Low Level Equilibrium Trap, Unemployment, School Quality, Child Labour and Human Capital Formation

Chakraborty, Bidisha and Chakraborty, Kamalika

Jadavpur University

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Bidisha Chakraborty

JADAVPUR UNIVERSITY, INDIA

Kamalika Chakraborty

JADAVPUR UNIVERSITY, INDIA

Abstract

This paper builds an overlapping generations household economy model and examines the impact of unemployment on child labour and the child's human capital formation and growth through the expectation of adult regarding future employability. The economy consists of two sectors- skilled sector and unskilled sector. If one individual is employed in skilled sector she gets wage proportional to human capital whereas unskilled sector gives a fixed return. Expected future earning of child is included in the parental utility function. Parental choice of schooling vis-a-vis child work is considered. We study the effect of change in unemployment rate, child wage, adult skilled labour wage, adult unskilled labour wage, responsiveness of wage to skill level, change in school quality on schooling and human capital growth rate. We find that in this model the decision regarding full schooling or partial schooling or zero schooling of child is based on parental level of human capital as well as school quality. Increase in child wage will increase schooling and human capital growth rate only if adults earn less than subsistence consumption expenditure. We also find that as the responsiveness of skilled wage to human capital increases, schooling and rate of growth of human capital formation increase but if there is no unemployment then schooling hour and growth rate will be independent of responsiveness of wage to human capital, lower is the employment rate in the skilled sector, lesser is the time devoted to schooling by the child. Increase in unskilled adult wage may or may not decrease child labour. But if there is no unemployment increase in unskilled adult wage will result in decrease in the incidence of child labour and increase in schooling and rise in growth rate. The model dynamics exhibits the possibility of low level equilibrium trap. Suitable policies to escape child labour trap are discussed as well.

Keywords: Low level equilibrium trap, Child labour, Unemployment, Human capital, Schooling

JEL Classification Numbers: E24, J21, J22, J24, O15

1. Introduction

According to ILO report, along with poverty, unemployment of adults is one of the most common causes of child labour. Many other studies support this view. Since there exists substantial literature dealing with poverty and child labour it is important to identify and analyze the link between unemployment and child labour. This paper explores the theoretical linkage between unemployment and child labour, through the expectations of the parent over whether she believes that the child will get employment in skilled sector in the future and time allocation of child by parent for education. Our main interest is to know how expectation of parents regarding job prospect of their children in the future and parental human capital act as decisive factors in determining current child labour status of the children. While modelling expectation of parents, adaptive expectation is assumed. Parents expect present employment rate to prevail in the future and believes her child would get employment in skilled sector with this probability. If the unemployment rate is high they decide to send their children to work. This decision will hamper the child's ability to accumulate human capital and can lead to low level equilibrium trap.

Unemployment of adult labour is considered to be one of the key factors affecting child labour. In our paper we show that the rise in current rate of adult unemployment leads to rise in child labour hour and decrease in schooling hours and human capital formation of the child. A major motivation to study the relationship between adult unemployment and child labour are the empirical works that show that even if parents value schooling of child, rise in adult unemployment rate may force them to reduce schooling hours of child and send child to work. Using data from Mexico, Skoufias and Parker (2002) show that increased work time by adult women in poor households tend to prevent the adverse effects of unemployment on weekly school attendance of children. However unemployment shock increases the probability that children do not continue school in the next year. Fabre and Pallage (2011) argue that child labour may serve as a natural insurance mechanism against adverse employment shocks hitting the family. Using historical data from a late nineteenth century of Philadelphia, USA, Goldin (1978) shows that the impact of adult unemployment raises the probability of their children participating in the labour force. Ahn and Ugidos (1996) examine the effects of parent's labour market situation on child's education and labour market situation using data from Spanish Labour Force Survey. They conclude that unemployed parents enormously increase the risk of unemployment of their children while they decrease the

chance of attainment of higher education, thereby creating intergenerational persistence of unemployment and poverty. There are many theoretical papers[1] dealing with unemployment and human capital accumulation but very few of them have taken into account the problem of child labour.

In child labour literature the relationship between adult wage, poverty and child labour has been extensively analysed. Parents generally send their children to school due to abject poverty. So a rise in adult wage is expected to reduce child labour. However according to Basu (2000), if the rise in wage is achieved by a minimum wage law, it can cause some adults to be unemployed and force them to send their children to work. Sarkar and Sarkar (2012) show that child labour may persist even if adult income rises. This may happen due to income inequality. In general a rise in parental income is expected to have a positive impact on child schooling and negative impact on child labour. Wahba (2005) shows that low adult wages are key determinants of child labour. Islam and Sivasankaran (2015) study the impact of NREGA program on three states of India. They conclude that increase in household income due to NREGA program taken up by adults can reduce child labour. However if wages in the economy increase or adults take up new jobs, demand for child labour could increase. Ray (2000), in his empirical study on Ghana, points out that adult male wage has significant impact on child labour as male adult labour and child labour are often considered as complimentary to one another whereas movement of female adult wage does not have significant impact on child labour. But none of these papers have studied the relationship between adult wage and child labour at the backdrop of unemployment. Our paper shows that only if there is no unemployment in the adult labour market, a rise in unskilled adult wage will result in decrease in the incidence of child labour. However, in the presence of unemployment, increase in unskilled adult wage may or may not be accompanied by reduction in child labour. The model also shows that if there is no unemployment, then schooling hour and growth rate will be independent of responsiveness of adult skilled wage to human capital but in the presence of unemployment child labour is always negatively related to adult skilled wage.

Child wage is considered to be another important determinant of child labour. Ray (2000) uses data set from Ghana and shows that child labour hours respond positively to child wage. Estevez (2011) concludes that child wage subsidies, which are meant to reduce the supply of

[1] Mauro and Carmeci (2003), Saint Paul (1996), Dellas (1997), Davis, Reeve (1997), Brown and Kaufold (1988), Pissarides (1992), Robinson (1993) studied unemployment and human capital formation.

child labour, will also increase the demand for child labour by reducing the cost of hiring one unit of child labour. Thus the effect of child wage subsidies on the incidence of child labour is ambiguous. The effect of rise in child wage on child labour is particularly important for those households who depend on child earnings to meet their subsistence consumption expenditure. According to Fan (2004), children's labour market participation raises the financial resources spent on their education. Therefore a small increase in child labour may enhance child's human capital. Das and Ghosh (2006) study the implications of Minimum Wage Law on labour market. They conclude that a suitably developed Minimum Wage Policy will reduce child labour not only in the short run but will ultimately eliminate it in the long run. But our paper shows that only if adults of the household earn less than subsistence consumption expenditure, a rise in child wage will increase schooling and human capital of the child in the short run and growth rate in the long run.

Besides parental wages and child wages, parental human capital is also another determinant of child's schooling. Empirical study by Oreopoulos, Page and Stevens (2003) reveals that increase in parental education has positive impact on academic outcomes of children. Using data from Egypt, Wahba (2005) concludes that parents who were child labourers themselves are more likely to send their children to work. Using primary data from two districts of Pakistan, Khan (2003) concludes that parental education is positively associated with child schooling and negatively associated with child labour. Ray (2000a), from his empirical study on Peru and Pakistan, confirms the positive impact that adult education has on child welfare. Empirical evidence of Brazil (Emerson Souza (2003)) also shows that parental education has strong negative effect on child labour status of the children.

But none of these papers have considered the parental expectation regarding future earning of child at the backdrop of unemployment. Mukherjee and Sinha (2006) consider expected future earning of child in parental utility function and explore the relation between child labour and education in a model where unemployment exists in formal sector. In this paper wage in informal sector depends on skill level whereas in the formal sector wage is given. However this paper does not consider the dynamics of human capital accumulation in presence of unemployment. Since child labour has a persistence property and child labour decision is mostly taken by the head of the family there is a strong intergenerational link in context of child labour. So overlapping generations model and dynamic setting is needed to analyze the vicious circle of child labour present in developing countries. Our paper develops

a simple overlapping generations model where parents are altruistic towards their children. The model allows us to address the issue of child labour in the short run as well as long run and show the dynamics of human capital formation of child at the backdrop of adult unemployment.

There exists a substantial literature dealing with child labour trap. Basu and Van (1998) propose that since parents dislike child labour, once adult wage reaches minimum they withdraw their children from market. This yields two stable equilibria. Veron and Fabre (2004) show that poverty trap arises due to subsistence consumption which the household has to maintain. In Emerson and Knabb (2007) also child labour trap arises because of discontinuous human capital accumulation function and inclusion of possibility of savings. Gupta (2001) has also shown child labour trap in two sector small open economy set up. Emerson and Souza (2003) have shown in their model, possibility of child labour trap and also found the same result empirically in context of Brazilian economy. In their model discrete jumps in the returns to education on reaching different stages of education leads to binary choice of schooling (either full schooling or zero schooling) which leads to the emergence of child labour trap. In Basu(1999), dependence of child labour on adult income and nature of the adult wage function leads to intergenerational persistence of child labour and thus generates child labour trap. Sarkar and Sarkar (2012) uphold income inequality to be a reason behind child labour trap. According to Bell and Gersbach (2001), absence of quality child rearing and absence of formal schooling can generate poverty trap and child labour. Sasmal and Guillen (2015), by empirically testing state level panel data on India, conclude that persistence of poverty across generations leads to child labour trap. According to Azariadis (1996), poverty traps can arise due to subsistence consumption, distorted international trade in intermediate inputs, demographic transitions when fertility is endogenous, technological complementarities in the production of consumption goods, financial intermediation services, manufacturers or human capital; coordination failures among voters, various restriction on borrowing; indivisibilities in human capital formation or child rearing and monopolistic competition in product or factor markets. The model dynamics in our paper allows us to derive the conditions under which educational technology binds an economy in a child labour trap in the long run in spite of the fact that children undergo full schooling in the current period.

None of the papers mentioned so far theoretically analyze the relationship among unemployment, child labour and dynamics of human capital formation. This paper attempts to fill this gap. The present paper builds an overlapping generations model of household economy consisting of a skilled sector and an unskilled sector. If one individual is employed in skilled sector she gets wage proportional to human capital whereas unskilled sector gives a fixed return. Expected future earning of child is included in the parental utility function and parental choice of schooling vis-a-vis child work is considered. This paper attempts to understand the relationship among unemployment, child labour and human capital development. In this model the decision regarding full schooling or partial schooling or zero schooling of child is based on parental level of human capital. We find in this model that lower is the employment rate in the skilled sector, lower is the belief that the child will get employment in the skilled sector and therefore lesser is the time devoted to schooling by the child. Hence child labour increases and that result in lower growth rate of human capital in the long run. in schooling and rise in growth rate. The model dynamics exhibits the possibility of low level equilibrium trap. There exists a critical value of parental human capital below which the economy is trapped by low level equilibrium while above this critical level steady growth of human capital emerges. So there exists a low level trap where children of uneducated parents remain uneducated and work as child labour. This model dynamics also show that if education system is efficient the families that send their children to full time schooling and also some families that send their children for partial schooling can escape from low level equilibrium trap. But if the education system is inefficient then some families who send their children for full time schooling may end up being at low level equilibrium. We also find that if education technology is efficient, we do not get any equilibrium if child labour is totally banned. This implies that all the individuals in the economy face positive human capital growth rate. In case of even inefficient education technology banning child labour leads to unique stable steady state equilibrium of human capital and low level equilibrium trap vanishes.

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. Concluding remarks are made in section 5.

2. The Model

We consider an economy that consists of identical households in overlapping generations framework[2]. Each household consists of one adult and one child. We consider two parents as one adult and two children as one child. The economy consists of two sectors- a skilled sector and an unskilled sector. If one individual is employed in skilled sector she gets wage proportional to human capital whereas unskilled sector gives a fixed return. The adult decides the time allocation of the child between work and schooling. Utility function of the adult depends on family consumption and expected earnings of the child in future[3]. When the child becomes adult he may or may not get job in the skilled sector. If she does not get job in skilled sector she gets employed in the unskilled sector. Adult forms expectations over whether she believes that the child will get job in skilled sector on becoming adult[4]. This forecasting depends on present level of unemployment in the economy. Human capital formation of the child depends on the time devoted to schooling by the child and human capital of the parent.

Following Glomm (1997), we assume parental choice of human capital investment. The adult decides how much time her child would devote to work in the unskilled sector and how much time for schooling by maximizing utility subject to the budget constraint. 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 in the unskilled sector. Wages earned by the adult and by the child constitute the total income of the household. If the child joins the skilled sector, on becoming adult, she gets a wage in the skilled sector which is a fixed proportion of the human capital possessed by her (δh_t)[5]. In unskilled sector the adults get a fixed return 'A'. Children, by working in the unskilled sector also get a fixed return which is less than the return obtained by the adults from unskilled sector. In this paper we assume $A>\delta \underline{h}$. This assumption implies that the

[2] Overlapping generations framework has been adopted by Becker and Tomes (1979), Acemoglu and Pischke (2000), Glomm (1997), Glomm and Ravikumar (1998).

[3] In Mukherjee and Sinha (2006), aggregate current consumption and the child's future earning enter in the parent's utility function. According to Genicot and Ray (2010), people's aspirations for their future well being (or that of their children) affect their incentives to invest. Expectations of the parents from their children affect their utility.

[4] In Emerson and Knabb (2007), households form expectations over whether they believe the government will keep its promise to implement the social security program to eradicate child labour.

[5] Hare and Ulph (1979) assume that wage rate depends on ability and amount of education received by an individual.

individuals with zero schooling earn less wage in skilled sector compared to that in unskilled sector.

Like Moav (2005), this paper assumes that human capital evolution is independent of physical capital. Human capital accumulation function of a child is assumed to take the following form[6]:

$$h_{t+1} = bs_t h_t + \underline{h}, \quad (1)$$

where 's_t' is the time devoted to studies by the child, and 'h_t' represents the level of human capital possessed by the adult; b>0 is a positive constant representing education technology parameter and also indicates school quality. It may be treated as indicator of school too. $\underline{h}$ represents the minimum level of human capital attained by a child even if she does not attend school(i.e. s_t=0).Thus h_{t+1}>0 even if s_t =0.

Household income is given by:

$$Y_t = A + A\varphi (1-s_t), \quad (2)$$

where Y_t is total income of the household, A is wage earned by the adult in unskilled sector and φ is the fraction of adult wage that a child labour receives. Here 0<φ<1 is a positive constant.

The household spends its income on purchasing consumption good only. So, the budget constraint of the household is given by:

$$A + A\varphi (1-s_t) = p_c c_t, \quad (3)$$

where p_c is the price of the consumption good and $p_c c_t$ represents the total consumption expenditure.

When adults work in skilled sector, household income is given by:

$$Y_t = w_t + A\varphi (1-s_t)$$

where w_t is the wage earned by the adult in the skilled sector. We assume wage earned in skilled sector (w_t) is proportional to the human capital acquired by that individual i.e. $w_t = \delta h_t$.

[6] According to Contrereas (2008), Emerson and Knabb (2006) and Galor and Tsiddon (1997), human capital of the parents play a crucial role in human capital development of the children.

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

$$U_t = \beta_1 \ln (c_t - \underline{c}) + \beta_2 \ln [f\, \delta(bs_t h_t + \underline{h}) + (1-f)\, A] \quad \text{if } c_t \geq \underline{c}$$
$$= -\infty \text{ otherwise,} \qquad (4)$$

where c_t represents consumption, $\underline{c}$ represents subsistence consumption. The utility function is defined on the range $c_t \geq \underline{c}$. Adult believes that the probability of the child getting job in skilled sector is f (present employment rate of skilled sector), $(\delta bs_t h_t + \underline{h})$ is the return that the child may get as an adult if he gets job in the skilled sector, adult believes that the probability of the child not getting job in skilled sector is (1-f).While modelling parental expectation, adaptive expectation is assumed. Parents observe present unemployment rate and expect that the same unemployment rate would prevail. So they believe that their children will get employed in skilled sector with probability f if the employment rate of skilled sector is f and rate of unemployment in skilled sector would be (1-f). It is assumed that whoever does not get job in skilled sector gets employed in unskilled sector. Unskilled sector absorbs all the residual labour force. So there is no possibility of remaining fully unemployed. A is the return that the child may get as an adult if he gets job in unskilled sector. $[f\, \delta(bs_t h_t + \underline{h}) + (1-f)\, A]$ represents total expected earning of child.

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

3. Short-run Equilibrium when adults work in unskilled sector

Utility maximization problem of an adult of the representative household is to maximize the utility, given by equation (4), subject to budget constraint given by equation (3) with respect to the decision variables of the household, viz, c_t and s_t.

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

$$s_t = \frac{\beta_2 f\delta b h_t (A + A\varphi - p_c \underline{c}) - \beta_1 A\varphi [f\delta \underline{h} + A(1-f)]}{A\varphi f\delta b h_t (\beta_1 + \beta_2)} \qquad (5)$$

[7] For detailed derivation please see equations (A.1) and (A.2) of Appendix.

From equations (A.1), (A.2) and budget constraint, it is clear that for positive consumption $A+ A\varphi(1-s_t)-p_c\underline{c} >0$ is a necessary and sufficient condition.

Now $s_t = 1$ when $h_t \geq \frac{\beta_1 A\varphi[f\delta\underline{h}+ A(1-f)]}{f\delta b[\beta_2(A-p_c\underline{c})-A\varphi\beta_1]} = \hat{h}$

Lower is the value of $\hat{h}$ higher is the chance that $h_t \geq \hat{h}$.

If $A> p_c\underline{c}$, and A is sufficiently high and $p_c\underline{c}$ is sufficiently low, higher is the chance that $\hat{h}$ is low and thus higher is the possibility that $h_t \geq \hat{h}$ i.e. higher possibility of no child labour.

Higher is the adult income more is the possibility that adult can meet her subsistence consumption requirements. Then she does not have to depend on the child to contribute towards family income. Adult instead sends the child to school for more hours.

The conditions for positive schooling are $A+ A\varphi-p_c\underline{c} >0$ and $h_t \geq \frac{\beta_1 A\varphi[f\delta\underline{h}+ A(1-f)]}{f\delta b\beta_2(A+A\varphi-p_c\underline{c})} = h_0$. This implies that even if the total earnings of the household exceed the subsistence consumption expenditure of the household, if $h_t \leq h_0$, $s_t = 0$.

Proposition 1: If initial human capital is higher than $\hat{h}$ there will be no child labour and if initial human capital is less than h_0 there will be no schooling of child.

Differentiating equation (5) with respect to h_t gives

$$\frac{ds_t}{dh_t} = \frac{\beta_1[f\delta\underline{h}+ A(1-f)]}{f\delta b(\beta_1+\beta_2)} \cdot \left(\frac{1}{h_t^2}\right) > 0$$

$$\frac{d^2s_t}{dh_t^2} = - \frac{\beta_1[f\delta\underline{h}+ A(1-f)]}{f\delta b(\beta_1+\beta_2)} \cdot \left(\frac{1}{h_t^4}\right) < 0$$

s_t is therefore upward rising concave shaped curve.

Till h_0 is reached, $s_t=0$.[Below h_0, $s_t=0$ (corner solution)].Thereafter s_t is represented by upward rising curve till $\hat{h}$ is reached. Beyond $\hat{h}$ it is parallel to horizontal axis. Thus parental human capital is a key factor in determining schooling of child and consequently the human capital formation of child.

This result tallies with Oreopolous, Page and Stevens (2003), Wahba(2005), Galor and Tsiddon (1997), Emerson and Knabb (2006), Glomm and Ravikumar (1998), Mukherjee and Das (2008), Contrereas (2008), Khan (2003), Chakraborty and Chakraborty (2014). These

papers also point out that parental human capital plays a key role in determining human capital formation of child.

Differentiating s_t with respect to the probability with which parent believes that the child will get employment in the skilled sector f, we have

$$\frac{ds_t}{df} = \frac{\beta_1 A}{f^2 \delta b h_t(\beta_1 + \beta_2)} > 0 \qquad (6)$$

Hence as f increases s_t increases.

If the parent believes that the child will get employment in skilled sector in the future, parent chooses more schooling and less child work in the short run. Parents send their children to school in the current period with the belief that they will get job in the skilled sector in the future since wage of skilled sector is proportional to human capital acquired. Hence, in the short run, when parents believe that children have better prospect of getting job in the skilled sector in the future when they become adults, parents will send their children to school for more hours in the present period.

This result tallies with the results of the existing literature e.g. Hanchane, Lioui and Touahri (2006), Skoufias and Parker (2002) and Goldin (1978).

Note that[8]:

i) $\frac{ds_t}{d\delta} > 0$. This implies that as δ increases i.e. the responsiveness of skilled wage to human capital increases, schooling also increases. As δ captures the marginal return to human capital, an increase in δ results in an increase in schooling of the child.

ii) The necessary and sufficient condition for $\frac{ds_t}{d\varphi} > 0$ is $p_c\underline{c} > A$. In this case wage obtained from child work is necessary to meet subsistence consumption. Here as φ increases, schooling increases. This is because higher earnings by the child obtained by working the same number of hours propel the parent to reduce the working hours of the child, necessary to meet subsistence consumption needs and instead increases the schooling hours of the child.

[8] For detailed derivation please see equations (A.5), (A.6) (A.7) and (A.8) of Appendix.

$\frac{ds_t}{d\varphi}<0$ when $p_c\underline{c}< A$. Note that in this case wage obtained from child work is no longer necessary for household. In this context, as child earns a lower proportion of the earning earned by the adult by working in the unskilled sector, schooling rises. This is because lower earnings by the child obtained by working the same number of hours induce the parent to reduce the working hours of the child, necessary to meet subsistence consumption needs and instead increase the schooling hours of the child.

The result implies that if adults send children for work only because of poverty then increase in child wage will reduce child labour but if it is not the case then increase in child wage will induce parents to substitute schooling by child work, hence child labour increases. The effect of rise in child wage on child labour is particularly important for those households who depend on child earnings to meet their subsistence consumption expenditure. According to Fan (2004) children's labour market participation raises the financial resources spent on their education. Therefore a small increase in child labour may enhance children's human capital. Estevez (2011) concludes that child wage subsidies, which are meant to reduce the supply of child labour, will also increase the demand for child labour by reducing the cost of hiring one unit of child labour. Thus the effect of child wage subsidies on the incidence of child labour is ambiguous. Das and Ghosh (2006) study the implications of Minimum Wage Law on labour market. They conclude that a suitably developed Minimum Wage Policy will reduce child labour not only in the short run but will ultimately eliminate it in the long run. Ray (2000) uses data set from Ghana and shows that child labour hours respond positively to child wage. In our paper we show that when subsistence consumption expenditure of the household is higher than adult's earning, a rise in child wage can only lead to a rise in schooling of the child, but if adults earn sufficiently to meet subsistence consumption expenditure then with increase in child wage schooling falls and child labour hour rises.

iii) The sufficient condition for $\frac{ds_t}{d\beta_1} < 0$ is $A + A\varphi - p_c\underline{c}>0$. This implies that if the total earnings of the household exceed the subsistence consumption expenditure of the household, as β_1 increases schooling falls. This is quite obvious because increase in β_1 implies that adult gives more importance to consumption than expected earnings from child. So if the earnings of the household are good enough to cover the subsistence consumption expenditure, adult will give less importance to expected earnings from the child and hence schooling of the

child will fall with rise in β_1. This reduces the rate of growth of human capital formation in the long run.

iv) $\frac{ds_t}{dA} > 0$ if $\beta_2 f\delta b p_c \underline{c} h_t > \beta_1 A^2 \varphi$ (1-f). This implies that if subsistence expenditure, preference towards child's expected income, parental human capital, responsiveness of wage to human capital, parental belief that the child will get employment in skilled sector are high, the only increase in unskilled wage will increase schooling of child. Otherwise, increase in unskilled wage may also lead to reluctance to send the child to school. In that case increase in unskilled wage may lead to fall in schooling. So the effect of increase in adult wage on child schooling is ambiguous.

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

4. Dynamics of human capital formation

From equation (5) it is clear that s_t is function of h_t. Therefore the equation of human capital formation i.e. equation (1) can be written as:

$h_{t+1} = b\, s_t(h_t)\, h_t + \underline{h}$

$\frac{dh_{t+1}}{dh_t} = b\frac{ds_t}{dh_t} h_t + b\, s_t$

When $s_t > 0$, $\frac{dh_{t+1}}{dh_t} = b\left[\frac{\beta_2^2 f\delta b(A+A\varphi-p_c\underline{c})^2}{\beta_1 A^2\varphi^2(\beta_1+\beta_2)\{f\delta\underline{h}+A(1-f)\}^2} h_t > 0\right.$

When $s_t = 0$, $\frac{dh_{t+1}}{dh_t} = 0$

When $s_t = 0+\varepsilon$ (where Lt $\varepsilon \to 0+$), $\frac{dh_{t+1}}{dh_t} > 0$

Therefore there is a discontinuity in h_{t+1} curve at point $s_t = 0$.

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

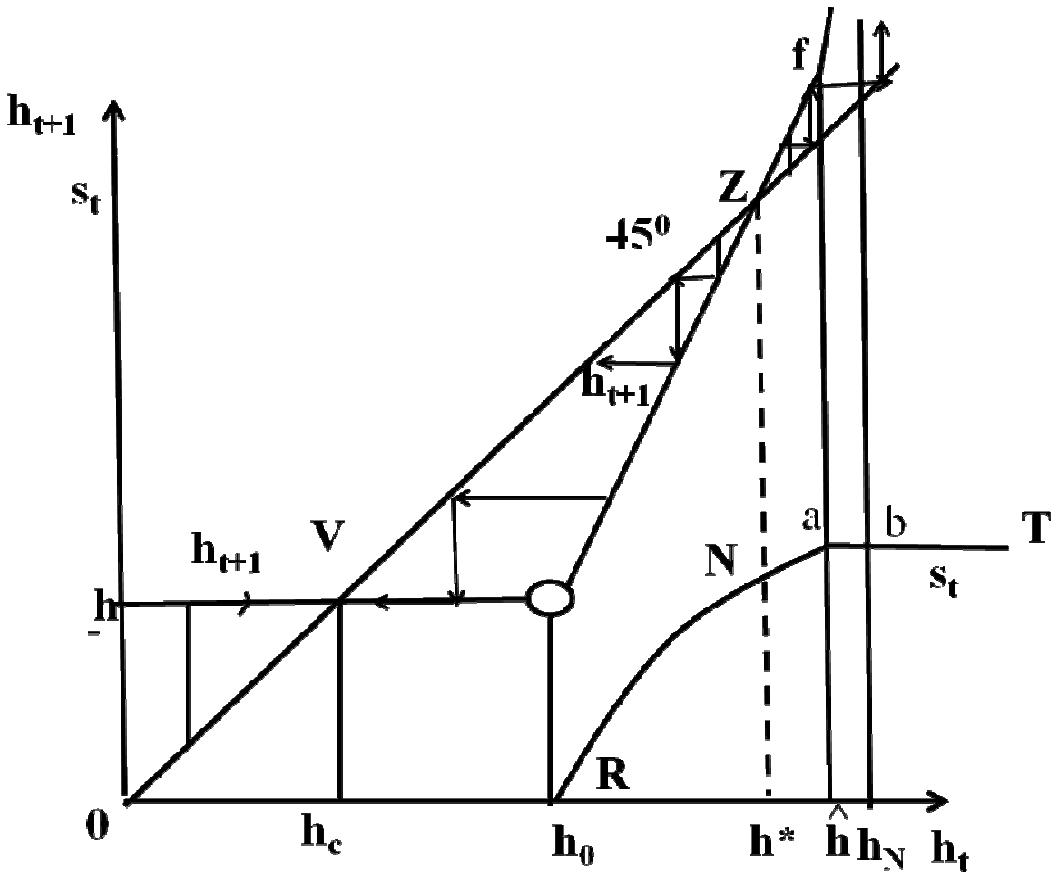

Figure 1

Till h_0 is reached s_t=0 and thus s_t coincides with horizontal axis (OR). Beyond h_0, s_t is represented by an upward rising concave shaped curve (Ra T). Beyond $\hat{h}$, s_t is represented by a straight line (aT) parallel to horizontal axis. Till h_0 is reached, h_{t+1} is represented by a straight line parallel to horizontal axis and beyond h_0 ,h_{t+1} is represented by an upward sloping straight line. Beyond point f, in full schooling regime h_{t+1} curve becomes more steep (since $b>bs_t$). We assume b>1. Under the assumption b>1, two possibilities emerge: $bs_t > 1$ or $bs_t < 1$. In Figure 1 we show the case where $bs_t > 1$.

When the child becomes adult and joins the skilled sector her wage is denoted by $w_{t+1} = \delta(bs_t h_t + \underline{h})$. If $\delta(bs_t h_t + \underline{h}) > A$, i.e. the return from skilled sector exceeds the return from unskilled sector, then only individuals want to be to be employed in the skilled sector. This is called the incentive compatibility condition.

Substituting the value of s_t from equation (5) in the incentive compatibility condition we get the following modified incentive compatibility condition:

$$h_t > \frac{A\varphi[Af(\beta_1+\beta_2)+\beta_1\{f\delta\underline{h}+A(1-f)\}-f(\beta_1+\beta_2)\underline{h}\,\delta]}{\beta_2 f\delta b(A+A\varphi-p_c\underline{c})} = h_N$$

If $h_t > h_N$, then one individual wishes to be employed in skilled sector. Similarly if $w_{t+1} = \delta(bs_t h_t + \underline{h}) < A$ i.e. $h_t < h_N$, then the individual does not have any incentive to work in skilled sector and would rather want to be employed in unskilled sector.

When $\delta\underline{h} > A$ i.e. when the person having lowest skill level, if she gets opportunity to be employed in skilled sector, earns higher than unskilled wage, then even the individuals having no education wish to be employed in skilled sector. But when opposite happens i.e. $\delta\underline{h} < A$, then some of the individuals having some level of education also prefer to work as unskilled worker because that yields higher return than the return of skilled sector with low human capital. In this model we assume $A > \delta\underline{h}$.

$h_N > h_0$ since $A\varphi f(\beta_1 + \beta_2)(A - \delta\underline{h}) > 0$

When $A > \delta\underline{h}$, then we also get the result that $h_N > \hat{h}$[9].This implies that when $A > \delta\underline{h}$, all children undergoing partial schooling and even some children having parental human capital level in $[\hat{h}, h_N]$ range undergoing full schooling, will be willing to join the unskilled sector on becoming adults. This also implies that problem of child labour occurs only for parents employed in unskilled sector. This case is shown in Figure i. This case is very close to reality where we find that low skilled individuals or individuals having poor background often prefer to join unskilled labour force in spite of being educated because they know their earning prospect is better in unskilled sector than in skilled sector given that their skill is low.

At steady state equilibria $h_t = h_{t+1}$. From Figure i we find that there are two steady state equilibria-V and Z. Below V, $h_t < h_{t+1}$. So h_t rises. Conversely if h_t starts somewhat above V, then $h_t > h_{t+1}$. So h_t falling. In the long run the economy moves to point V (h_c) where h_t is stuck to $h_c = \underline{h}$ - minimum level and this is the low level equilibrium. On the other hand if initial h_t is at somewhere below Z (i.e. $h_t < h^*$) then $h_t > h_{t+1}$. So h_t falls moving towards V (low level equilibrium). If initial h_t is somewhere above Z (i.e. $h_t > h^*$) then $h_t < h_{t+1}$.So h_t keeps on rising infinitely. Steady state growth at V is stable whereas steady state growth at Z is unstable.

[9] See Appendix.

h_c represents the value of h_t corresponding to low level equilibrium whereas h* represents the value of h_t corresponding to high level equilibrium.

Proposition 2: There exist two steady state equilibria. The low level equilibrium is stable whereas the high level equilibrium is unstable.

Individuals with $h_t < h_0$ do not send their children to school (i.e. $s_t=0$) and so do their descendants in all future generations. Children attain here only a minimum level of human capital i.e $\underline{h}$. Since we have assumed return from unskilled sector is higher than return from skilled sector for the individuals having human capital level $\frac{\beta_1 A\varphi[f\delta\underline{h}+A(1-f)]}{f\delta b\beta_2(A+A\varphi-p_c\underline{c})}$, so all these individuals will remain employed in unskilled sector generations after generations. Now for individuals having skill level between h_0 and h* send their children for partial schooling but not all their descendants will get opportunity to have even partial schooling because in the long run they will be driven towards the equilibrium point h_c where the equilibrium schooling is zero and their children will work full time as child labour. So this equilibrium (V) may be termed as child labour trap.

If education technology is highly or moderately efficient, i.e. $b\geq 1$, $\hat{h}$ is greater than h*. But if education technology is less efficient, i.e. $b<1$, then $\hat{h}$ will be less than h*.

$$\hat{h}=\frac{\beta_1 A\varphi[f\delta\underline{h}+A(1-f)]}{f\delta b[\beta_2(A-p_c\underline{c})-A\varphi\beta_1}$$

$$h^* = \frac{A\varphi[f\delta\underline{h}\beta_2-\beta_1 A(1-f)]}{f\delta[A\varphi(\beta_1+\beta_2)-\beta_2 b(A+A\varphi-p_c\underline{c})}$$

For $b\geq 1$, $h^*<\hat{h}$.However for $b<1$, $h^*>\hat{h}$ or $\hat{h}<h^*$[10].

In Figure i we show the case for $b\geq 1$ where $\hat{h} > h^*$.

If the parental human capital belongs to $[h^*,\hat{h}]$ and if education is efficient $[b>1,\hat{h}>h^*]$ then also they send their children for partial schooling but their descendants will be lucky to have steady growth of human capital. If education system is not that efficient $[b<1,\hat{h}<h^*]$ then parents having skill level $[\hat{h},h^*]$ will send their children for full schooling but their future generations will be driven back to child labour trap.

[10] See Appendix.

The individuals having human capital level belonging to [$\hat{h}$, h_N] range inspite of being employed in low skilled sector will send their children to school for full time. Their future generations will work as skilled labour. The individuals having human capital level above h_N themselves wish to be employed in skilled sector though there is no guarantee that they will get opportunity to be actually employed in skilled sector because of the existence of unemployment. But they send their children to school full time. So child labour problem does not exist for this category. Hence in this model, adults who work as skilled labour will never send their children for work.

Dynasties in this economy may be divided into two groups- dynasties with human capital above a critical level h*, where generation after generation there will be steady state growth of human capital and dynasties with human capital below that critical level, where generation after generation are stuck to low level of human capital.

When $\underline{c}$=0 i.e, even when households do not have to maintain subsistence consumption, then also the child labour trap arises. However if β_2=0, i.e. when parent's utility does not depend on expected earnings from child, then child labour trap ceases to exist. So the existence of child labour trap in the present paper critically depends on the dependence of parental utility on expected income of child.

When $\hat{h} > h^*$, parents with human capital level higher than h*(h_t>h*) but with $h_t < \hat{h}$ send their children for partial schooling but over time they will send their children for full schooling and in the long run there will be no child labour and they will face steady growth. However if $\hat{h} < h^*$, the families with initial human capital above $\hat{h}$ but below h* will send their children for full schooling but in future they will face no growth but retardation. Even they will converge towards low level equilibrium because of inefficiency of education technology.

Proposition 3: If education technology is very efficient or school quality is very good the families that send their children for full time schooling and also some families that send their children for partial schooling can surely escape from low level equilibrium trap.

Several studies point to the importance of school quality as an important determinant of schooling and work. However, school quality is virtually never measured directly. It is quite possibly the case that, when a family is poised to move children out of the workforce into school and fails to do so, the culprit is poor schools. Poor school quality is found to be

weakly important in rural Ghana (Lavy, 1996) and very important for Africa generally (Bonnet, 1993). It should be noted, though, that even if poor school quality lowers the value of formal education, there is an abundance of empirical evidence across Latin America, Africa and Asia that the return to education is still quite high and more than offsets the foregone income of children in school.

We can also consider the case where b>1 and $bs_t < 1$

This case is shown in the following figure:

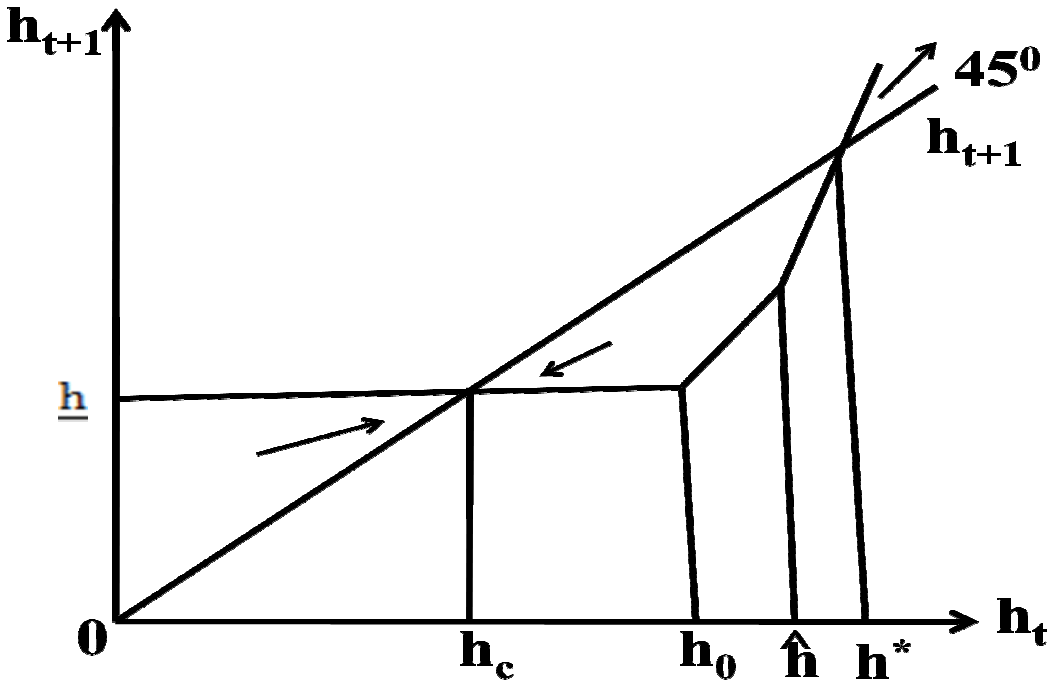

Figure 3

In this case we get two equilibria- h_c and h^*. The equilibrium at h^* is an unstable one. At h*every child goes for full schooling. But some families sending their children for full schooling may end up being stuck in low level equilibrium trap. We get a low level equilibrium trap in this case as well.

Proposition 4: When b >1 and $bs_t < 1$, at good equilibrium being unstable, all parents having human capital higher than h*send their children for full schooling and face positive human capital growth. But some parents having human capital level higher than $\hat{h}$ but lower that h* sending their child for full schooling will end up being stuck in low level equilibrium trap.

We can also consider the case where b<1 and $bs_t < 1$.

This case is represented by the following diagram:

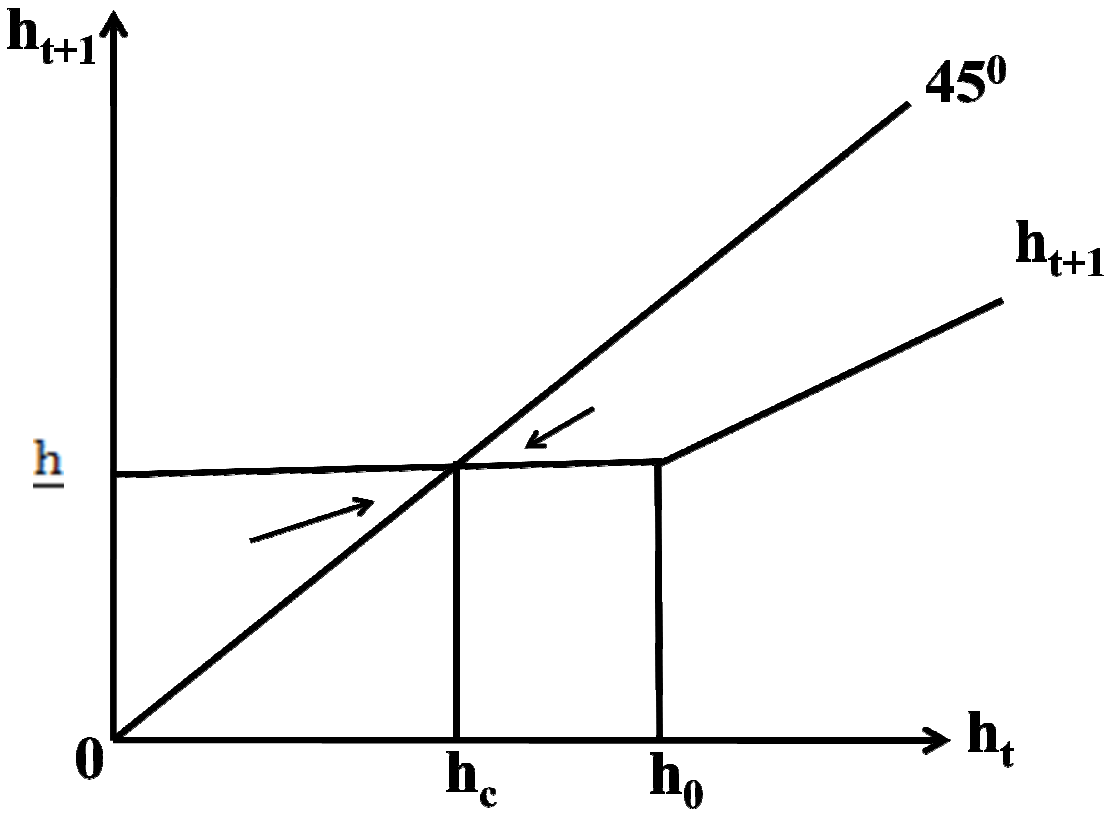

Figure 4

In this case we get unique stable steady state equilibrium h_c. Except child labour trap no other good equilibrium exists in this case.

Proposition 5: If education technology or school quality is poor the human capital of all children in economy converges towards minimum level of human capital. Good equilibrium does not exist anymore.

However, note that if $h_0 < \underline{h}$ then h_{t+1} curve will lie above 45^0 line throughout and there does not exist any bad equilibrium. Now $h_0 < \underline{h}$ implies $\frac{\beta_1 A\varphi[f\delta\underline{h} + A(1-f)]}{f\delta b\beta_2(A+A\varphi-p_c\underline{c})} < \underline{h}$.

If b,β_2, f are high and $p_c\underline{c}$ is low then the above is condition is likely to be satisfied. This implies that when school quality is good, individuals derive more utility from child's expected income compared to present consumption, unemployment rate is low, and subsistence consumption expenditure is less the economy may escape from bad equilibrium. Then all individuals in the society will face human capital growth rate.

Proposition 6: When school quality is good, individuals derive more utility from child's expected income compared to present consumption, unemployment rate is low, and subsistence consumption expenditure is less the economy may escape from bad equilibrium.

5. Effect of Child Labour Ban

We may also study the effects of child labour ban in our model. In our model $h_{t+1}= bs_th_t +\underline{h}$. So a child labour ban implies $h_{t+1}= bh_t +\underline{h}$. We consider two cases.

Case 1: b>1

The effects of ban in this case are shown in the following diagram:

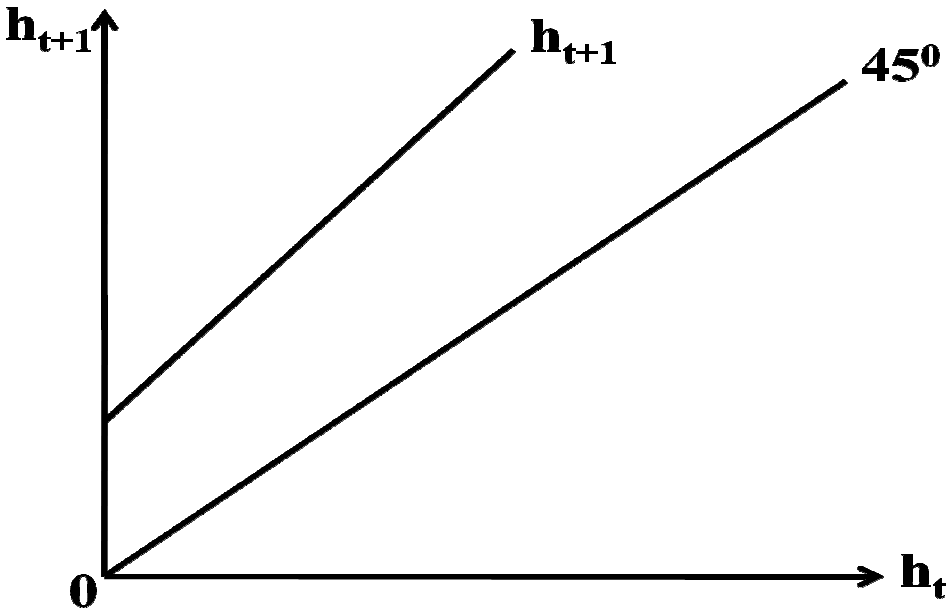

Figure 5

In this case we do not get any equilibrium if child labour is totally banned. However, all the individuals in the economy will face positive human capital growth rate.

Case 2: b<1

The effects of ban on this case are shown in the following diagram:

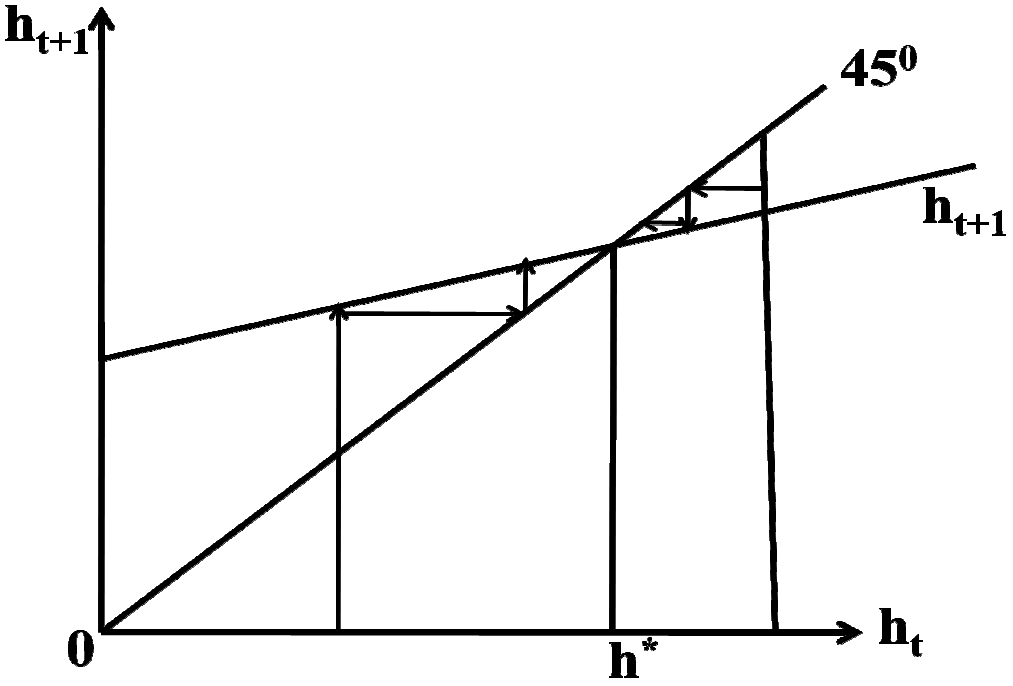

Figure 6

In this case we get unique stable steady state equilibrium of human capital (h^*). Child labour trap vanishes. Thus a child labour ban can be considered as a policy prescription to overcome the problem of child labour trap in this case.

6. Comparative Static Effects

Let us now study the effect of increase in the belief that the child will get employment in the skilled sector on the growth rate of human capital.

Let the growth rate of human capital $\frac{h_{t+1}}{h_t}$ be denoted by Ψ. Then,

$$\Psi=\frac{h_{t+1}-h_t}{h_t}=\frac{\beta_2\, f\delta b\left(A+A\varphi-p_c\underline{c}\right)-\frac{\beta_1 A\varphi[f\delta\underline{h}+A(1-f)]}{h_t}}{A\varphi f\delta(\beta_1+\beta_2)}+\frac{\underline{h}}{h_t}-1 \qquad (7)$$

Differentiating (7) with respect to f we have:

$$\frac{d\Psi}{df}=\frac{\beta_1 A}{h_t f^2\delta(\beta_1+\beta_2)}>0$$

This implies that higher is the belief that the child will get employment in the skilled sector in future, higher is the rate of growth of human capital. From the above result and result obtained from equation (6) we arrive at next proposition:

Proposition 7: There is positive relationship between the belief that the child will get employment in the skilled sector in the future and the schooling in the short run and the rate of growth of human capital in the long run.

Differentiating (7) with respect to δ we have:

$$\frac{d\Psi}{d\delta} = \frac{\beta_1 A(1-f)}{h_t \delta^2 f(\beta_1+\beta_2)} > 0$$

As δ captures the marginal return to human capital, an increase in δ results in an increase in schooling of the child. This in turn increases the growth rate of human capital formation.

Proposition 8: As the responsiveness of wage to human capital increases, schooling and rate of growth of human capital formation increase. If there is no unemployment then schooling hour and growth rate will be independent of responsiveness of wage to human capital (δ).

We also get the result that the necessary and sufficient condition for $\frac{d\Psi}{d\varphi} > 0$ is $p_c\underline{c} > A$[11]

If subsistence consumption expenditure of the household exceeds the wage earned by the adult from the unskilled sector, growth rate will increase only if child wage increases. This is because higher earnings by the child obtained by working the same number of hours, induce the parent to reduce the working hours of the child, necessary to meet subsistence consumption needs and instead increases the schooling hours of the child, which in turn increase the rate of growth of human capital formation. If subsistence consumption expenditure of the household is less than the wage earned by the adult from the skilled sector, schooling will increase even if child wage decreases. In this case contribution from the child labour of the family towards family income is no longer necessary to meet subsistence consumption. Now when child wage decreases substitution effect is stronger than income effect. Lesser earnings by the child obtained by working the same number of hours induce the parent to substitute the working hours of the child, by schooling hours which increases the rate of growth of human capital formation.

[11] For detailed derivation please see equation (A.11) of Appendix.

Proposition 9: Increase in child wage will increase schooling in the short run and growth rate in the long run only if subsistence consumption expenditure of the household exceeds adult income.

Moreover the necessary and sufficient condition for $\frac{d\Psi}{dA} > 0$ is $\beta_2 f\delta b p_c \underline{c} h_t > \beta_1 A^2 \varphi (1-f)$[12].

If subsistence expenditure, preference towards child's expected income, parental human capital, responsiveness of wage to human capital, parental belief that the child will get employment in skilled sector are high, then only increase in unskilled wage leads to increase in growth rate, otherwise, increase in unskilled wage may also lead to reluctance to join skilled sector and consequently willingness to acquire human capital and this may consequently retard growth rate. Note that if there is no unemployment increase in adult unskilled wage will result into increase in schooling and increase in growth rate.

Proposition 10: Increase in unskilled wage will increase growth rate only if $\beta_2 f\delta b p_c \underline{c} h_t > \beta_1 A^2 \varphi (1-f)$. However, if there is no unemployment, increase in adult unskilled wage will result into increase in schooling and increase in growth rate.

7. Concluding Remarks and Policy Prescriptions

This paper builds an overlapping generations household economy model and examines the impact of unemployment on child labour and the child's human capital formation through the expectation of adult regarding future employability. In this model, each household consists of one adult and one child. The adult is employed in the unskilled sector.[13] The child, on becoming adult may join the skilled sector or unskilled sector. If the child joins the skilled sector on becoming adult, she earns a wage proportional to her human capital while in the unskilled sector she earns a fixed return as an adult. The adult derives satisfaction from household consumption and expected earning of child. She forms expectations over whether she believes that the child will get employment in the skilled sector in the future. Human capital accumulation of the child depends on the time devoted to schooling by the child and human capital of the parent. The adult maximizes her utility by making decisions about consumption and time allocation of child between schooling and work. We have obtained

[12] For detailed derivation please see equation (A.12) of Appendix.

[13] It is shown that child labour problem does not exist for parents employed in skilled sector.

some interesting results. Increase in child wage will increase schooling in the short run and human capital growth rate in the long run only if adults earn less than subsistence consumption expenditure. In the short run, lower is the employment rate in the skilled sector, lower is the belief that the child will get employment in the skilled sector and therefore lesser is the time devoted to schooling by the child. Hence child labour increases and that result in lower growth rate of human capital in the long run. Increase in adult unskilled wage may or may not decrease child labour. But if there is no unemployment increase in adult unskilled wage will result into decrease in child labour and increase in schooling and growth rate. Individuals possessing human capital below a certain level do not send their children to school and if human capital exceeds that particular level then parents send their children to school but not all their descendants will remain educated in future generations. If return from unskilled sector exceeds the return that an individual, possessing minimum level of skill, will get from the skilled sector then all children undergoing partial schooling and even some children attending school full time will prefer to be employed in the unskilled sector on becoming adults as they know their earning potential is better in unskilled sector compared to skilled sector.

The model dynamics shows that there exist two equilibria in case of efficient education technology. The low level equilibrium (with low level of human capital) is stable whereas the high level of equilibrium (with high level of human capital) is unstable. It implies if initial human capital endowment is below a critical level, the economy is trapped in a low level equilibrium where human capital is stuck to very low level and there will be no growth. This equilibrium may be termed as child labour trap. On the other hand if initial human capital endowment is above that critical level, there will be steady state growth of human capital, parents will send their children for full time schooling and child labour will not exist anymore. This model dynamics also show that if education system is efficient the families that send their children to full time schooling and also some families that send their children for partial schooling can escape from low level equilibrium trap. But if the education system is relatively inefficient then some families who send their children for full time schooling may end up being at low level equilibrium. In case of very inefficient education technology there exists only one steady state equilibrium that represents child labour trap.

We also find that increase in child wage will increase schooling and human capital growth rate only if adults earn less than subsistence consumption expenditure; as the responsiveness

of skilled wage to human capital increases, schooling and rate of growth of human capital formation increase but if there is no unemployment then schooling hour and growth rate will be independent of responsiveness of wage to human capital; lower is the employment rate in the skilled sector, lesser is the time devoted to schooling by the child. Increase in unskilled adult wage may or may not decrease child labour. But if there is no unemployment increase in unskilled adult wage will result in decrease in the incidence of child labour and increase in schooling and rise in growth rate.

In our paper we have assumed that schooling of child does not involve any explicit cost. Relaxation of this assumption will alter some of the important results of the paper. Moreover we have not considered the existence of credit market in our model. Existence of credit market can have significant implication for child labour because in spite of parental altruism, child labour may be prevalent because of imperfect credit market. In our paper we have also assumed that parents expect present unemployment rate to prevail in the future and believes that the probability of her child not getting employment in skilled sector matches with this current unemployment rate. Thus we have assumed probability of being unemployed to be an exogenous variable. But unemployment probability has close connection with length of schooling. Individuals with higher educational levels have lesser chance of being unemployed than individuals with lower educational level. Thus unemployment probability may be determined within the model. All these may be considered for future research.

Our research has important policy implications. We study the effects of child labour ban both in case of efficient and inefficient education technology. In case of efficient technology all individuals in the economy will face positive human capital growth rate in case of child labour ban. In case of inefficient education technology, instead of multiple equilibrium there is unique steady state equilibrium of level of human capital though with no growth. In this case low level equilibrium trap vanishes due to child labour ban. Moreover government should undertake policies that make education system more effective so that employment rate in skilled sector increases. This will boost the confidence of adults and they will be more eager to send their children to school in expectation that the children will get employment in the skilled sector in future. Moreover to help the households to move out of the low level equilibrium trap to the high level equilibrium, parental human capital needs to be increased beyond the critical level h*, so that households reach the take off stage where growth keeps on increasing. To ensure this the most effective policy is compulsory schooling of adults. Our

research also suggests that if the education system is more efficient some adults who choose partial schooling for their children may also face steady growth rate of human capital and hence individuals in a society are more mobile across income classes. This will improve the adults' level of human capital which in turn will have positive impact on child's level of human capital. In this model if education technology improves (i.e. b increases) and minimum level of human capital possessed by the child ($\underline{h}$) increases then the h_{t+1} curve may shift up and the low level equilibrium trap may be avoided. Thus properly designed education policies involving compulsory schooling of adult can reduce the intergenerational transmission of low level of human capital and persistence of child labour trap.

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Appendix

The optimization problem of the household is to maximize

$$Z= \beta_1 \ln(c_t - \underline{c}) + \beta_2 \ln [f\delta(bs_th_t + \underline{h}) + (1-f)\, A] + \lambda [A + A\varphi\,(1-s_t) - p_c\, c_t] + \theta(c_t - \underline{c})$$

where λ is the Lagrange multiplier. The decision variables of the household are c_t and s_t. The first order conditions for maximization of utility are given by:

$$\frac{\delta Z}{\delta c_t} = \frac{\beta_1}{c_t - \underline{c}} - \lambda p_c + \theta = 0 \qquad \text{(A.1)}$$

$$\frac{\delta Z}{\delta s_t} = \frac{\beta_2 f\delta b h_t}{f\delta(bs_th_t + \underline{h}) + (1-f)\, A} - \lambda A\varphi = 0 \qquad \text{(A.2)}$$

$$\theta \geq 0,\ \theta\,(c_t - \underline{c}) = 0 \qquad \text{(A.3)}$$

From budget constraint $A + A\varphi\,(1-s_t) = p_c\, c_t$, we get

$$c_t = \frac{A}{p_c} + \frac{A\varphi\,(1-s_t)}{p_c} \qquad \text{(A.4)}$$

From (A.1) and (A.2) and using (A.4) we get,

$$s_{t=} \frac{\beta_2\, f\delta b h_t (A + A\varphi - p_c \underline{c}) - \beta_1\, A\varphi[f\delta \underline{h} + A(1-f)]}{A\varphi f\delta b h_t (\beta_1 + \beta_2)} \qquad \text{(A.5)}$$

$$\frac{ds_t}{d\delta} = \frac{\beta_1\, A^2\, \varphi(1-f)}{A\varphi f\delta^2 b h_t (\beta_1 + \beta_2)} \qquad \text{(A.6)}$$

$$\frac{ds_t}{d\varphi} = \frac{\beta_2\,(-A + p_c \underline{c})}{A\varphi^2 (\beta_1 + \beta_2)} \qquad \text{(A.7)}$$

$$\frac{ds_t}{d\beta_1} = \frac{-\beta_2\, f\delta b h_t (A + A\varphi - p_c \underline{c}) - \beta_2\, A\varphi f\delta \underline{h} - \beta_2\, A^2\, \varphi(1-f)}{A\varphi f\delta b h_t (\beta_1 + \beta_2)^2} \qquad \text{(A.8)}$$

$$\frac{ds_t}{dA} = \frac{\beta_2\, f\delta b p_c \underline{c} h_t - \beta_1\, A^2\, \varphi(1-f)}{A^2 \varphi f\delta b h_t (\beta_1 + \beta_2)} \qquad \text{(A.9)}$$

Let the growth rate of human capital $\frac{h_{t+1}}{h_t}$ be denoted by Ψ. Then,

$$\Psi = \frac{h_{t+1} - h_t}{h_t} = \frac{\beta_2\, f\delta b (A + A\varphi - p_c \underline{c}) - \frac{\beta_1 A\varphi[f\delta \underline{h} + A(1-f)]}{h_t}}{A\varphi f\delta (\beta_1 + \beta_2)} + \frac{\underline{h}}{h_t} - 1 \qquad \text{(A.10)}$$

$$\frac{d\Psi}{d\varphi} = \frac{\beta_2\, b(-A+p_c\underline{c})}{A\varphi^2(\beta_1+\beta_2)} \qquad (A.11)$$

$$\frac{d\Psi}{dA} = \frac{\beta_2\, f\delta b p_c\underline{c}\; h_t - \beta_1 A^2\varphi(1-f)}{A^2\varphi f\delta\, h_t(\beta_1+\beta_2)} \qquad (A.12)$$

$$\hat{h}- h^*=\frac{A\varphi}{f\delta}\left[\left\{\frac{f\delta\underline{h}\,\beta_1+\beta_1A(1-f)}{\beta_2 b(A-p_c\underline{c})-A\varphi\beta_1}\right\}-\left\{\frac{\beta_1A(1-f)-f\delta\underline{h}\beta_2}{\beta_2 b(A+A\varphi-p_c\underline{c})-A\varphi(\beta_1+\beta_2)}\right\}\right]$$

In the above expression, for b>1, the denominator of h* within third bracket> denominator of $\hat{h}$ within third bracket.

For b=1, the denominator of h* within third bracket= denominator of $\hat{h}$ within third bracket.

Numerator of h* within third bracket<numerator of $\hat{h}$ within third bracket.

Therefore for b≥1, h*<$\hat{h}$.

However for b<1, h*> $\hat{h}$ or $\hat{h}$ < h*.

$$h_N-\hat{h}= -\frac{A\varphi}{f\delta\beta}\left[\frac{(f\delta\underline{h}\,\beta_2-\beta_1A-\beta_2Af)\{\beta_2(A-p_c\underline{c})-A\varphi\beta_1\}+\beta_1\beta_2(A+A\varphi-p_c\underline{c})\{f\delta\underline{h}+A(1-f)\}}{\beta_2(A+A\varphi-p_c\underline{c})\{\beta_2(A-p_c\underline{c})-A\varphi\beta_1\}}\right]$$

$$= -\frac{A\varphi}{f\delta\beta}\left[\frac{\beta_2f(\beta_1+\beta_2)(A-p_c\underline{c})\{(\delta\underline{h}-A)-\beta_1A(\beta_1+\beta_2)A(1-\varphi)\}}{\beta_2(A+A\varphi-p_c\underline{c})\{\beta_2(A-p_c\underline{c})-A\varphi\beta_1\}}\right]$$

Now in the denominator within the third bracket of the above expression, $A+A\varphi-p_c\underline{c}>0$, otherwise we get the corner solution $s_t=0$. Again if $\beta_2(A- p_c\underline{c})<A\varphi\beta_1$, then $s_t=1$ i.e the case of no child labour. So we take $\beta_2(A- p_c\underline{c})>A\varphi\beta_1$.

If $A>\delta\underline{h}$, then the numerator within the third bracket of the above expression is negative.[If $A- p_c\underline{c}<0$, then $\beta_2(A- p_c\underline{c})-A\varphi\beta_1 <0$. Then we get the corner solution $s_t=1$ i.e. no child labour case. So we take $(A- p_c\underline{c})>0$].

Therefore $h_N-\hat{h}>0$ i.e. $h_N>\hat{h}$.