

[19] This interpretation is similar to the results in Basu and Ray (2001), where preference heterogeneity and greater inequality in relative bargaining power between parents increases child labor.

participating in family work, where the effect is zero. This could indicate that child labor acts as a substitute for female labor in these cases. An absent father is negatively related to participation in all forms of non-school activity, but is not significant in the case of family work. This may indicate that absent fathers are primarily migrant workers, sending money home to facilitate their children's school attendance.

5.5 Household characteristics

Children from larger households are more likely to participate in any form of non-school activity, although the effect is not significant in the case family work. This may be due to the fact that, in the case of family labor, the marginal product of child labor is decreasing in the number of family members employed in the family enterprise, and as such the incentive to employ children is diminished as household size increases.

The variables measuring household composition (with the number of adult males in the household as the base category) indicate that an increase in the number of females in the household decreases the likelihood that the child participates in some form of non-school activity. These results are particularly strong in regards to the number of adult females and females over age 60 (with the exception of girls participating in family work). Therefore, children that come from households with a high proportion of adult women are more likely to attend school. This could indicate that female labor is a stronger substitute for child labor, or that adult females have a higher preference for child schooling than males.

Finally, boys from households headed by a female are significantly more likely to be idle or participate in non-family work than to attend school.

5.6 Village characteristics

The measure intended to capture access to credit markets, the presence of a bank or cooperative in the village, is negatively related to participation in all non-school activity but is only significant in the case of idle girls. The coefficient on the variable measuring the absence of an anganwandi in the village is positive and significant in the case of idle children and girls participating in domestic work. This suggests that the availability of child care does not affect the decision to send children to directly income-generating work rather than school.

5.7 Marginal effects

Table A1 and table A2 in Appendix 2 present the marginal effects from the multinomial logit regressions on estimated probabilities for participation in primary occupation categories for boys and girls, respectively. The results are straightforward except in the case of income, which is in logs, and the dummy variables. As a result, the effect of a 10% change in household income can be read directly from the tables, while the marginal effect of a dummy variable is for a discrete change from 0 to 1.

The results indicate that household income and parental education levels have relatively large marginal effects on all estimated participation probabilities. Further, the marginal effects of land ownership and the leasing of land by the household are large in the case of boys' family work participation. The marginal effects of absent parents (particularly mothers) is large in most cases, though less so in the case of non-family work.

5.8 Are idle children really idle?

The results presented in table 5 and table 6 indicate that many of the factors that affect child participation in family work are also significant in the case of idle children, particularly the amount of land owned by the household. This may indicate that many of the children classified as idle are in fact participating in family work. In some instances, these children may be working less than half the year (in which case family work would not be considered their main occupation), while in others it may be a reporting error. Further, children are significantly more likely to be idle if there is no anganwandi present in the village, which indicates that many of these children may be taking care of younger siblings.

The empirical analysis has not included measures of the quality or the direct cost of schooling due to data limitations. There is evidence, however, that parents may refrain from sending their children to school if the quality of the school is low and/or if the direct costs of schooling are high (see Leclercq (2001) and Drèze and Kingdon (2001), for example). When schooling is not a viable option, it is reasonable to believe that some parents will have their children participate in some form of work rather than do nothing at all. In this case, it may be more likely that the children work less than half the year, in which case work would not be considered their main occupation. The fact that many of the children classified as idle in our sample may in fact be working lends support to the liberal definition of child labor presented in

Jayaraj and Subramanian (2005), where all children who are not attending school are considered to be working.[20]

5.9 Previous results

Both Duraisamy (2000) and Leclercq (2002) have used the same NCAER data set to examine child labor in rural India. Our results are not directly comparable, however, for a number of reasons. Leclercq focuses on North India only, and limits his sample to children aged 10-14, while Duraisamy's sample includes children aged 5-19. Neither author distinguishes between the types of work that children participate in, and both use the idle category as their comparison group. This last point may be particularly problematic, as many of these children may in fact be working.

With these caveats in mind, both Duraisamy and Leclercq find that parental education is a significant determinant of child labor versus schooling. Further, both find a significant negative relationship between measures of household income (unistrumented in Duraisamy's case) and child labor. Leclercq finds strong evidence that child labor, especially in the case of girls, is a substitute for adult female work, while land (measured per capita) is only significant in the case of girls' school attendance. That Leclercq does not find a significant effect of land on participation in work may depend on the fact that idle children are the comparison group, and that he places all working children in one category.

6 Conclusions

When looking at the factors that influence whether or not a child participates in labor, it would appear that household income and parental education play the largest role. Household income has a significant positive effect on school attendance and a significant negative effect on all non-school activities, which indicates that policies directed at raising household income should increase school attendance. Therefore, it may be possible to increase school attendance in the short- to medium-run through means of income redistribution. However, theoretical models have shown that the results of income redistribution on school attendance are ambiguous and depend on the mean income level of the economy (Swinnerton and Rogers, 1999; Rogers and Swinnerton, 2001; Ranjan, 2001). As a result, macroeconomic growth strategies that raise the level of income of the entire society are likely the best long-run policies

[20] For our purposes, the liberal definition of child labor is impractical as we cannot meaningfully allocate idle children between the different types of work analyzed in this paper.

for reducing child labor via household income.

The relatively large negative marginal effects of parental education on all non-school activities indicate that educated parents have a greater preference for sending their children to school. This in turn indicates that increased access to education may be a more effective long term means of reducing child labor and increasing school attendance than either income or land redistribution. The fact that the marginal effects of mothers' education is at times larger than the marginal effects of fathers' education lends further support to the idea that reducing the gender inequality in school attendance may have significant long term results in reducing child labor and increasing school attendance. Indeed, education appears to have a dynastic effect, where educational attainment leads to a virtuous circle, while the lack of education could lead to a poverty trap. Therefore, policies aimed at improving the quality and accessibility of schools may be the most successful in eliminating child labor in the long run.

In terms of the effect of market imperfections on child labor, it would appear that land and labor market imperfections dominate credit market imperfections in the case of family work. This in turn has implications for policy. One implication is that land redistribution will not necessarily work in the same manner as income distribution with respect to child labor. Therefore, policies aimed at improving the functioning of land and labor markets may be desirable. Further, the results may indicate that returns to family work experience outweigh returns to schooling, at least over a range of land holdings. This suggests that one way to reduce child family labor is to improve the quality of schools. This would also likely reduce the number of idle children significantly. School availability seems to have the most significant impact on idle children. Therefore, policies that aim to improve access to schooling may not have an immediate impact on reducing child labor, as they may instead draw children primarily from the pool of idle children. As there are significantly more idle girls than boys, this may help to close the gender gap. Further, as there are significantly more idle children than working children, policies that effect idle children may have the greatest impact on school attendance.

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Appendix 1

Proof of proposition 2. From (12) and (13) it is clear that a smaller value of λ_1 will decrease the likelihood that these equations hold with equality. Conversely, a small value of λ_1 will increase the likelihood that (14) holds with equality. We know from (15) that $\lambda_1 = W\delta\left(\frac{\partial U_2}{\partial X_2}\right)$. Therefore, we want to find $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, holding the credit market effects of land constant. First, substitute (2a) - (2c) and (3) into (4); then substitute (4) into (6a) or (6b). This allows us to calculate the effect of land on X_2, which in turn allows us to calculate the effect of an increase in land on λ_1. Making these substitutions, the income effect of land can be expressed as:

$$\left(\frac{\partial \lambda_1}{\partial A_o}\right) = W\delta\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\left(\left(\frac{\partial Y_2}{\partial A_o}\right) + \left(\frac{\partial Y_1}{\partial A_o}\right) g\left(\bullet\right)\right)$$

where W and $g\left(\bullet\right)$ are credit market effects that are held constant. All of the partial derivatives in this expression are positive, with the exception of $\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)$, which is negative (this follows from our assumption that the utility function is concave in X_2). Therefore, the entire expression is negative, i.e. an increase in land has the effect of lowering λ_1. ■

Proof of proposition 3. From (12) and (13) it is clear that a smaller value of λ_1 will decrease the likelihood that these equations hold with equality. Conversely, a small value of λ_1 will increase the likelihood that (14) holds with equality.

From (15) we can express λ_1 as $\lambda_1 = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g\left(\omega_1, A_o; Z\right)\right)\delta\left(\frac{\partial U_2}{\partial X_2}\right)$. Therefore, we want to find $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, holding the income effects of land constant. As with Proposition 2, we can substitute (2a) - (2c) and (3) into (4) and then substitute (4) into (6b). Further, we substitute (4) into our above expression for λ_1. Making these substitutions, the credit market effect of land can be expressed as:

$$\begin{aligned}\left(\frac{\partial \lambda_1}{\partial A_o}\right) = {} & W\delta\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\omega_1\left[\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \left(\frac{\partial g}{\partial A_o}\right)\right] \\ & + \left[2\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \omega_1\left(\frac{\partial^2 g}{\partial \omega_1^2}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \left(\frac{\partial g}{\partial A_o}\right)\right]\delta\left(\frac{\partial U_2}{\partial X_2}\right).\end{aligned} \qquad (*)$$

When the household borrows, $\omega_1 < 0$ and the rate of interest the household must pay on the debt is negatively related to both the size of the debt and the amount of land the household can offer as collateral, i.e. $\left(\frac{\partial g}{\partial \omega_1}\right) < 0$ and $\left(\frac{\partial g}{\partial Ao}\right) < 0$. Further, the interest rate paid on the loan falls more slowly as the the size of the loan decreases, i.e. $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) > 0$. Therefore, it is clear that the entire expression is negative, and that an increase in land holding leads to a smaller value of λ_1, thus decrease the likelihood that children from households with large holdings of land participate in work while increasing the likelihood

that these same children attend school. ■

Proof of proposition 4. As in Proposition 3 above, we are interested in $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, where λ_1 can be expressed as $\lambda_1 = \left(\omega_1\left(\frac{\partial g}{\partial \omega_1}\right) + g(\omega_1)\right)\delta\left(\frac{\partial U_2}{\partial X_2}\right)$. Again, we can substitute (2a) - (2c) and (3) into (4) and then substitute (4) into (6a). Finally, we substitute (4) into our above expression for λ_1. Making these substitutions, the credit market effect of land can now be expressed as:

$$\left(\frac{\partial \lambda_1}{\partial A_o}\right) = W\delta\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\omega_1\left[\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right)\right] + \left[2\left(\frac{\partial g}{\partial \omega_1}\right)\left(\frac{\partial Y_1}{\partial A_o}\right) + \omega_1\left(\frac{\partial^2 g}{\partial \omega_1^2}\right)\left(\frac{\partial Y_1}{\partial A_o}\right)\right]\delta\left(\frac{\partial U_2}{\partial X_2}\right) \quad (**)$$

When the household saves, $\omega_1 > 0$ and the rate of interest the household receives is positively related to the amount of of wealth saved, i.e. $\left(\frac{\partial g}{\partial \omega_1}\right) > 0$ and land has no effect on the interest rate, i.e. $\left(\frac{\partial g}{\partial Ao}\right) = 0$. Further, the interest rate paid on savings rises more slowly as the amount saved increases, i.e. $\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) < 0$. Clearly, the first term in (**) is negative, as $\left(\frac{\partial^2 U_2}{\partial X_2^2}\right) < 0$. Further, this term is smaller than the first term in (*) by $\left(\frac{\partial g}{\partial A_o}\right)$. The sign of the first term is ambiguous, and depends on whether $2\left(\frac{\partial g}{\partial \omega_1}\right) + \omega_1\left(\frac{\partial^2 g}{\partial \omega_1^2}\right) \gtreqless 0$. Due to the concave nature of $g(\omega_1)$, we know that $0 < \left(\frac{\partial g}{\partial \omega_1}\right) < 1$, which in turn implies that $2\left(\frac{\partial g}{\partial \omega_1}\right) < 2$. Therefore, if $\omega_1 < 2\left(\frac{\partial^2 g}{\partial \omega_1^2}\right)^{-1}$, then the second term of the expression is positive; otherwise, the second term is negative. When the second term in (**) is negative, it is smaller than the second term in (*) by $2\left(\frac{\partial g}{\partial \omega_1}\right) + \left(\frac{\partial g}{\partial A_o}\right)$.

In the case where the second term in (**) is positive, the entire expression will still be negative if the first term is larger than the second term. ■

Appendix 2

Table A1: Marginal effects after multinomial logit on estimated probabilities of boys' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-0.0787	-0.0067	-0.0044	-0.0141
Household owns land[d)]	-0.0202	0.00002	0.0037	-0.0013
Household owns 15 to 29 acres of land[d)]	0.0031	0.0001	0.0016	-0.0028
Household owns 30 to 59 acres of land[d)]	0.0122	-0.0006	0.0038	-0.0025
Household owns 60 or more acres of land[d)]	0.0248	0.0006	0.0065	-0.0057
Household leases in land [d)]	0.0039	-0.0013	0.0042	-0.0029
Household owns productive assets [d)]	-0.0255	-0.0031	-0.0021	-0.0019
Index of productive assets	-0.0016	0.00003	0.0001	-0.0001
School availability:				
No primary school in village [d)]	0.0098	-0.0009	0.0007	0.0050
No middle school w/in 2km [d)]	0.0133	-0.0007	-0.0004	-0.0023
No high school w/in 4km [d)]	0.0049	0.0006	-0.0001	0.00001
Child characteristics:				
Child's age	-0.0093	0.0022	0.0025	0.0051
Birth order	0.0087	-0.0003	0.00001	-0.0016
Child of the household head [d)]	-0.0082	0.0003	0.0011	0.0046
Parental characteristics:				
Father primary education [d)]	-0.0848	-0.0038	-0.0027	-0.0055
Mother primary education [d)]	-0.0916	-0.0043	-0.0020	-0.0055
Father middle education[d)]	-0.0865	-0.0081	-0.0036	-0.0084
Father secondary education [d)]	-0.1015	-0.0051	-0.0046	-0.0099
Mother middle/secondary education [d)]	-0.0585	-0.0018	-0.0058	-0.0073
Mother absent [d)]	0.0363	0.0063	-0.0007	0.0087
Father absent [d)]	-0.0559	-0.0044	-0.0002	-0.0043
Household characteristics:				
Household size	0.0035	0.0014	0.0001	0.0027
Number of males 60+	-0.0357	-0.0022	-0.0002	-0.0036
Number of females 60+	-0.0252	-0.0016	-0.0015	-0.0034
Number of females 15-59	-0.0082	0.0015	0.0007	0.0021
Number of males 0-3	0.0011	0.0002	0.0008	-0.0017
Number of females 0-3	-0.0103	-0.0009	0.0009	-0.0027
Number of males 4-6	-0.0154	-0.0020	0.0010	-0.0020
Number of females 4-6	0.0007	-0.0009	-0.0006	0.0001
Number of males 7-14	-0.0217	-0.0011	-0.0004	-0.0013
Number of females 7-14	0.0316	0.0041	0.0007	0.0129

Female household head [d)]	0.0035	0.0014	0.0001	0.0027
Village characteristics:				
Bank/coop in village [d)]	-0.0102	-0.0023	-0.0011	-0.0007
No anganwandi in village [d)]	0.0158	0.0010	-0.0009	-0.0001

Note: The superscript d) indicates a dummy variable, and in these cases the marginal effect is for a discrete change from 0 to 1. The marginal effects are calculated at the mean of each variable for each regression.

Table A2: Marginal effects after multinomial logit on estimated probabilities of girls' participation in primary occupation categories.

	Dependent variable: Primary occupation category			
Household income, land and productive assets:	*Idle*	*Domestic work*	*Family work*	*Non-family work*
ln(household income)[(+)]	-0.1713	-0.0576	-0.0101	-0.0143
Household owns land[d)]	-0.0072	-0.0016	-0.0013	-0.0038
Household owns 15 to 29 acres of land[d)]	0.0222	0.0126	0.0014	0.0007
Household owns 30 to 59 acres of land[d)]	0.0305	0.0133	0.0034	-0.0021
Household owns 60 or more acres of land[d)]	0.0473	0.0148	0.0071	-0.0043
Household leases in land [d)]	0.0323	0.0072	0.0059	0.0001
Household owns productive assets [d)]	-0.0179	-0.0146	0.0003	-0.0008
Index of productive assets	-0.0024	0.0013	0.00002	0.0001
School availability:				
No primary school in village [d)]	0.0061	0.0030	-0.0006	-0.0008
No middle school w/in 2km [d)]	0.0224	-0.0025	-0.0020	-0.0013
No high school w/in 4km [d)]	0.0155	0.0062	0.0013	0.0017
Child characteristics:				
Child's age	-0.0158	0.0234	0.0047	0.0040
Birth order	0.0076	-0.0004	-0.0004	-0.0015
Child of the household head [d)]	-0.0003	0.0062	0.0047	0.0031
Parental characteristics:				
Father primary education [d)]	-0.0957	-0.0207	-0.0058	-0.0037
Mother primary education [d)]	-0.1149	-0.0281	-0.0064	-0.0040
Father middle education[d)]	-0.1073	-0.0313	-0.0063	-0.0071
Father secondary education [d)]	-0.1460	-0.0344	-0.0114	-0.0047
Mother middle/secondary education [d)]	-0.1158	-0.0431	-0.0101	-0.0083
Mother absent [d)]	0.0116	0.0711	0.0109	0.0050
Father absent [d)]	-0.1103	-0.0206	-0.0026	-0.0029
Household characteristics:				
Household size	0.0222	0.0061	0.0003	0.0020
Number of males 60+	-0.0095	-0.0024	0.0010	0.0016

Number of females 60+	-0.0419	-0.0066	0.0007	-0.0037
Number of females 15-59	-0.0231	-0.0073	-0.0013	-0.0021
Number of males 0-3	0.0102	0.0019	0.0025	0.0002
Number of females 0-3	-0.0067	0.0037	0.0019	-0.0003
Number of males 4-6	-0.0011	-0.0004	-0.0020	-0.0012
Number of females 4-6	-0.0036	-0.0014	0.0014	-0.0013
Number of males 7-14	-0.0046	-0.0026	-0.0003	-0.0005
Number of females 7-14	-0.0165	-0.0030	0.0009	0.00001
Female household head [d)]	0.0057	-0.0029	-0.0018	0.0016
Village characteristics:				
Bank/coop in village [d)]	-0.0238	-0.0027	-0.0007	-0.0010
No anganwandi in village [d)]	0.0342	0.0042	0.00003	0.0010

Note: The superscript d) indicates a dummy variable, and in these cases the marginal effect is for a discrete change from 0 to 1. The marginal effects are calculated at the mean of each variable for each regression.