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Child Labour, human capital formation and size of landholding: short run and long run analysis

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Abstract

This paper considers an overlapping generations model of a household economy in an agrarian set up to examine the short run as well as long run effects of increase in size of land holding on child labour, human capital formation and growth. It is assumed that each household consists of one adult and one child. The adult is employed outside agricultural sector and earns wage proportional to human capital and the child is employed in the land possessed by the household and also goes to school. The adult derives satisfaction from household consumption and human capital level of its child. Human capital accumulation of child depends on time devoted by child for schooling and financial resources invested towards education. The Parent maximizes her utility by making decision about consumption, educational investment for the child and time allocation of the child between schooling and work. It is found that in the short run, an increase in size of land holding leads to decrease in school attendance by children and increase in child labour. Moreover it is found that wage and human capital level of the parent positively influence human capital level of the child. In the long run, size of land holding shows U shaped relationship with both steady state level of human capital and growth rate of human capital.

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1. Introduction

Poverty is considered to be one of the main reasons behind child labour. Except in rare instances, parents are likely to send their children to work only if their income drops to a very low level. This is known as the 'Luxury Axiom.' There has been enough empirical evidence to support this view (Basu and Van 1998, Basu 1999a, Emerson and Souza 2003, Edmonds and Pavcnik 2005, Edmonds 2005, Rickey 2009).

However some recent evidences have challenged the hypothesis that child labour is caused by poverty. In any agrarian economy, size of landholding may be considered as proxy of wealth. Thus increase in land implies additional source of wealth for the household. It has been observed that children in land-rich households are often more likely to work than the children in land-poor households. This is known as the 'wealth paradox'. The reason is family based work[1]. This seems to cast doubt on the earlier hypothesis that child labour is caused by poverty. According to International Labour Organization's report (ILO 2013), the majority of child labourers (68.5%) are unpaid family members. In agriculture this percentage is higher and is combined with very early entry into work, sometimes between 5-7 years of age. So, the relationship among the size of land holding, child labour and human capital formation is worth considering as an important research problem. For controlling family based work of child labour in agricultural farms, for human capital formation and for enhancement of growth – should we increase or decrease the land ownership of labouring households? This paper attempts to answer this question theoretically.

A part of the research question posed in this paper has been addressed by multiple empirical works. Bhalotra and Heady (2003), in their study on developing countries – Ghana and Pakistan, show that as the amount of land possessed by the household increases, child labour in the household also increases. Moura (2009) derives a relationship between security of tenure on land and child labour. On the basis of empirical evidence from Brazil, Moura observes that with an increase in tenure security, child labour hours will fall and adult labour will rise. Using 1961 Census of India data, Rosenzweig and Evenson (1977) find that increase in land size is responsible for increase in marginal value product of children in land, decrease is school enrolment of children and increase in child labour. Boutin (2012)'s study shows that the demand for children helpers within the family increases to a certain threshold level with the rise in land ownership in Mali. The larger the land size, the lower the probability for a child to work away from the family farm. Dumas (2007) shows that due to the absence of hired adult labour market, child labour increases with increase in land size. However, none of these papers focused on the relationship between human capital formation of a child working on land, and land size.

Despite its importance, the relationship among land size, child labour and human capital formation of child working on land –has been explored by only a handful of theoretical studies. Bar and Basu (2008)theoretically examine the effect of an increase in

[1]Apart from family based agricultural work, studies of Basu (1999b), Rogers and Swinnerton (2004) challenge the "Luxury Axiom." Basu (1999b) shows that increase in adult wage does not decrease child labour if increase in adult wage is caused by Minimum Wage law. In a model with intergenerational transfer and two sided altruism, Rogers and Swinnerton (2004) show that in the presence of capital market imperfection, there is a possibility of non-monotonic relation between parental income and child labour depending on utility function of both adult and child.

household's land ownership on child labour and conclude that a small increase in land wealth can lead to more child labour not only in the short run but also in the long run. However, as soon as the land size goes above a critical level, child labour goes down in the long run, even though the immediate consequence could be that of an increased child labour. The inverted U-shaped relationship between the size of land holdings and child labour is supported by Basu, Das and Dutta (2007), who used a model where child leisure appears in the adult utility function and labour leisure choice of child is made by the parent. Then the results of their model have been empirically verified using a data set from India. This study reveals that the turning point beyond which increase inland size leads to a decline in child labour occurs at 3.6 acres of land per household, which is well below the observed maximum value of land holding. In both Bar and Basu (2008) and Basu, Das and Dutta (2007), the possibility of education for the child labourer has not been considered.

A subset of the extant child labour literature deals with the human capital formation of children. Fan (2004) studies the effect of change in relative wage between child labour and adult labour on child labour and children's human capital formation. In a model of child labour and human capital formation, Baland and Robinson (2000) study the welfare aspect of child labour and the possible policies that can bring about Pareto improvement in this context. Study of Sarkar and Sarkar (2012) deals with income inequality, investment in human capital and persistence of child labour. Among the empirical work, one of the noteworthy papers is by Emerson and Souza (2007) that shows that child labour has a large negative impact on the future earnings of children when they eventually work as adults, especially for male children, even when controlled for schooling. This study was conducted using a data set from Brazil. Studies of Ravallion and Quentin (2000), Akabayashi and Psacharopoulos (1999), Heady (2003), and Ray and Lancaster (2004) show the adverse effect of increase in working hours of children on their human capital development. However, none of these papers analyses the relationship among land size, child labour and human capital development, in the short run and the long run.

This paper builds an overlapping generation's model of household economy in a rural set up, includes the human capital of child in parental utility function and considers parental choice of schooling vis-à-vis child work to understand the relationship among land size, child labour and human capital development, in the short run and the long run. We find that though an increase in land size reduces child schooling and increases child labour in short run, in the long run the size of land holding exhibits a U-shaped relationship with steady state human capital as well as its growth. The rest of this paper is organized as follows. Section 2 describes the basic model, section 3 describes the short run equilibrium, and section 4 discusses the dynamics of human capital formation. Section 5 discusses possible extensions of the basic model. Concluding remarks are made in section 6.

2. The Model

We consider an economy that consists of identical households in overlapping generations framework. Individuals live for two periods. All individuals are identical within each generation. Each household consists of one adult and one child. We consider two parents as "one adult" and two children as "one child." Each household possesses land owned by it. The adult is employed outside the agricultural sector and

earns 'w_t' wage. Here we assume that the agricultural sector is less productive than the non-agricultural sector and consequently, even fora minimum level of human capital, adult wage earned from non-agricultural work is higher than the return from the agricultural sector. We also assume that either the law or the nature of the job restricts the child worker from being employed in the non-agricultural sector. Therefore, the adult prefers sending her child to work on land owned by the household rather than working on the land herself. So, the child is employed only as agricultural labour[2]. If the difference in productivity between the agricultural and the non-agricultural sectors is not significant enough, then perhaps the adult would prefer to work on the agricultural land as well.

Following Glomm (1997), Baland and Robinson (2000),we assume parental choice of human capital investment. The adult decides how much time her child would devote to work on the household land and how much time for schooling, to acquire human capital. The adult sends her child to school for 's' units of time and for the remaining '(1 –s)' units of time, the child is employed on the household land. The wage earned by the adult and the revenue earned from agricultural activities on the household land constitute the total income of the household. Agricultural output depends on the land size and the time devoted to work on land by the child. Households do not have to bear any cost of labour for agriculture as they do not have to pay their children for their work and they do not have to pay rent as the land is owned by them. The remuneration paid to the child for work is not decided on a competitive basis. Following Glomm (1997) and Fan (2004), it is assumed that the adult derives her satisfaction from household consumption and the education level of her child. Hence, the utility of the adult of a representative household depends on the household's consumption 'c' and the human capital formation of the child 'h_{t+1}'[3].

Utility function of an adult of the representative household is defined as follows:

$$U_t=\beta \ln(c_t) + (1 - \beta) \ln(h_{t+1}) \quad (1)$$

Human capital accumulation function of a child is assumed to take the following form:

$$h_{t+1}=s_t^{\gamma}x_t^{1-\gamma}, \quad (2)$$

where 's' is the time devoted to studies by the child, and 'x' represents the financial resources spent on education of the child[4]; $0<\gamma<1$is a positive coefficient.

It is evident that if no time is spent in school by the child ($s_t=0$), paying for learning by parents ($x_t>0$) would not result in any human capital accumulation for the child ($h_{t+1}=0$).

[2]Though it is assumed for simplicity, this is a limitation of this paper. However, study of Dumas (2007) supports this assumption by showing that adult labour markets for family based agricultural work in less developed countries are imperfect and sometimes absent. Rosenzweig and Wolpin (1985) show that land market is weak in developing countries and land market failure reinforces labour market failure (Bhalotra, Heady (2001).

[3]This assumption has been adopted by Glomm (1997), Fan (2004) and has been justified by Galor and Moav (2000).

[4]According to Fan (2004), Glewwe et al. (2004), financial resources play a crucial role in children's human capital development.

Plugging equation (2) into (1) we get:

$$U= \beta \ln(c_t) + (1 - \beta)[\gamma \ln(s_t) + (1 - \gamma) \ln(x_t)] \quad (3)$$

The production function of the agricultural commodity is given by:

$$Y_{at} = A (1 - s_t) L^{\alpha}, \quad (4)$$

Where Y_{at} is the agricultural output, A is the technological index of the agricultural sector, L is the land possessed by the household and $(1 - s_t)$ is the time spent by the child worker on the household agricultural farm.

Non-diminishing marginal returns to child work in the agricultural sector has been assumed purely for algebraic simplicity[5].

Therefore, the household income is given by:

$$Y_t= w_t + p_a A(1 - s_t)L^{\alpha}, \quad (5)$$

Where Y_t is the total income of the household, w_t is the wage earned by the adult in the labour market, p_a is the price of the agricultural good.

In this model, we assume the marginal productivity of the adult in non-agricultural work is higher than that in agricultural work. So, $w_t > p_a AL^{\alpha}$, and it is assumed that the child worker cannot be employed in non-agricultural work either by law or because of the nature of the job[6].

The household spends its income for purchasing consumption good and for financing the child's schooling cost. So, the budget constraint of the household is given by:

$$w_t + p_a A (1 - s_t)L^{\alpha} = p_c c_t + x_t, \quad (6)$$

where p_c is the price of consumption good and $(p_c c_t + x_t)$ represents the total expenditure of the household.

Let us first apply the model in the short-run equilibrium context, and understand the relationship between land size and schooling.

3. Short-run Equilibrium

Utility maximization problem of an adult of the representative household is to maximize the utility, given by equation (3), subject to budget constraint, given by equation (6) with respect to the decision variables of the household, viz.,c_t, s_t and x_t.

[5]To analytically find comparative static results, we assume production function of agriculture to be linear with respect to time devoted to work by the child, in this model.

[6]Manacorda (2003) shows that as child labour laws restrict children from participating in outside labour market, they can be employed more on one's own land.

From the first order conditions[7] of the above optimization problem, we obtain:

$$x_t = \frac{1-\gamma}{\gamma} . s_t p_a A L^{\alpha} \quad (7)$$

$$s_t = \frac{(1-\beta).\gamma[p_a A L^{\alpha} + w_t]}{p_a A L^{\alpha}} \quad (8)$$

Differentiating s_t with respect to size of land holding L, we have:

$$\frac{ds_t}{dL} = \frac{-(1-\beta)\gamma p_a A \alpha L^{\alpha-1} w_t}{(p_a A L^{\alpha})^2} < 0 \quad (9)$$

This implies that as land holding increases, time devoted to schooling by the child decreases.

Proposition 1:In the short run equilibrium, increase in the size of land holding decreases school attendance of child (increases child labour) and increase in adult wage increases attendance in school by child(decreases child labour).

As the land size increases, marginal return from school attendance remains unchanged but marginal return from farm work increases. Hence, in the short run, it is obvious that parents choose less schooling and more child work in response to an increase in land size. This result tallies with the results of existing literature e.g. Bhalotra and Heady (2003), Bar and Basu (2008), Rosenzweig and Evenson (1977), Dumas (2007) etc., and contradicts the finding of Moura (2009).We also find that increase in adult wage increases school attendance by child. Since we have assumed adult wage to be directly proportional to adult human capital, our result implies that human capital acquired by the child is positively related to human capital level of the parent.

Human capital dynamics in the long run is analysed in the next section.

4. Dynamics of human capital

Suppose the wage of an adult is a constant proportion δ of her skill denoted by h_t. Thus, $w_t = \delta h_t$.

Using equations (2), (7) and (8) we have:

$$h_{t+1} = \frac{(1-\beta).\gamma.(p_a A L^{\alpha} + \delta h_t)}{p_a A L^{\alpha}} . \{\frac{1-\gamma}{\gamma} . p_a A L^{\alpha}\}^{1-\gamma} \quad (10)$$

[7] See Appendix A.1 for detailed derivations.

Differentiating h_{t+1} with respect to h_t, we have:

$$\frac{dh_{t+1}}{dh_t} = \frac{(1-\beta).\gamma.\delta}{p_a A L^{\alpha}} \cdot \left\{\frac{1-\gamma}{\gamma} . p_a A L^{\alpha}\right\}^{1-\gamma} > 0 \qquad (11)$$

This implies that parents having higher level of human capital are more likely to have children with higher human capital. Studies done by Ray (2000), Rickey (2009), Akabayashi and Psacharapoulos (1999), Ravallion and Wodon (1999), Ray and Lancaster (2003) – support this finding.

The relationship between h_t and h_{t+1} is shown in the following diagram:

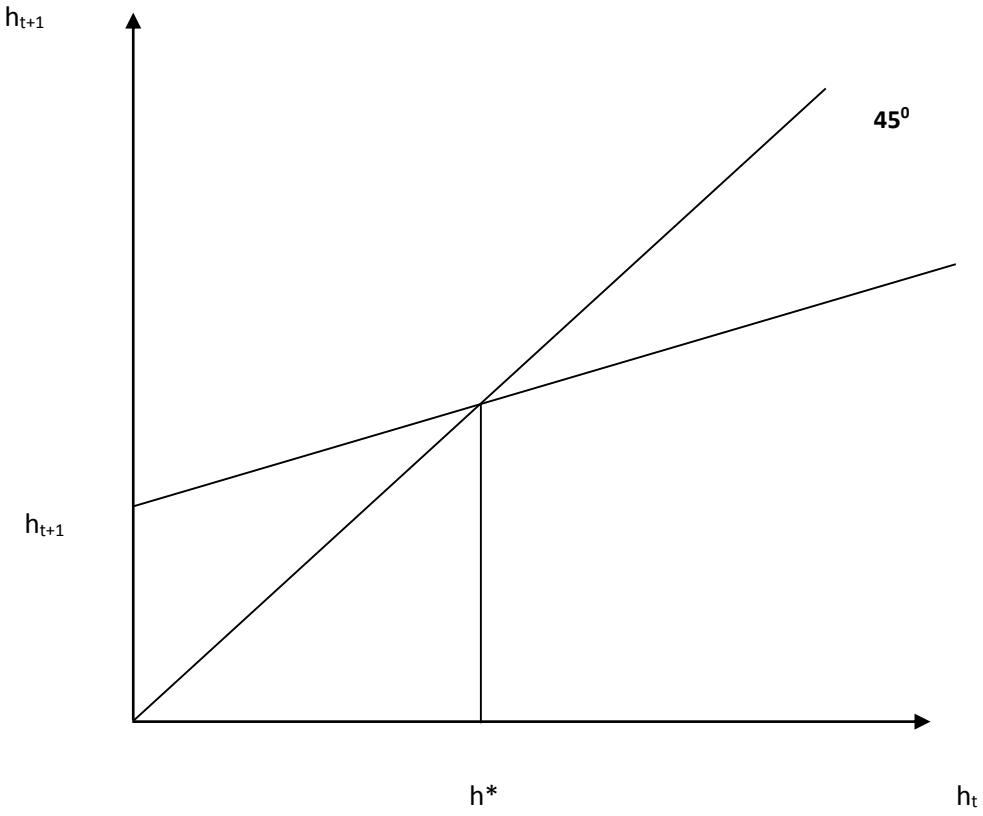

Figure i

Let the steady state level of h be h*. At steady state, $h_t = h_{t+1}$. Then, from equation (10), the steady state level of human capital is given by:

$$h^* = \frac{(1-\beta).\gamma.(p_a A)^{(2-\gamma)}.(1-\gamma)^{1-\gamma}.L^{\alpha}}{\gamma^{(1-\gamma)} p_a A L^{\alpha\gamma} - (1-\beta).\gamma.\delta\{(1-\gamma).p_a A\}^{1-\gamma}} \qquad (12)$$

The positivity of steady state human capital requires:

$$L > L^* = \left[\frac{(1-\beta).\gamma.\delta\{(1-\gamma)p_a A\}^{1-\gamma}}{\gamma^{(1-\gamma)}p_a A} \right]^{\frac{1}{\alpha\gamma}}$$

In our model, we assume land size L>L*and hence, positive h*.

Note that $\frac{\delta h^*}{\delta\beta} < 0$. This implies that as the share of consumption rises in the utility function of the household, the steady state level of human capital declines. This is intuitive because an increase in share of consumption implies a decline in the importance of the offspring's human capital in the utility function of the household. If this happens, in this parental choice of schooling model, parent chooses less schooling and steady state level of human capital decreases. Also note that $\frac{\delta h^*}{\delta\delta} c > 0$.This implies that as the adult's wage δ rises i.e. the responsiveness of wage to human capital increases, steady state level of human capital also rises. As δ captures marginal return to human capital, an increase in δ results in an increase in h*.

For any positive h* there exists a size of landholding $\tilde{L}$below which as land size increases, steady state human capital falls, but beyond $\tilde{L}$as land size increases, h*also increases[8].$\tilde{L}$ is given by:

$$\tilde{L} = \left[\frac{(1-\beta).\delta\{(1-\gamma).p_a A\}^{-\gamma}}{\gamma^{-\gamma}} \right]^{\frac{1}{\alpha\gamma}}$$

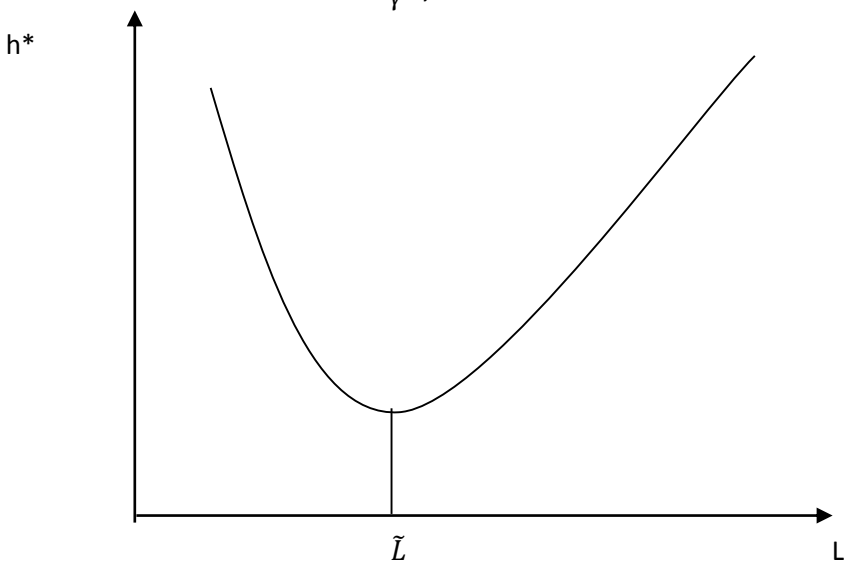

Figure ii

Note that $\tilde{L}$> L*. So, for any size of landholding L such that $\tilde{L}$>L> L*, with increase in L, h* decreases and for all L> $\tilde{L}$,with increasing L, h* increases. This shows that the steady state human capital level and land size exhibit a U-shaped relationship.

[8]For mathematical proof, see Appendix A.2.

Proposition 2: When the size of landholding is small, increase in land size decreases steady state human capital. When size of land holding exceeds $\tilde{L}$, increase in land size raises steady state human capital.

With increase in household land size, school attendance by children falls and the ratio of financial resources spent on education to school attendance rises because of parental altruism. Initially, when landholding is small, falling effect of school attendance dominates the rising effect of financial resources. Consequently, steady state human capital level falls. But after a while, the trend reverses, and human capital level starts increasing. Then, in the next period, when the child joins the workforce as adult with higher human capital, earns a higher wage and after being parent she sends her child to school for a longer duration. Thus, in the long run, increase in land size above a critical level leads to increase in steady state human capital.

This result is close to the finding of Bar and Basu (2008), and Basu, Das, Dutta (2008) in the sense that they revealed an inverted U shaped relationship between land size and child labour. However, these papers do not consider the possibility of schooling of the child labourer and do not look into the relationship between steady state human capital and land size.

Let us now study the effect of increase in land size on the growth rate of human capital. Letthe growth rate of human capital $\frac{h_{t+1}}{h_t}$be denoted by φ. Then,

$$\Phi = \frac{h_{t+1}}{h_t} = \{(\frac{1-\gamma}{\gamma}).\ p_a\ A\ L^{\alpha}\}^{1-\gamma}.(1-\beta).\gamma.[\frac{1}{h_t} + \delta\ (p_a\ A\ L^{\alpha})^{-1}$$

The relationship between φ and L can be shown in the following figure:

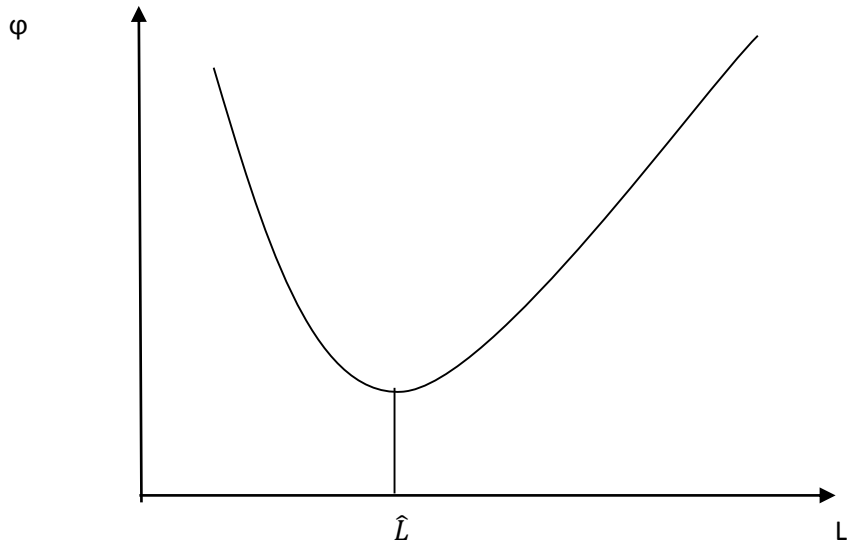

Figure iii

The L for which growth rate of human capital φ is minimized is denoted by$\hat{L}$[9].

$$\hat{L}=\left[\frac{\delta\gamma h_t}{p_a A(1-\gamma)}\right]^{\frac{1}{\alpha}}$$

As long as L<$\hat{L}$, there is a negative relationship between the growth rate of human capital and land size. Only when land size exceeds$\hat{L}$, there is a positive relationship between φ and L.

Proposition 3: Given h_t, there is a U-shaped relationship between the growth rate of human capital and the size of land holding.

As long as the size of land holding is below a certain critical level, an increase in land size leads the adult to send her child to work on household land for extended units of time rather than sending the child to school. Time devoted to schooling keeps on decreasing with increase in land size, due to the enhanced marginal return from child work compared to schooling at margin. Consequently, human capital formation of the child gets affected as the hours of schooling falls, and the growth rate of human capital decreases.

However, as land size exceeds a certain critical level, parental altruism over child schooling decision gains strength. As the parent invests more and more resources towards schooling, h_{t+1} increase, and when the child attains adulthood and enters the workforce as an adult –her wage rate increases. This will lead this adult to invest more towards her child's schooling in the next generation. In the long run, this improves schooling and the human capital formation of the future generations. Hence, the growth rate of human capital also increases.

In the next section, few extensions of the basic model are discussed.

5. Extensions of the Basic Model

In this section, we consider a few extensions of the basic model. First, we assume that adult labour and child labour are substitutable in agricultural and non-agricultural work. We consider two types of the adult labourer – the agricultural worker and the non-agricultural worker. For the agricultural worker, human capital will not yield any return but for the non-agricultural worker, however, it may be assumed that adult wage will be proportional to human capital. This in turn will affect the household's budget constraints and the adult's choice of school attendance of her children. Hence, human capital dynamics will be different for the two classes of adults.

Let us assume in this case that agricultural productivity is not much different for the adult and the child worker, whereas non-agricultural productivity is different, or in other words, adults have comparative advantage in non-agricultural work whereas

[9]See Appendix A.3 for mathematical proof.

children have comparative advantage in agricultural work, given by:

$$w - w_c^E > s_t\, p_a\, AL^{\alpha},$$

where w and w_c^E are adult wage and effective child wage in non-agricultural work respectively.

Even under this assumption, our basic model holds good.

But if there is no such comparative advantage, and both the child and the adult work in the agricultural and non-agricultural sectors, then land size might not influence child labour decision.

In this paper, we have assumed that child work has non diminishing marginal returns from agricultural work. If we relax this assumption and allow for diminishing marginal returns to child work in the agricultural sector, i.e.an agricultural production function given by:

$$Y_{at} = A\,(1-s_t)^{1-\alpha}\, L^{\alpha}$$

Even in this case, our Proposition 1 holds true; existence of unique steady state human capital can be shown. However, because of the non-linearity of agricultural production with respect to child work, comparative static results with respect to land size would be complicated.

Following Basu, Das, Dutta (2007), if we consider disutility of parent from child's work[10] then we find that all the propositions hold good and the critical value of land acreage, beyond which increase in land size raises steady state human capital level – decreases. However, the critical value of land acreage, beyond which an increase in land size raises growth rate – remains the same.

6. Concluding Remarks

This paper builds an overlapping generations household economy model in a rural set up and examines the impact of an increase in the size of landholding on school attendance by the child labourer, and the child's human capital formation and growth. In this model, each household consists of one adult and one child. The adult is employed outside the agricultural sector and earns a wage proportional to her human capital while the child is employed on the land possessed by the household. The adult derives satisfaction from household consumption and the human capital level of her child. Human capital accumulation of the child depends on the time devoted for schooling, and financial resources invested towards education. The adult maximizes her utility by making decisions about consumption, educational investment for child and time allocation of child between schooling and work. We have found that an increase in land size leads to a decline in schooling of the child worker in the short run, but in the long run, land size shows a U-shaped relationship with both steady state human capital and the growth rate of human capital. It is also found that parents possessing higher levels of human capital are more likely to send their children to school. Thus, policies that promote adult education and increase in land size above a critical level can act as

[10]Suppose the utility function of an adult of the representative household is given by: $U_t=\beta_1 \ln(c_t) +\beta_2 \ln(s_t)+(1-\beta_1-\beta_2)\ln h_{t+1}$. Positive β_2 captures disutility from child work. However, if we assume that adult and/or child leisure influences utility – our results might change.

effective strategic drivers for reducing child labour and enhancing human capital in the short and the long run. The relationship between child labour, land size and human capital dynamics deserves larger and deeper exposition. The following research questions may be posed – what will happen if adult labour and child labour are substitutable in the agricultural sector? How will land size affect human capital formation and growth if leisure is included in the utility function? What will happen with the existence of unemployment in the labour market? What will happen if fertility decision is endogenous? In addition, we did not consider the problems introduced by intergenerational contracting and/or credit market imperfections. These problems may be considered for future research.

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