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The Wealth Paradox Revisited: Credit Market Imperfections and Child Labor

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Abstract

We revisit the model of child labor in a peasant household presented in Bhalotra and Heady (2003), and demonstrate that the effect of credit market imperfections on child labor differs between households that save and households that borrow. This in turn is important for the interpretation of empirical results.

Key words: Child labor, credit market imperfections, wealth paradox

JEL Classification: J22; J13; D13; O12

1 Introduction

The International Labor Organization estimates that 191 million children aged five to fourteen participated in some form of work in 2004. The vast majority of these children, 69 percent, were employed in the agricultural sector (Hagemann et al, 2006). Further, very few children work outside of the home but are rather employed on the family farm or enterprise (Edmonds and Pavcnik, 2005). Therefore, the amount of land a household owns can be expected to play a role in the decision to send a child to work. Bhalotra and Heady (2003) use the term "the wealth paradox" to describe the fact that child labor is more common in land-rich households than in land-poor households. Land is often an input in production and as such should generate income for the household, which in turn should act to lower the incidence of child labor. They explain the apparent paradox by means of land and labor market imperfections, which increase the marginal product of child labor as land holdings increase, providing a greater incentive to employ child labor. They refer to this as the substitution effect of land. If the substitution effect outweighs the income effect, then child labor will increase with an increase in land holdings.

Bhalotra and Heady further argue that credit market imperfections will act to mitigate the wealth paradox: when credit markets are imperfect, an increase in land holdings will decrease the likelihood of child labor. We will argue that following their assumptions, this is only unambiguously true in the case when the household borrows; when households save, credit market imperfections may increase the likelihood that children from land-rich households work, adding a further dimension to the wealth paradox. The analysis shows that the effect of credit market imperfections on child labor when households borrow or save is not symmetrical. This has important implications for the interpretation of econometric results regarding the effect of land on the incidence of child labor, as it has currently not been possible to empirically separate the credit market effects from the substitutions effects of land.

The remainder of the paper is structured as follows. Section 2 describes the theoretical model of a peasant household specified by Bhalotra and Heady (2003). Section 3 derives the credit market effect of land on child labor, and demonstrates how this effect is ambiguous when households save. We also examine the possibility that there is no credit market effect of land when households save. Section 4 concludes the paper.

2 The theoretical model

The markets for land, labor and credit are all assumed to be imperfect. Each household contains one parent and one child. The parent decides how the child's time is allocated, and households do not hire out labor. The parent produces output in each period using their own labor, owned and rented land, hired labor and potentially their child's labor as inputs. The child may also attend school in the first period.

First period household income, Y_1, is a function of the household production function as follows:

$$Y_1 = f_1\left(A_o, A_{r1}, L_{p1}, L_{c1}, L_{h1}\right) - w_{h1}L_{h1} - p_{r1}A_{r1} \tag{1}$$

where A_o and A_r are owned and rented land, L_p, L_{c1} and L_h are parent, child and hired labor, w_h is the wage paid to hired labor and p_r is the price of rented land. There are decreasing marginal returns to all inputs, and land and labor enter the production function multiplicatively.

In the second period the child may or may not continue to live in the 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. Second period household income is given by:

$$Y_2 = f_2\left(A_o, A_{r2}, L_{p2}, L_{h2}\right) + w_{c2}\left(S, L_{c1}\right) L_{c2} - w_{h2} L_{h2} - p_{r2} A_{r2}. \quad (2)$$

w_{c2} is not necessarily an explicit wage; it may be the marginal product of the child's own farm labor. The child's second period wage is a function of its labor supply and schooling in the first period, allowing for a dynamic effect of first period time allocation on second period wage.

2.1 The credit market

The household can either save or borrow in the first period, so that first period consumption is not bound by first period income. The household is assumed to inherit some initial financial wealth from period zero. First period net financial wealth, K_1, is thus given by:

$$K_1 = K_0 + Y_1 - X_1 - C\left(S\right) \quad (3)$$

where $K_0 \gtreqless 0$ is initial financial wealth, $C\left(S\right)$ is the cost of schooling, and X_1 is first period consumption (the price of which is normalized to unity).

The critical assumption in Bhalotra and Heady (2003) that is central to our analysis is as follows: When the credit market is imperfect the interest rate, r, available to the household becomes a function of wealth (Bhalotra and Heady, 2003, p224). Hence, second period financial wealth is a function of both first period wealth and the interest rate. If $K_1 < 0$, 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. Bhalotra and Heady claim that collateral will most likely take the form of owned land, A_o, making the interest rate a function of A_o, Z and K_1 when the household takes a loan. Consequently, second period net financial wealth is given by:

$$K_2 = Y_2 - X_2 + K_1\left(1 + r\left(K_1, A_o; Z\right)\right) \quad (4)$$

yielding the second period budget constraint:

$$X_2 = Y_2 + K_1\left(g\left(K_1, A_o; Z\right)\right). \quad (5)$$

We assume that $\left(\frac{\partial g}{\partial K_1}\right) > 0$, $\left(\frac{\partial^2 g}{\partial K_1^2}\right) < 0$ and $\left(\frac{\partial g}{\partial A_o}\right) = 0$ when the household saves and that $\left(\frac{\partial g}{\partial K_1}\right) < 0$, $\left(\frac{\partial^2 g}{\partial K_1^2}\right) > 0$ and $\left(\frac{\partial g}{\partial A_o}\right) < 0$ when the household borrows.

2.2 Utility maximization

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

$$U = U_1 (X_1, L_{p1}, L_{c1}, S) + U_2 (X_2, L_{p2}, L_{c2}) \tag{6}$$

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. Thus, the parent is faced with the following maximization problem:

$$\begin{aligned} \max\ U \ \text{ subject to } & K_1 - K_0 - f_1 (A_o, A_{r1}, L_{p1}, L_{c1}, L_{h1}) \\ & + w_{h1} L_{h1} + p_{r1} A_{r1} + X_1 + C(S) = 0 \ \text{ and} \\ & X_2 - f_2 (A_o, A_{r2}, L_{p2}, L_{h2}) - w_{c2} (S, L_{c1}) L_{c2} \\ & + w_{h2} L_{h2} + p_{r2} A_{r2} - K_1 g (K_1, A_o; Z) = 0. \end{aligned} \tag{7}$$

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

$$\frac{\partial \Gamma}{\partial X_1} = \left(\frac{\partial U_1}{\partial X_1}\right) - \lambda_1 = 0 \tag{8}$$

$$\frac{\partial \Gamma}{\partial X_2} = \left(\frac{\partial U_2}{\partial X_2}\right) - \lambda_2 = 0 \tag{9}$$

$$\frac{\partial \Gamma}{\partial K_1} = \left(K_1 \left(\frac{\partial g}{\partial K_1}\right) + g (K_1, A_o; Z)\right) \lambda_2 - \lambda_1 = 0 \tag{10}$$

$$\frac{\partial \Gamma}{\partial L_{cf1}} = \left(\frac{\partial U_1}{\partial L_{cf1}}\right) + \left(\frac{\partial f}{\partial L_{cf1}}\right) \lambda_1 + L_{c2} \left(\frac{\partial w_{c2}}{\partial L_{cf1}}\right) \lambda_2 \leq 0 \tag{11}$$

$$\frac{\partial \Gamma}{\partial S} = \left(\frac{\partial U_1}{\partial S}\right) - \left(\frac{\partial C}{\partial S}\right) \lambda_1 + L_{c2} \left(\frac{\partial w_{c2}}{\partial S}\right) \lambda_2 \leq 0. \tag{12}$$

When equation (11) holds with equality, the child will participate in family labor. Similarly, when equation (12) holds with equality the parent will send their child to school. The first order conditions also imply that

$$\lambda_1 = \left(\frac{\partial U_1}{\partial X_1}\right) = W \left(\frac{\partial U_2}{\partial X_2}\right) \tag{13}$$

and

$$\lambda_2 = \left(\frac{\partial U_2}{\partial X_2}\right) \tag{14}$$

where $W = \left(K_1\left(\frac{\partial g}{\partial K_1}\right) + g\left(K_1, A_o; Z\right)\right)$.

3 Discussion

The following propositions regarding the credit market effect of land can be derived from the above results:

Proposition 1 *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 work and more likely to attend school as land holdings increase.*

Proof. From (11) 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 (12) holds with equality.

From (13) we can express λ_1 as $\lambda_1 = \left(K_1\left(\frac{\partial g}{\partial K_1}\right) + g\left(K_1, A_o; Z\right)\right)\left(\frac{\partial U_2}{\partial X_2}\right)$. Therefore, we want to find $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, holding the direct income effects of land constant. First, substitute (1) into (3); then substitute (2) and (3) into (5). Further, we substitute (3) into our above expression for λ_1. Making these substitutions, the credit market effect of land can be expressed as:

$$\begin{aligned}\left(\frac{\partial \lambda_1}{\partial A_o}\right) &= W\left(\frac{\partial^2 U_2}{\partial X_2^2}\right) K_1\left[\left(\frac{\partial g}{\partial K_1}\right)\left(\frac{\partial f_1}{\partial A_o}\right) + \left(\frac{\partial g}{\partial A_o}\right)\right] \\ &+ \left[2\left(\frac{\partial g}{\partial K_1}\right)\left(\frac{\partial f_1}{\partial A_o}\right) + K_1\left(\frac{\partial^2 g}{\partial K_1^2}\right)\left(\frac{\partial f_1}{\partial A_o}\right) + \left(\frac{\partial g}{\partial A_o}\right)\right]\left(\frac{\partial U_2}{\partial X_2}\right).\end{aligned} \tag{*}$$

When the household borrows, $K_1 < 0$ 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. $\left(\frac{\partial g}{\partial K_1}\right) < 0$ 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. $\left(\frac{\partial^2 g}{\partial K_1^2}\right) > 0$. 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 decreasing the likelihood that children from households with large holdings of land work while increasing the likelihood that these same children attend school. ■

Proposition 2 *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 work and more likely to attend school as land holdings increase when first* *period wealth is sufficiently large, given that the interest rate on savings rises with the amount saved. 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. As in Proposition 1 above, we are interested in $\left(\frac{\partial \lambda_1}{\partial A_o}\right)$, where λ_1 can be expressed as $\lambda_1 = \left(K_1\left(\frac{\partial g}{\partial K_1}\right) + g\left(K_1, A_o; Z\right)\right)\left(\frac{\partial U_2}{\partial X_2}\right)$. Again, we can substitute (1) into (3); then substitute (2) and (3) into (5). Finally, we substitute (3) into our above expression for λ_1. Making these substitutions, the credit market effect of land can now be expressed as:

$$\left(\frac{\partial \lambda_1}{\partial A_o}\right) = W\left(\frac{\partial^2 U_2}{\partial X_2^2}\right) K_1\left[\left(\frac{\partial g}{\partial K_1}\right)\left(\frac{\partial f_1}{\partial A_o}\right)\right] + \left[2\left(\frac{\partial g}{\partial K_1}\right)\left(\frac{\partial f_1}{\partial A_o}\right) + K_1\left(\frac{\partial^2 g}{\partial K_1^2}\right)\left(\frac{\partial f_1}{\partial A_o}\right)\right]\left(\frac{\partial U_2}{\partial X_2}\right) \qquad (**)$$

When the household saves, $K_1 > 0$ and the rate of interest the household receives is positively related to the amount of of wealth saved, i.e. $\left(\frac{\partial g}{\partial K_1}\right) > 0$ and land has no direct 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. $\left(\frac{\partial^2 g}{\partial K_1^2}\right) < 0$. 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 second term is ambiguous, and depends on whether $2\left(\frac{\partial g}{\partial K_1}\right) + K_1\left(\frac{\partial^2 g}{\partial K_1^2}\right) \gtreqless 0$. The entire expression is positive when evaluated at $K_1 = 0$ (in which case $\left(\frac{\partial \lambda_1}{\partial A_o}\right) = 2\left(\frac{\partial g}{\partial K_1}\right)\left(\frac{\partial f_1}{\partial A_o}\right)\delta\left(\frac{\partial U_2}{\partial X_2}\right)$), but becomes smaller as K_1 increases. Beyond a critical level of K_1 ($= K_1^*$) the expression becomes negative. Therefore, when first period wealth is sufficiently small, i.e. $K_1 < K_1^*$, the expression is positive and the credit market imperfection acts to increase the likelihood that children work as land holdings increase. The critical level of wealth beyond which the expression is negative is:

$$K_1^* = \frac{-\left[g(K_1)\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\left(\frac{\partial g}{\partial K_1}\right) + \left(\frac{\partial^2 g}{\partial K_1^2}\right)\left(\frac{\partial U_2}{\partial X_2}\right)\right]}{2\left(\frac{\partial g}{\partial K_1}\right)^2\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)} \qquad (***)$$

$$\frac{-\left[\left(g(K_1)\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\left(\frac{\partial g}{\partial K_1}\right) + \left(\frac{\partial^2 g}{\partial K_1^2}\right)\left(\frac{\partial U_2}{\partial X_2}\right)\right)^2 - 8\left(\frac{\partial g}{\partial K_1}\right)^3\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)\left(\frac{\partial U_2}{\partial X_2}\right)\right]^{\frac{1}{2}}}{2\left(\frac{\partial g}{\partial K_1}\right)^2\left(\frac{\partial^2 U_2}{\partial X_2^2}\right)}.$$

Households with first period wealth greater than K_1^* will be less likely to send their children to work and more likely to send them to school as land holdings increase. ■

The credit market effect of land on child labor is only unambiguously negative in the case where the household borrows, as shown in Proposition 1. Proposition 2 demonstrates that there is a potential additional wealth paradox when households save and their first period wealth is sufficiently small; in this case, an increase in land will increase the likelihood of child labor. Therefore, the credit market effect will rather reinforce the substitution effect of land when households have small positive first period wealth. This in turn may contribute to the nonlinear relationship between land and child labor found in the empirical evidence presented in Bhalotra and Heady (2003).

It is also possible that the interest rate on savings does not vary with K_1, i.e. $\left(\frac{\partial g}{\partial K_1}\right) = 0$ when $K_1 > 0$. In this case, it is clear from Proposition 2 that there will be no credit effect of land on child labor when households save, meaning the credit market effect would only exist for households that borrow. This result would hold even if $\left(\frac{\partial g}{\partial K_1}\right) = 0$ when $K_1 < 0$ as well, given that $\left(\frac{\partial g}{\partial A_o}\right) < 0$ when $K_1 < 0$.Again, the effect of credit market imperfections on the incidence of child labor will differ depending on whether the household saves or borrows.

4 Conclusion

We have shown that the effect of credit market imperfections on the incidence of child labor is not the same when households borrow as when they save; in the extreme case the effects move in opposite directions. Even when credit market imperfections reduce child labor in households that save, this effect will be smaller than for households that borrow. Finally, we have shown that it is possible that credit market imperfections are only relevant in the child labor decision for households that borrow. All of these results are important for the interpretation of empirical results, as it has thus far not been possible to empirically separate the credit market effects of land from the substitution effect. Therefore, empirical research into the effect of land on child labor should distinguish between households that have net savings versus net borrowings in order to control for the asymmetrical effect of credit market imperfections in these cases.

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