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ESSAYS IN DEVELOPMENT ECONOMICS

BY

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DISSERTATION

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# ABSTRACT

The idea that market and non-market processes function in ways that exacerbate initial differences in human capital and wealth, has been at the centre of economic theory for decades. Though there are a number of channels through which such intergenerational transmission of poverty and inequality may occur, economists have noted the importance of imperfect credit markets, fiscal policies, threshold externalities, mortality differentials and institutions. This thesis highlights some of these processes and concentrates on the theories of multiple equilibria. The thesis is divided into three parts. The first chapter deals with the relationship between human capital, child labour and mortality and shows how multiple equilibria may emerge. The second paper analyses the role of foreign aid in overcoming child labour traps. The final chapter analyses the role of political and economic institutions in FDI policies.

Chapter 1 identifies situations in which child labour is a temporary phenomena and situations in which it is not. The paper utilizes a three period OLG model with endogenous life expectancy and child labour, with both, private and public education systems. It is shown that under certain assumptions the evolution of child labour exhibits an “inverted-U” shaped pattern, suggesting that the problem of child labour is a temporary stage of economic development. In this case human capital inequalities are temporary. But the

results also show that under reasonable assumptions child labour may show long run persistence and human capital distribution may exhibit polarization. The novel feature of the paper is that it shows how the interaction between human capital and life expectancy is crucial to child labour dynamics and can create multiple equilibria.

Chapter 2 studies a model where multiple equilibria emerge in a model where mortality is exogenous but fertility and child labour decisions are endogenous. In a three period overlapping generations model with child labour, exogenous increases in child health endowments increase child labour and fertility. On the other hand, cash transfer and compulsory education funded through foreign aid have a negative effect on child labour. Foreign aid has a positive effects on fertility if cash transfers for child support are unconditional, and no effect if transfers are conditional on time spent in school. This result supports conditional cash transfer programs like the Brazilian *Bolsa Familia*.

The first two chapters show how variations in the initial levels of human capital lead to widely divergent long run outcomes. In the third chapter attention is shifted to a different type of initial condition, namely political and economic institutions. Both Brazil and India are important emerging economies and despite many similarities their approach towards foreign direct investment (FDI) has been markedly different. This chapter analyses the reasons behind this from a historical perspective. Following previous literature it is argued that historical experiences of the two nations exerted a lasting influence on economic policies followed by the two economies. In nineteenth century Brazil, initial industrial growth was closely related to in-

ternational trade and international finance. Further, for a number of reasons, entrepreneurs and policy makers were more open to foreign investments. In contrast, in India, colonization led to a negative perception with regards to foreign investment and as a result FDI played a limited role in the economy until the 1990's. Even in the neo-liberal era, though both economies have opened their economies to FDI, India continues to restrict its role and has followed a more gradualist approach.

*To Samyukta, My Parents and My Brother*

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# CHAPTER 1

## CHILD LABOUR, HUMAN CAPITAL ACCUMULATION AND MORTALITY

### 1.1 Introduction

It has been estimated that there are over 200 million child labourers across the world of which 115 million children are employed in hazardous industries. The idea of children working in sweatshops and in chemical industries is obviously ethically and morally abhorrent. Moreover, child employment can have deleterious effects on the economy as well. By displacing schooling, child employment can reduce human capital accumulation. On the other hand, it has been argued that children work because families are poor (Basu and Van 1998). In the absence of alternative sources of income, when capital markets are imperfect, child labour can potentially be the difference between survival and destitution. In such situations child employment provides families with additional income that may help them cope with poverty and even encourage investments in child quality (Dessy and Pallage 2004; Patrinos and Psacharopoulos 1997). Seen in this light policy makers are faced with a major trade off. On the one hand child labour may be harmful and absolutely immoral, but on the other hand it could just be an inevitable stage of the development process that societies have to bear with, at least in the short run.

Historians of child labour have noted how the industrial revolution in Eu-

rope was associated with massive increases in child labour. But eventually as the fruits of development trickled down to the average household and as family wages increased, the employment of children began to decline (Nardinelli 1980). Britain, which had some of the highest incidence of child labour in Europe, saw a sustained decline in child labour after 1870. Based on the historical record of advanced economies it may be tempting to think about child labour in contemporary developing economies as a temporary distortion, something that would be wiped out in the long run. A similar logic has been used by Krugman (1997) to make a case for allowing sweatshops in developing economies. In his view, though sweatshops are exploitative, they are temporary maladies associated with initial stages of economic development. Sweatshops are necessary evils that allow families to cope with poverty and any attempts at banning them may actually aggravate the problems faced by developing nations.

The powerful logic of these views cannot be ignored and policy makers have to contend with these trade offs in a careful manner. But it should also be noted that these opinions are based on an implicit assumption that economic modernization is inevitable, a view that was tremendously popular amongst development economists in the 1950's and 1960's. To Rostow (1990) the process of economic development was best understood as a sequence of "stages". He believed that in the incipient stages, economies start out as traditional societies and in this stage they face a variety of economic bottlenecks. But he also believed that the process of growth and development would eventually propel these traditional economies towards a phase of self-sustained growth and the distortions associated with traditional societies would disappear. Based on the experiences of developed economies, Kuznet

(1955) noted that a characteristic feature of *modern economic growth* was an “inverted-U” shaped pattern of inequality, in which temporary increases of inequality would be followed by greater equality in advanced stages of development. Similarly Keynes, though an ardent critic of markets, believed that with appropriate state intervention economic progress was inevitable. Writing in the early stages of the Great Depression, in an essay titled “Economic Possibility for our Grandchildren”, he says:

“All this means in the long run that mankind is solving its economic problem. I would predict that the standard of life in progressive countries one hundred years hence will be between four and eight times as high as it is to-day. There would be nothing surprising in this even in the light of our present knowledge. It would not be foolish to contemplate the possibility of a far greater progress still” (Keynes [1930]1932: 364-365).

In this paper we throw light on some of these complex questions. We attempt to identify situations in which child labour is a temporary phenomena and situations in which it is not. More specifically, we show that under certain assumptions the evolution of child labour exhibits an “inverted-U” shaped pattern, strongly supporting Krugman’s hypothesis that distortions like sweatshops and child labour are indeed temporary fallouts of economic development. But the results also show that under reasonable assumptions child labour may show long run persistence. To study these questions we construct a three period OLG model with endogenous mortality and child labour, with both, private and public education systems. In order to capture the trade off between child labour and human capital, we assume that the human capital of each agent consists of schooling and non-schooling inputs

(Fan 2004; Contreras 2008). This allows for child labour to have two contradictory effects on human capital: on the one hand it displaces schooling and reduces human capital, but on the other hand the additional income generated encourages investments in the non-schooling input.

In the first section of the paper, we study the evolution of human capital in an economy with homogeneous agents. In this case we find that optimal child labour and schooling are independent of parental human capital i.e. child labour is a persistent phenomenon even in the long run. In the absence of any endogenous mechanism to reduce child labour external interventions and regulations are the only way of ensuring that child labour declines. However, the impact of these regulations on human capital could be detrimental to the economy. In a publicly financed education system, child labour regulations improve human capital accumulation. However in a privately financed system the results change drastically and we find that child labour regulations may reduce human capital accumulation. From a policy perspective this indicates that unless anti-child labour policies are supported by public investments in education, economic development may be retarded.

In the second part of the paper we study the evolution of human capital in a model with heterogeneous agents. Agents differ from each other in terms of the initial human capital endowment. We introduce non-convexities in the mortality function to show how small initial differences can be amplified into polarization of the long run human capital distribution<sup>1</sup>. Thus

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<sup>1</sup>The non-convexity in the mortality function takes the form of a human capital threshold. Above a particular threshold parents are “sufficiently” healthy and allocate fewer resources towards their own health. But below the threshold parents are likely to spend a larger portion of their incomes on their own survival.

like in Chakraborti and Das (2005a, 2005b), mortality differentials can play an important role in perpetuating inequality. Here again the type of educational system plays a big role in determining the long run distribution of human capital. In a private education regime, inequalities can be persistent. In a public education system global externalities generated by public inputs form a link between various dynasties, so that human capital accumulation of richer households have a “trickle down” effect on poorer households (Galor and Tsiddon 1996, 1997). Thus inequalities could decrease in a public education system. As far as child labour dynamics are concerned there are two possible outcomes. Child labour could either exhibit an “inverted-U” shaped pattern or exhibit long run persistence.

There are three main contributions of this paper. First, this paper contributes to existing literature on inequality. Previous studies have shown how credit markets (Banerjee and Newman 1993; Galor and Zeira 1993), fiscal policies (Alesina and Rodrik 1994) or institutions (Acemoglu et al. 2001; Engerman and Sokoloff 2002) generate inequality. There is a growing literature which suggest that mortality differentials are an additional channel through which inequalities can be transmitted from one generation to the next (Castelló-Climent and Doménech 2008; Chakrabarti and Das 2005b). These studies however do not incorporate child labour dynamics into their analysis. Second, this paper shows conditions under which an “inverted-U” shaped pattern for child labour may emerge by isolating the impact of life expectancy on labour market decisions. Bar and Basu (2009) investigate a similar hypothesis for child labour but provide a different channel. In their study child labour may initially increase with landed wealth, but eventually intergenerational bequests rise sufficiently and put the economy on a low

child labour trajectory. Thirdly, the paper underscores the importance of public infrastructural spending in eradicating child labour. In this way it adds to existing literature on the relation between public spending and development (Tamura 1991; Glomm and Ravikumar 1992, 2003; De la Croix and Doepke 2004; Bhattacharya and Qiao 2007, Fioroni 2010 ).

## 1.2 The Model

Consider an OLG model with three periods: childhood, parenthood and old-age. In the first period agents are children. A child can either work ( $l_t$ ) or go to school ( $s_t$ ). The cost of sending a child to school is, thus, the opportunity cost of forgone child labour income. All such decisions are taken by the parent. We assume child labour is  $\gamma$  times as productive as adult labour (Basu and Van 1998). Thus when adult wages are  $w_t$  then children earn  $\gamma w_t$ . In the second period, the agents reach parenthood. Though all agents survive to adulthood with certainty, the survival to old age is uncertain. Adult agents must therefore decide on how much to spend on their own survival  $x_t$  (given an endogenous probability of survival  $\theta(x_t)$ ). In addition they must also decide on human capital investments of their children, which include child labour and schooling decisions. In old-age, agents derive utility from human capital of their children ( $h_{t+1}$ ). Following Bhattacharya and Qiao (2007) we suppose that an adult agent faces the following objective function:

$$\theta(x_t) \frac{h_{t+1}^{1-\sigma}}{1-\sigma} \quad \text{where } \sigma, \theta(\cdot) \in (0, 1) \quad (1.1)$$

We assume human capital accumulation depends on three inputs: (i) the amount of schooling each agent receives as a child ( $s_t$ ), (ii) non-schooling or

quality expenditures that agents receive as children,( quality expenditures may include things like provision of nutritious food, vaccinations, vitamin supplementation, adequate child health care or improving quality of education by opting for private tutors, for example.) and (iii) Parental human capital. Within this set up, quality expenditures may be financed privately or publicly. In a public education regime the government imposes a flat rate tax  $\tau$  to fund public expenditures. We assume the government balances budgets. The human capital production function can be written as:

$$h_{t+1} = (E_t^\eta e_t^{1-\eta})^\alpha (s_t)^\beta (h_t)^{1-\alpha-\beta} \quad \text{where } \alpha + \beta < 1; \alpha, \beta \in (0, 1) \quad (1.2)$$

Here  $E_t$  is the public input and  $e_t$  is the privately financed quality expenditure. To isolate the impact of public and private education systems we consider two cases. In one scenario  $\eta = 1$  i.e. child quality expenditures are entirely financed by the government and there is no scope for private investment (a public education system). In the second case  $\eta = 0$ , so that all quality expenditures are privately financed (a private education system). This production function is similar to the model in Glomm and Ravikumar (1992), Fan (2004) and Contreras (2008).

### 1.2.1 The Public Education System: $\eta = 1$

Consider the first scenario in which government taxes adult agents at a rate  $\tau$ . In this case  $E_t = \tau w_t h_t$  The production of human capital is given by:

$$h_{t+1} = (E_t)^\alpha (s_t)^\beta h_t^{1-\alpha-\beta} \quad (1.3)$$

In this case, the optimization problem is:

$$\underset{x_t, s_t}{\text{maximize}} \quad \theta(x_t) \frac{h_{t+1}^{1-\sigma}}{1-\sigma}$$

s.t.

$$x_t = w_t h_t (1 - \tau) + w_t h_t \gamma (1 - s_t) \quad (1.4)$$

$$h_{t+1} = (E_t)^\alpha (s_t)^\beta (h_t)^{1-\alpha-\beta} \quad (1.5)$$

$$s_t + l_t = 1, \quad \gamma > 0 \quad (1.6)$$

The budget constraint ((1.4)) indicates parent's spending on their own survival which is financed by their own incomes net of taxes and income generated from child labour. Note that children are  $\gamma$  times as productive as adults. Thus child labour and adult labour are substitutable (Basu and Van 1998). The human capital function is given by (1.5). (1.6) denote standard constraints. In order to ensure a solution exists we suppose that the elasticity of survival function  $\theta$  with respect to health expenditure (which we denote by  $\epsilon$ ), is less than  $\sigma$  (Lemma 1, Bhattacharya and Qiao 2007). From the above equations and the optimization problem we obtain the following FOC's:

$$s_t : -\theta'(x_t) w_t h_t \gamma \frac{h_{t+1}^{1-\sigma}}{1-\sigma} + \theta(x_t) \beta E_t^\alpha s_t^{\beta-1} h_t^{1-\alpha-\beta} h_{t+1}^{-\sigma} = 0 \quad (1.7)$$



Using the FOC, together with the budget constraint and the elasticity equation  $\epsilon = \frac{\theta'(x_t)x_t}{\theta(x_t)}$  we obtain the following optimal solutions:

$$x_t = \frac{w_t h_t (1 + \gamma - \tau) \epsilon}{\epsilon + \beta(1 - \sigma)} \quad (1.8)$$

$$s_t = \frac{(1 + \gamma - \tau)(1 - \sigma)\beta}{\gamma(\epsilon + \beta(1 - \sigma))} \quad (1.9)$$

Substituting the above optimal solutions into the human capital equation, we get:

$$h_{t+1} = \Delta^1 (h_t)^{1-\beta}, \text{ where } \Delta^1 = (\tau w_t)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1 - \sigma)(1 - \tau + \gamma)}{\epsilon + \beta(1 - \sigma)}\right)^\beta \quad (1.10)$$

For a range of parametric values  $\Delta^1 (h_t)^{1-\beta}$  is concave. A trivial and non-trivial steady state ( $h^{PU}$ ) exist. Moreover since child labour ( $1 - s_t$ ) is simply a function of parameters, it persists even in the long run. This implies that there is no endogenous mechanism that alleviates the child labour problem and that external interventions like bans and sanctions may be required. Following Fan (2004) we measure the impact of anti-child labour regulations by  $\gamma$ . The intuition is that regulations that penalize the use of child labour end up reducing relative productivity  $\gamma$ . From our derivation above we can see that as  $\gamma$  decreases, parents find it increasingly attractive to send children to school rather than to work. This suggests that government regulations against child labour (by decreasing  $\gamma$ ) are likely to decrease child labour and augment human capital. This result is formally stated below.

**Proposition 1** *The degree of substitutability between adult and child labour,  $\gamma$ , is inversely related to schooling  $s_t$  and the steady state human capital  $h^{PU}$  i.e.  $\frac{dh^{PU}}{d\gamma} \leq 0$  and  $\frac{ds_t}{d\gamma} \leq 0$*

*Proof: Follows from the solutions found above.*

There has been substantial discussion regarding the impact of harsh anti-child labour regulations, and our results suggest that these interventions can improve human capital. But as we shall see below, this result is sensitive to the type of educational regime being analysed.

### 1.2.2 The Private Education System: $\eta = 0$

Now let us analyse the second possible scenario in which child quality expenditures are entirely privately financed. This implies that the human capital production function is:

$$h_{t+1} = (e_t)^\alpha (s_t)^\beta h_t^{1-\alpha-\beta} \quad (1.11)$$

The optimization problem is similar to the previous case except that now there is no state involvement. The modified problem can be restated as:

$$\underset{x_t, e_t, s_t}{\text{maximize}} \quad \theta(x_t) \frac{h_{t+1}^{1-\sigma}}{1-\sigma}$$

s.t.

$$x_t + e_t = w_t h_t + w_t h_t \gamma (1 - s_t) \quad (1.12)$$

$$h_{t+1} = (e_t)^\alpha (s_t)^\beta (h_t)^{1-\alpha-\beta} \quad (1.13)$$

$$0 \leq e_t \leq 1, s_t + l_t = 1, \gamma > 0 \quad (1.14)$$

Notice that the budget constraint indicates that a parent's spending on their own survival and on the quality of their child is financed by adult and child labour incomes. The FOC's give us:

$$e_t : -\theta'(x_t) \frac{h_{t+1}^{1-\sigma}}{1-\sigma} + \theta(x_t) \alpha e_t^{\alpha-1} s_t^\beta h_t^{1-\alpha-\beta} h_{t+1}^{-\sigma} = 0 \quad (1.15)$$

$$s_t : -\theta'(x_t) w_t h_t \gamma \frac{h_{t+1}^{1-\sigma}}{1-\sigma} + \theta(x_t) \beta e_t^\alpha s_t^{\beta-1} h_t^{1-\alpha-\beta} h_{t+1}^{-\sigma} = 0 \quad (1.16)$$

Using the budget constraint, the FOC's and the equation for elasticity of the survival function  $\epsilon = \frac{\theta'(x_t)x_t}{\theta x_t}$  we obtain the following optimal solutions:

$$x_t = \frac{(1+\gamma)w_t h_t \epsilon}{\epsilon + (\alpha + \beta)(1-\sigma)} \quad (1.17)$$

$$s_t = \frac{(1+\gamma)(1-\sigma)\beta}{\gamma(\epsilon + (\alpha + \beta)(1-\sigma))} \quad (1.18)$$

$$e_t = \frac{(1+\gamma)w_t h_t (1-\sigma)\alpha}{\epsilon + (\alpha + \beta)(1-\sigma)} \quad (1.19)$$

Like the previous case, optimal schooling is independent of parental human capital  $h_t$ . Moreover, while schooling is negatively related to the degree of adult labour-child labour substitution ( $\gamma$ ), both  $e_t$  and  $x_t$  are positively associated with it. We may conclude that child labour income is complementary to child-quality expenditures and adult health expenditures. The human capital accumulation law can be re-written as:

$$h_{t+1} = \Delta^2 (h_t)^{1-\beta} \quad \text{where} \quad \Delta^2 = (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma)}{\epsilon + (\alpha + \beta)(1-\sigma)}\right)^{\alpha+\beta} \quad (1.20)$$

For plausible parameters, the function  $\Delta^2 (h_t)^{1-\beta}$  is concave and there is

one non-trivial steady state solution for the above dynamic system ( $h^{PV}$ ). An important difference between the private and public education systems is the relationship between  $\gamma$  and the steady state human capital. In a private education model a child's participation in the labour market though detrimental to schooling, can be counterbalanced by an increase in child quality spending, as long as  $\gamma$  is big enough. In other words, the extra resources generated by child labour income ensures that a child's labour force participation is complementary to human capital growth (for a high enough value of  $\gamma$ ). This result is formalized in the next proposition:

**Proposition 2** *The relation between  $\gamma$  and the child schooling ( $s_t$ ) and steady state human capital ( $h^{PV}$ ) can be summarized as:*

$$\frac{dh^{PV}}{d\gamma} \begin{matrix} \geq \\ \leq \end{matrix} 0 \Leftrightarrow \gamma \begin{matrix} \geq \\ \leq \end{matrix} \frac{\beta}{\alpha} \quad \text{and} \quad \frac{ds_t}{d\gamma} \leq 0 \quad (1.21)$$

*Proof: Follows from the solutions found above.*

In LDC's where the labour market is restricted to low skilled occupations (textiles, gems and jewellery, agriculture etc.) one may expect relative child productivity,  $\gamma$ , to be high. In such cases, government regulations against child labour, partial bans and sanctions, would hurt the economy. To put it differently anti-child labour policies would improve human capital only if they are backed by a public education system. In the absence of such a public funded system, reductions in  $\gamma$  may diminish human capital.

### 1.3 Discussion

In development economics there is a substantial literature on the relation between child endowments and human capital (Becker and Tomes 1976; Behrman Pollak and Taubman 1982). It has been argued that child endowments (skills, abilities etc.) are important determinants of parental investments in child quality. In general, a parent may follow three types of investment strategies: compensating (If parents invest more in those children who have smaller endowments), reinforcing (If parents invest more in those children who have larger endowments) and neutral (If a parent's investment is equal across children irrespective of their endowments)<sup>2</sup>. Obviously the type of strategy pursued has a crucial impact on the child's future human capital.

In a model with private expenditures, we find that parents follow a compensating investment policy for plausible values of  $\gamma$ . Children with better labour productivity (lower schooling ability) receive lesser schooling. But the resulting child labour income allows parents to compensate this by spending on child quality. Another way of understanding this result is to look at the FOC's in (1.15) and (1.16). An increase in child labour income allows parents to spend more on their own health, thereby increasing their probability of survival to old-age. By increasing the patience parameter (and hence decreasing the marginal utility from an additional unit of health expenditure), parents are more willing to spend on their child's future human capital. In contrast, under a publicly financed system parents follow a re-enforcing strategy of investment. Children with better productivity (lower schooling ability) are

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<sup>2</sup>See Behrman Pollak and Taubman 1982 for a discussion.

forced to devote a larger share of their time allocation towards work ( $1 - s_t$ ). But unlike the previous case this does not bring about any compensating increase in child quality expenditures. A combination of these two forces results in lower human capital for children with higher labour productivity (lower schooling ability).

It is clear from the model that there are differences in how a child is valued in the economy. That these differentials may depend on, amongst other things, cultural and social perceptions should also be stressed. To take an example, it has been argued that women in many Asian and African countries suffer from lower standards of living than men. Amartya Sen had famously argued that this general neglect of women in Asia and Africa meant that “more than 100 million women were missing” due to excess mortality. The results obtained above provide one channel through which this gender differential arises. In LDC’s social and cultural norms imply a particular division of labour in which women are generally involved in unpaid home production, while males are generally employed in “productive”, wage earning occupations like farming etc. These differences in productivity (or at least what is perceived as being productive), could very well result in lower human capital for women if, for instance, parents compensate more “productive” male children with better quality expenditures than female children. What is important to understand is that these differences are not just a result of differences in natural endowments but also a result of complex social and cultural norms including traditional male-female divisions of labour. In an empirical study, Barcellos et al. (2012) find evidence that parents tend to invest more on male children than on female children. Thus not only do male children receive greater child care they also receive better vitamin sup-

plementation, vaccinations etc.

To illustrate our point let us develop a simple extension of our models presented above, for an economy with heterogeneous agents. Following Cardak (1999), we assume that the heterogeneity in this model could stem from two sources: (a) from differences in the initial human capital distribution and (b) because children differ from each other in terms of the parameter  $\gamma$ . Assume the  $\gamma$  is independent of the initial distribution of human capital<sup>3</sup>. For the sake of brevity we shall analyse a private education model<sup>4</sup>. To simplify our analysis let us suppose that there are two types of households ( $N = 2$ ): those with initial endowment  $(\gamma^H, h_{H,0})$  and those with  $(\gamma^L, h_{L,0})$ , where  $\gamma^H > \gamma^L$ . As before, in a private education regime each parent need to decide on child schooling ( $s_{it}$ ), child quality investments ( $e_{it}$ ) and their own health expenditures ( $x_{it}$ ). From the results obtained earlier, the optimal human capital accumulation for type  $i$  under a private education regime is:

$$h_{i,t+1} = (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma^i}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma^i)}{\epsilon + (\alpha + \beta)(1-\sigma)}\right)^{\alpha+\beta} (h_{i,t})^{1-\beta} \quad (1.22)$$

In order to understand the determinants of inequality let us define  $g_t = \frac{\bar{h}_{t+1}}{\bar{h}_t}$  and define per capita human capital as  $\bar{h}_t = \frac{(h_{H,t} + h_{L,t})}{2}$ . Following Fioroni (2010) we can define relative human capital as:

$$\hat{h}_{i,t} = \frac{h_{i,t}}{\bar{h}_t} \quad (1.23)$$

But this implies  $\hat{h}_{L,t+1} = 2 - \hat{h}_{H,t+1}$ . The relative human capital for high and

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<sup>3</sup>Thus both pecuniary and non-pecuniary factors influence the dynamics of inequality.

<sup>4</sup>The same procedure can be applied in an identical fashion to a public education system

low types can be written as:

$$\hat{h}_{H,t+1} = \frac{h_{H,t+1}}{\bar{h}_{t+1}} = \frac{1}{g_t \bar{h}_t^\beta} (w_t \alpha)^\alpha \left( \frac{\beta}{\gamma^H} \right)^\beta \left( \frac{(1-\sigma)(1+\gamma^H)}{(\epsilon + (\alpha + \beta)(1-\sigma))} \right)^{\alpha+\beta} (\hat{h}_{H,t})^{1-\beta} \quad (1.24)$$

$$\hat{h}_{L,t+1} = 2 - \hat{h}_{H,t+1} = \frac{1}{g_t \bar{h}_t^\beta} (w_t \alpha)^\alpha \left( \frac{\beta}{\gamma^L} \right)^\beta \left( \frac{(1-\sigma)\beta(1+\gamma^L)}{(\epsilon + (\alpha + \beta)(1-\sigma))} \right)^\beta (\hat{h}_{L,t})^{1-\beta} \quad (1.25)$$

Taking the ratio of the above equations we get:

$$\frac{\hat{h}_{H,t+1}}{2 - \hat{h}_{H,t+1}} = \left( \frac{\frac{(1+\gamma^H)^{\alpha+\beta}}{(\gamma^H)^\beta}}{\frac{(1+\gamma^L)^{\alpha+\beta}}{(\gamma^L)^\beta}} \right) \left( \frac{\hat{h}_{H,t}}{2 - \hat{h}_{H,t}} \right)^{1-\beta} \quad (1.26)$$

The distributions of human capital for the two types diverge and inequality is persistent as long as  $\gamma^H \neq \gamma^L$ . To see this, suppose that  $\gamma^H = \gamma^L$ . Under this assumption, the dynamic system (1.26), reduces to:

$$\hat{h}_{H,t+1} = \frac{2}{\left[ \frac{2}{\hat{h}_{H,t}} - 1 \right]^{1-\alpha-\beta} + 1} \quad (1.27)$$

We provide a basic sketch the dynamics of this system, though an interested reader may refer to Fioroni (2010) for a detailed proof. Clearly (1.27) has two steady states at 0 and 1 where the steady state at 1 is stable. But at the higher steady state of 1, since  $\hat{h}_{H,t+1} = 2 - \hat{h}_{L,t+1}$ , the human capital of low-type and high type households converge to the same point. In other words, when  $\lambda^i = \lambda$  for all  $i$ , then the long run distribution of human capital becomes degenerate and inequality disappears:

$$\lim_{t \rightarrow +\infty} h_{i,t+1}(h_{i,t}, \lambda) = h^{PV} \quad \forall i, i = 1, 2, \dots, N$$

The examples above, though extremely simple, point to the multi-dimensional nature of the child labour problem: inequalities emerge even if the two house-



holds begin at the same initial wealth level,  $w_0h_0$ . Here the divergence is entirely generated by non-pecuniary factors. This obviously has important implications for targeting vulnerable households since purely monetary measures might turn out to be poor indicators of vulnerability. In that sense, the inter-relationship between wealth and non-wealth factors is absolutely crucial in understanding and framing policies aimed at regulating child labour and improving human capital of a nation<sup>5</sup>. One possible policy that could reduce inequality would be a cash transfer program. If households with vulnerable children could be targeted, in the long run one could expect inequalities to disappear.

## 1.4 Human Capital Inequality and Externalities

The process of economic development generates uneven processes that aggravate inequality but can also produce counteracting compensatory forces that ameliorate inequalities. Under conditions of perfect competition traditional growth models predict convergence in the long run. However, in the past few decades economists have begun to study conditions under which long run distributions exhibit polarization. It is argued that when capital markets are imperfect and markets exhibit threshold effects, initial levels of wealth dictate long run outcomes. When access to credit is limited, agents who find themselves below a particular threshold could be stuck in poverty traps, while others may escape this fate. In this section we shall briefly study an economy with heterogeneous agent and analyse the dynamics of inequalities in the presence of threshold effects in the mortality function. Following Galor and Tsiddon (1996, 1997) we show that a combination of neighbourhood ef-

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<sup>5</sup>See Fors (2012) for a discussion and survey

fects, thresholds and non-existent credit markets generate inequalities which can be persistent.

Consider an economy with individuals defined by a measure  $N$ . Denote the initial distribution of human capital by  $G_0(h_{i0})$ . Following Bhattacharya and Qiao (2007), we assume that the probability of survival for agent  $i$  depends on a private input  $x_{it}$  and an externality  $\psi(\cdot)$  which is a function of human capital. More specifically, the survival probability is:

$$\theta(x_{it}, h_{it}) = \begin{cases} b\bar{\psi}x_{it}^{b\bar{\psi}} & \text{if } h_{it} \geq \tilde{h} \\ b\psi(h_{it})x_{it}^{b\psi(h_{it})} & \text{if } h_{it} < \tilde{h} \end{cases} \quad (1.28)$$

Here  $b$  is a constant while  $\psi(h_{it})$  is an externality arising from the local home environment. This implies that the elasticity of health expenditures can be written as:

$$\epsilon = \frac{x_{it}\theta'}{\theta} = \begin{cases} b\bar{\psi} & \text{if } h_{it} \geq \tilde{h} \\ b\psi(h_{it}) & \text{if } h_{it} < \tilde{h} \end{cases} \quad (1.29)$$

We assume:

$$b\psi(h_{it}) \in (0, \sigma), \quad \psi(0) = \psi^0 > 0, \quad \psi(\infty) = \psi^{Max} < \infty, \quad \psi^0 > \bar{\psi} \text{ and } \psi'(h_{it}) > 0. \quad (A1)$$

In previous studies on child labour, low level poverty traps emerge due to non-convexities in utility functions (Basu and Van 1998) or production func-

tions (Hazan and Berdugo 2002; Chakrabarti and Das 2005b). In contrast this paper points towards a third possibility: non-convexities in mortality functions that arise due to the presence of (local) health externalities. This approach is closely related to Chakrabarti and Das (2005b) who also analyse the impact of non-convexities in mortality on inequality. The mechanism that generates persistence of inequality here may be explained as a combination of two factors: First, local externalities in the form of parental human capital affects a child's human capital (a) directly, by appearing as an input in the human capital production function, (b) but also indirectly, by affecting the mortality function. Second, the impact of the local externality on the mortality function takes the form of a threshold that we have described above. For households with low human capital, adult health is more responsive to any increase in health spending i.e. elasticity of the life expectancy function is high. This means that the additional utility derived from consumption of health expenditure throttles investment in human capital, condemning the entire household to a low level poverty trap. Household with higher human capital derive lower returns from health and thus transfer larger resources to human capital development. In this way low human capital and poor health can combine to produce persistent inequalities. Of course there is no necessary reason why inequalities ought to be persistent. Below, we discuss various cases that can emerge.

Denote the human capital dynamics in public and private regimes by  $h_{it+1}^{PU} = B(h_{it}^{PU})$  and  $h_{it+1}^{PV} = A(h_{it}^{PV})$  respectively. In the set up outlined here, if household incomes lie below some critical threshold, the elasticity of mortality with respect to health expenditures is increasing in human capital. On the other hand, households that are fortunate enough to

lie above this threshold have constant elasticity rates. Since human capital is inversely related to the elasticity of the mortality function, richer households end up spending larger amounts on their children's human capital. In a private regime, the dynamics are:

$$h_{it+1}^{PV} = A(h_{it}^{PV}) = \begin{cases} \Delta^2 (h_{it}^{PV})^{1-\beta} & \text{if } h_{it}^{PV} \geq \tilde{h} \\ \tilde{\Delta}^2 (h_{it}^{PV})^{1-\beta} & \text{if } h_{it}^{PV} < \tilde{h} \end{cases} \quad (1.30)$$

Where  $\Delta^2 = (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma)}{b\bar{\psi} + (\alpha + \beta)(1-\sigma)}\right)^{\alpha+\beta}$  and

$$\tilde{\Delta}^2 = (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma)}{b\psi(h_{it}^{PV}) + (\alpha + \beta)(1-\sigma)}\right)^{\alpha+\beta}.$$

Similarly, in a public regime, the dynamics are:

$$h_{it+1}^{PU} = B(h_{it}^{PU}) = \begin{cases} \Delta^1 \bar{h}_t^\alpha (h_{it}^{PU})^{1-\alpha-\beta} & \text{if } h_{it}^{PU} \geq \tilde{h} \\ \tilde{\Delta}^1 \bar{h}_t^\alpha (h_{it}^{PU})^{1-\alpha-\beta} & \text{if } h_{it}^{PU} < \tilde{h} \end{cases} \quad (1.31)$$

Where  $\Delta^1 = (\tau w_t)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1-\tau+\gamma)}{(b\bar{\psi} + \beta(1-\sigma))}\right)^\beta$  and

$$\tilde{\Delta}^1 = (\tau w_t)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1-\tau+\gamma)}{(b\psi(h_{it}^{PU}) + \beta(1-\sigma))}\right)^\beta$$

Notice that this also means that child labour increases for  $h_{it}^j < \tilde{h}$  ( $j = PU, PV$ ) but above this threshold it drops to some constant. As in Bhattacharya and Qiao (2007), there is a distinct possibility of non-monotonic

dynamics. But for what follows, we will only analyse cases where this is not so i.e. we assume that there is a positive relation between human capital of parents and children (Becker and Tomes 1986). This can be ensured by choosing a suitable functional form for  $\psi(h_{it}^j)$ <sup>6</sup>. In the dynamical systems above depending on the values of  $\tilde{h}$ ,  $B(h_{it}^{PV})$  and  $A(h_{it}^{PU})$  could have multiple equilibria or a unique one. The following proposition clarifies the human capital dynamics. Let  $h^{jP}$  and  $h^{jR}$  denote low level and high level steady states. The dynamics of human capital are summarized by the following proposition:

**Proposition 3** *In both public and private education regimes, if the adult mortality function given in (2.9) satisfies (A1), then the human capital accumulation equation for dynasty  $i$  ( $j = PU, PV$ ) could have :*

- *Multiple steady states (two non-trivial steady states and one trivial unstable equilibrium)*

$$\lim_{t \rightarrow +\infty} h_{it}^j = \begin{cases} h^{jR} & \text{if } h_{it}^j \geq \tilde{h} \\ h^{jP} & \text{if } h_{it}^j < \tilde{h} \end{cases}$$

- *A unique low-level human capital trap such that:*

$$\lim_{t \rightarrow +\infty} h_{it}^j = h^{jP}$$

- *A unique high-level human capital equilibrium such that:*

$$\lim_{t \rightarrow +\infty} h_{it}^j = h^{jR}$$

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<sup>6</sup>If the elasticity of  $\psi$  is sufficiently small then  $\frac{dh_{t+1}}{dh_t}$  will always be positive.

*Proof:* See Appendix.

Figures 1.1, 1.2 and 1.3 show these possibilities for the  $i$ th dynasty. This proposition suggests that distributional dynamics can be extremely complicated. Intuitively, with multiple equilibria there is a tendency towards polarization, while with a unique equilibrium inequalities are temporary. We discuss these distributional dynamics in the following section.

### **Distributional Dynamics and the Evolution of Child Labour**

With a unique steady state, there is convergence in the long run. With multiple equilibria there are a number of complexities that arise and in some cases the distribution does exhibit polarization. To illustrate the distributional dynamics with multiple equilibria consider a simple illustration. Let us begin with a private education regime. Following Galor and Tsiddon (1996, 1997) let's assume that there exist two classes of agents: Rich agents who begin with  $\tilde{h}$  amount of capital, and poor agents who start below the threshold, say at  $h^{jP}$ <sup>7</sup>. Let  $L_t^P$  and  $L_t^R$  be the number of poor and rich agents at time  $t$ . Starting from  $t = 0$ , rich agents continue to invest in human capital until they converge towards the high level steady state  $h^{jR}$ . On the other hand poorer agents who begin with an initial human capital of  $h^{jP}$ , have no incentive to invest (since they are already at a equilibrium). It is evident therefore that the steady state distribution is marked by a polarization of

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<sup>7</sup>In other words richer agents begin in the basin of attraction of the high level equilibrium while poorer agents begin at the low level equilibrium.

human capital:

$$\lim_{t \rightarrow +\infty} G_t(h_{it}^{PV}) = \begin{cases} h^{PV,R} & \text{with mass of } L^{*R} \\ h^{PV,P} & \text{with mass of } L^{*P} \end{cases}$$

In the public education regime, though the local externality generates polarization, there is an additional force at work. The public input into education serves as a global externality that connects poor and rich dynasties. If this global externality is strong enough, it may result in a “trickle down” effect as benefits of human capital flow down from richest to poorest households. To understand the role of the public input, let us take an extreme example. Assume that the public input takes the following form:

$$E_t = \begin{cases} \delta_2 & \text{if } \bar{h}_t \geq \tilde{h} \\ \delta_1 & \text{if } \bar{h}_t < \tilde{h} \end{cases} \quad \text{where } \delta_2 > \delta_1$$

The equation above shows that as average human capital crosses a threshold, public input jumps from a lower to a higher value. Though extremely simple, this example brings out the basic role of the public input. Figure 1.5 shows possible dynamics of human capital. The figure depicts two paths of human capital. The lower curve which we denote by  $h(h_t, \delta_1)$  is associated with a lower level of public expenditure. If average human capital lies above the threshold, then the relevant dynamics are given by  $h(h_t, \delta_2)$ . As before let us think of a situation in which at time zero,  $L^P$  poor agents find themselves at the point  $h^{jP}$ . It is clear that they have no incentive to invest in human capital. On the other hand richer agents with initial wealth  $\tilde{h}$  accumulate wealth and begin to converge to  $h^{jR}$ . So even if  $\bar{h}_0 < \tilde{h}$ , it is still possible that at some finite time  $t^* > 0$ , the average human capital,  $\bar{h}_{t^*}$  may come to

exceed the threshold. If this happens, the entire human capital curve shifts upwards to  $h(h_t, \delta_2)$  and the low level steady state disappears. If this shift was to occur poorer families would begin to accumulate human capital and over time inequalities would reduce.

Unlike the previous case with homogeneous agents, in the modified model, child labour becomes a function of parental human capital and therefore is no longer a constant. This generates explicit dynamics for child labour. If there exists a unique equilibrium then two possibilities arise. If the unique equilibrium is  $h^{jR}$  then child labour increases at initial stages of development but begins to decline at later stages. Figure 1.4 depicts this situation for multiple thresholds in the survival function. The curve initially increases, reaches a maximum and eventually starts declining in step like functions. This resembles an “inverted-U” shaped pattern, something that has been observed in the empirical study of Basu, Das and Dutta (2010). On the other hand if the unique equilibrium is  $h^{jP}$ , child labour is persistent even in the long run. With multiple equilibria, child labour is higher amongst poorer dynasties and there is no trend towards an “inverted-U” shaped pattern both at an individual level and at an aggregate level. Here the role of global externalities become crucial. In a public education regime, the “trickle down” effect may eliminate the low level equilibrium and an “inverted-U” shaped pattern might emerge in the long run. The impact of school quality on reducing child labour has been confirmed by (Ray 2003). The novel aspect of these results is that human capital drives these varied dynamics through its impact on life expectancy.



## 1.5 Child Labour: A Temporary Stage of Development?

In the model without heterogeneity child labour is a function of parameters and is completely independent of household wealth. Though this seems unrealistic at the first glance, what the results suggest is that there maybe no endogenous economic mechanisms that generate reductions in child labour. Thus external interventions and anti-child labour legislations may have an important role to play in eliminating child labour. Historically, child labour was rampant in 19th century Britain and United States, but state intervention against child employment (Factory Acts in Britain, Compulsory Education laws in United States) had a decisive impact in bringing children into schools and away from the labour market. Nonetheless household child labour decisions cannot be completely independent of household characteristics. Therefore household wealth, parental human capital levels and most importantly, adult life expectancy, may all be crucial elements. It is well known that Europe witnessed significant reductions in child labour in the last half of the 19th century. Cunningham (1996) and Humphries (2003) note that child labour in Britain declined, though in a somewhat erratic fashion, from 1850 onwards, with a strong downward trend from 1870 onwards. The rise in life expectancy on the other hand seems to have pre dated the reductions in child labour (Cutler et al. 2006). If true, this suggests that life expectancy and child labour may have exhibited the sort of pattern that our results support: initial increases in life expectancy could have been compatible with high levels of child labour, but sustained improvements in life expectancy could have eventually decreased child employment. Of course, whether a similar logic is applicable to contemporary developing nations is a

complex question, though as we have noted, economists like Paul Krugman seem to agree with the “inverted-U” shaped hypothesis. Empirical studies on this issue provide mixed evidence<sup>8</sup>. Basu, Das and Dutta (2010) confirm the existence of an “inverted-U” shaped relation between child labour and landed wealth. Using data from Indian states, Kambhampati and Rajan (2006) support the hypothesis (with respect to income). On the other hand, drawing on data from western India Swaminathan (1998) finds that child labour increases with income growth. The model outlined above provides explanations for these conflicting results.

## 1.6 Conclusion

This paper studies the interrelation between human capital, child labour and adult mortality. The results show that local externalities and threshold effects in the mortality function can lead to multiple equilibria. As a result initial inequalities in human capital generate mortality differentials, which in turn cause long run polarization of the distribution. Thus differences in life expectancy can be a crucial channel through which inequality and poverty are transmitted across generations. While local externalities are specific to a particular household, global externalities form a connection across households, thereby counteracting the process of polarization. In a public education regime the public input performs the function of a global externality. If the compensatory effect emanating from the public input is strong enough, long run distribution does not exhibit polarization even in the presence of thresholds in the mortality function.

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<sup>8</sup>See Fors (2012) for a survey

These results also indicate that life expectancy is a crucial determinant of child labour decisions. Less educated parents face a higher risk of mortality and are more likely to send children to work than to school. Thus there is a possibility for poorer families to get stuck in a child labour trap. Families with high initial human capital can escape this fate. On the other hand, under certain conditions the interaction of human capital and life expectancy could also generate an “inverted-U” shaped pattern of child labour i.e. initial stages of development are marked by an increase in child labour while later stages witness a decline. The novel contribution of the paper is to show how the “inverted-U” pattern emerges because of the interaction between life expectancy and parental human capital.

From a policy perspective our analysis suggests that child labour could be a persistent phenomenon in which case concerted efforts by the state and other agencies to reduce child employment may be required. Policy interventions could take two forms: Legislative and punitive policies aimed at directly penalizing the use of child labour (like bans and penalties of various sorts) or investments in public infrastructure aimed at improving returns from schooling. The first sort of policy is, in itself, unlikely to enhance human capital. However when combined with public investments, punitive actions against child labour may enhance human capital. In a model with heterogeneous agents and threshold externalities, public inputs could play an important role in distributing the benefits of growth to the entire economy thereby reducing child labour and long run inequality.

# 1.7 Figures

Figure 1.1

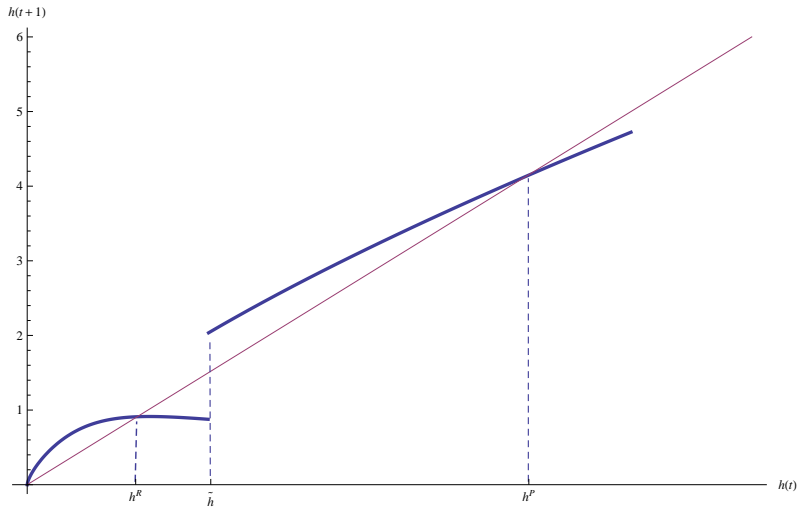


Figure 1.2

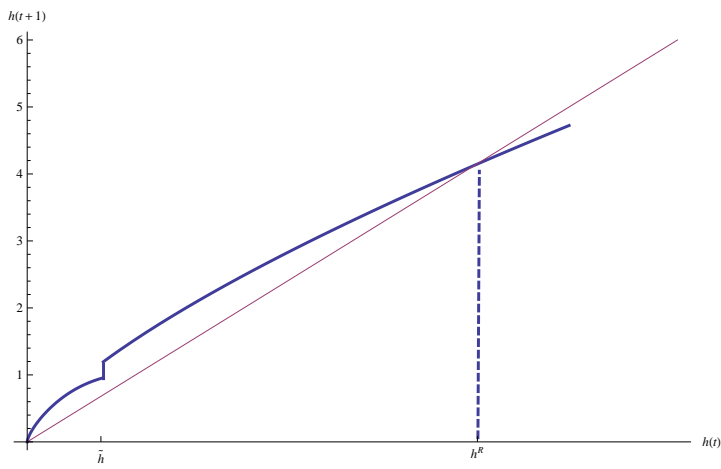


Figure 1.3

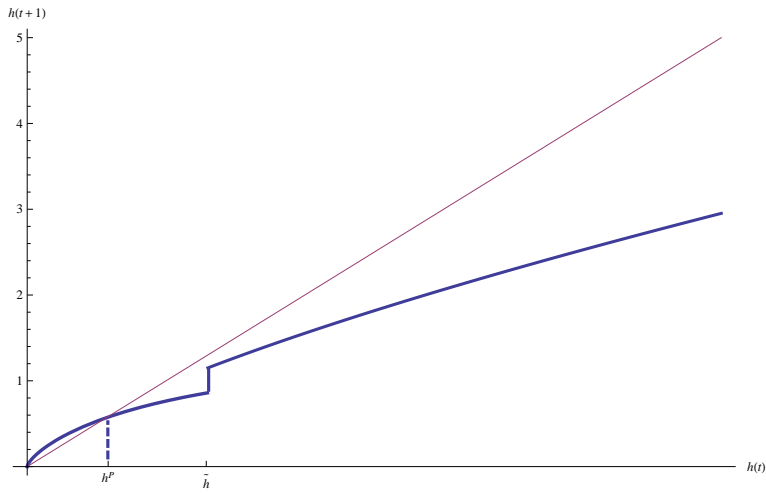


Figure 1.4

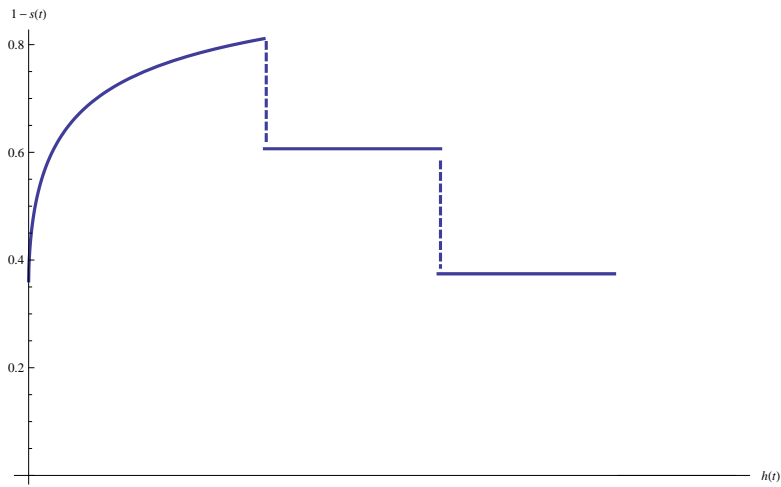
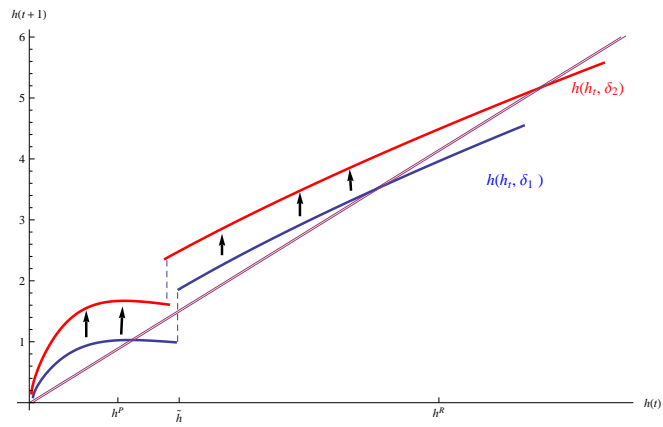


Figure 1.5



## CHAPTER 2

# CHILD LABOUR, HUMAN CAPITAL ACCUMULATION AND FOREIGN AID

### 2.1 Introduction

Child labour today is a global phenomenon. The importance and pervasiveness of child labour in our world today can be judged by the fact that 12 percent of children between the ages of 5 and 14 are employed as child labourers. At a disaggregated level the trends are less than comforting. Between 2004 and 2008 child labourers in the 5-14 year category declined from over 170 million to around 152 million. The number of child labourers in the 15-17 year category, however, have increased from 52 million in 2004 to 62 million in 2008 (Diallo et al. 2010). Facts regarding children employed in hazardous occupations reveals that in 2008 a large portion of child labourers continue to be employed in hazardous industries.

It is clear that substantial progress has been made in reducing child labour, but the dimensions of the problem continue to be daunting. Given the enormity of the issue, a large literature on child labour has emerged. This paper is closely related to a particular strand of this literature that concentrates on the interrelationship between fertility, mortality and child labour. Chakraborty and Das (2005a) analyse child labour in an old age security model where adults face mortality risks. Mortality risks translate into a lower discount on future consumption, making poorer parents less likely

to invest in child quality. Strulik (2004) analyzes a model with endogenous fertility and educational decisions, where high levels of child mortality may lead to stagnation of the economy. Eswaran (2000) and Baland and Estevan (2007) analyse an old age security set up with young adult mortality to model child labour under imperfect markets<sup>1</sup>.

Historically, most mortality reductions have occurred at early stages of life (Kalemli-Ozcan 2008). Given this fact, the relationship between infant mortality (as opposed to young adult mortality or adult mortality) and child labour becomes all the more relevant. This paper introduces infant mortality into an old age security model similar to Chakraborty and Das (2005). Following Doepke (2005) and Azarnert (2006) we assume decisions regarding schooling and child labour are made *ex-post* i.e. after mortality risks have occurred. In that sense infant mortality may be interpreted as a health endowment. The crucial feature of an old age security model is that children are a source of future income. Parents must then decide whether to invest in child quality by increasing schooling which leads to greater human capital in the future, or to invest in child quantity by increasing fertility. Poor parents have large families and send their children to work rather than to school. At very low levels of parental human capital, child labour traps might emerge.

If child labour is a detriment to economic progress, then its elimination has to become an integral aspect of economic policy. On the one hand, market forces themselves have proven to be potent forces in reducing the demand for child labour. Technological progress and increased competition, in 19th century Britain and United States, forced employers to replace the labour of

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<sup>1</sup>Baland and Estevan (2007) do not endogenize fertility decisions.

children with the more skilled and more productive labour of adults. In the British textile industries for instance, the introduction of steam power in the early 19th century led to a decrease in the recruitment of children (Nardinelli 1980). In the United States too, the use of mechanical pickers in coal mines lead to substantial reductions in child employment (Hindman 2002). On the other hand, active state intervention and regulation has also helped in controlling child labour. Examples of such intervention include abolition of child labour, minimum age restrictions, compulsory education supported by cash transfer schemes etc. British Factory acts of 1833, the National Recovery Act of 1933 in the United States are important examples of successful anti-child labour legislations (Humphries 2003). What was true in the nineteenth century is also true for modern developing countries. Brazil's *Bolsa Escola* programme, Mexico's *Progresas* or South Korea's compulsory education drives have played a significant role in getting children into schools (Weiner 1991, Schultz 2004).

In addition to the factors described above, growing international activism against child labour has begun to play a significant role in modern day policy making. In this context there is a growing debate about the role of international agencies and developed countries in reducing child employment (Jafarey and Lahiri 2002, Neumayer and de Soysa 2005, Kitaura 2009, ILO 2010). Since a large share of development spending in LDC's is being financed by foreign sources, the link between child labour and foreign aid needs to be carefully analysed. In this paper we analyse the effectiveness of foreign aid in tackling child employment. We find that cash transfers and compulsory education systems funded via foreign aid, can play an important role in the elimination of child labour.



Broadly speaking, this paper points to some important implications for policies that are designed to eliminate child labour. Previous literature has supported the hypothesis that improvements in health are sufficient to reduce child labour. In contrast, this paper shows that the relation between health and child labour is far more complex and that improvements in human capital are more likely to generate powerful incentives to eliminate child labour. Similar results have been obtained by Azarnert (2006) and Acemoglu and Johnson (2007) though in a different context. These findings point to the substantial role that can be played by direct and concerted policies like conditional cash transfers and compulsory education laws, especially when they are funded by foreign aid. These findings are in stark contrast with studies (like Azarnert 2008) which have found foreign aid funded cash transfers to be detrimental to human capital accumulation.

## 2.2 The Environment

Consider a three period OLG model. During the first period, agents spend their time endowments on schooling ( $e_t$ ) and on child labour ( $l_t$ ). During the second period, adult agents spend their time endowments on child-care and on labour market participation. In this model fertility is endogenously determined by the adult.  $z_1$  denotes the cost per birth. Note that a child plays a passive role in this model. Schooling and child labour decisions are taken entirely by adults. Moreover, as we have mentioned earlier, schooling and child labour decisions are taken ex-post i.e. after mortality has occurred (Azarnert 2006, Doepke 2005). In the third period, old agents receive a share

of their children's human capital as old age security.

We denote the probability of survival by a function  $P(\cdot)$ . To simplify analysis we assume that the survival rate is exogenously given<sup>2</sup>. Human capital of an adult depends on the schooling he received as a child. The human capital production function is given by a simple linear function (Chakraborty and Das 2005a):

$$H_{t+1} = H(e_t) = \gamma(1 + e_t), \quad \gamma > 0 \quad (2.1)$$

Note that this production function assumes that each individual is endowed with at least one unit of human capital at birth, irrespective of the amount of schooling received. The old-age security structure in Chakraborty and Das (2005a) implies that surviving children donate  $\alpha$  of their adult incomes to the elders in the family.

### 2.2.1 Fertility and Schooling Choice

Each adult solves the following utility maximization problem:

$$\underset{e_t, n_t}{\text{maximize}} \quad U(c_t) + \beta U(c_{t+1})$$

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<sup>2</sup>Like in Azarnert (2006), we could endogenize infant survival, by making it a function of parental human capital and child cost  $z_1$ , but this would not change the results of this paper.

s.t.

$$c_t = w(1 - e_t)n_tP + (1 - \alpha)(1 - z_1n_t)H_t \quad (2.2)$$

$$c_{t+1} = \alpha P n_t H_{t+1} \quad (2.3)$$

$$0 \leq e_t \leq 1, n_t \geq 1, e_t + l_t = 1, w > 0 \quad (2.4)$$

The period 1 budget constraint consists of two components: child labour income and adult income. Adult and child wage rates are given by  $\gamma$  and  $w$  respectively. Old-age consumption depends on the transfers made by adults to the elderly, which implies that  $n_t \geq 1$ . In addition we make the following assumption:

$$w < \gamma; \quad (A1)$$

(A1) ensures adult labour is more productive than child labour, thus ensuring that returns to education are high enough. Maximising the objective function with respect to the constraints set out above we obtain the following F.O.C's:

$$n_t : [w(1 - e_t)P - (1 - \alpha)z_1H_t]U'(c_t) + \beta\alpha PH_{t+1}U'(c_{t+1}) \leq 0 \quad (2.5)$$

$$e_t : -wn_tPU'(c_t) + \beta\alpha n_tP \frac{dH_{t+1}}{de_t}U'(c_{t+1}) \leq 0 \quad (2.6)$$

From this it follows:

$$\frac{U'(c_t)}{\beta U'(c_{t+1})} \geq \frac{\alpha P H_{t+1}}{(1-\alpha)H_t z_1 - wP(1-e_t)} \equiv R_t^n \quad (2.7)$$

$$\frac{U'(c_t)}{\beta U'(c_{t+1})} \geq \frac{\alpha \gamma}{w} \equiv R_t^e \quad (2.8)$$

The R.H.S of (2.7) and (2.8) are the returns to fertility ( $R^n$ ) and schooling ( $R^e$ ) respectively. They show the cost of future consumption relative to current consumption. In Chakraborty and Das (2005a: 275) increases in adult survival rates imply that “Healthier parents who expect to live longer behave more patiently and are more willing to substitute toward old-age consumption. The way they do so is by investing in their children’s future productivity.” As soon as we introduce infant mortality into the model things change dramatically. An exogenous increase in  $P$ , reduces the fertility costs incurred by adults and increase future utility derived from children i.e. returns to fertility are increasing in  $P$ .

Assuming  $U(.) = \ln(.)$ , the optimal schooling and fertility decisions are given by:

$$e_t = \begin{cases} \frac{\beta-1}{1+\beta} + \frac{\beta}{1+\beta} \frac{1-\alpha}{wP} (1-z_1)H_t & \text{if } e_{t-1} \geq \tilde{e} \\ 0 & \text{if } e_{t-1} < \tilde{e} \end{cases} \quad (2.9)$$

$$n_t = \begin{cases} 1 & \text{if } e_{t-1} > \tilde{e} \\ \frac{\beta}{1 + \beta} \frac{(1 - \alpha)H_t}{(1 - \alpha)H_t z_1 - wP} & \text{if } e_{t-1} < \tilde{e} \end{cases} \quad (2.10)$$

Where  $\tilde{e}$  is determined by setting  $R^e \leq R^n$  and  $e_t = 0$ . Simplifying we get  $\tilde{e} = \left(\frac{2wP}{(1-\alpha)z_1\gamma}\right) - 1$ .

The optimal schooling and fertility decisions imply that when parental schooling is below  $\tilde{e}$ , children are not schooled at all and fertility rates are greater than 1. Above  $\tilde{e}$ , fertility is at its lowest value. Notice that in this case schooling is a normal good, so that increases in the income of parents increases its demand.

There are two additional facts that are worth noting. First, schooling in (2.9) is positively related to  $\gamma$  (adult wage) and negatively relate to  $w$  (child wage). Increases in relative child wages ( $\frac{w}{\gamma}$ ) increases the opportunity cost of studying, in terms of foregone child labour income and thus discourages schooling<sup>3</sup>. Second, like Azarnert (2006) our model predicts that an exogenous increase in  $P$  might reduce the time spent in school and increase fertility rates<sup>4</sup>. Since child survival is already observed by parents before they make schooling decisions, one possible interpretation of  $P$  is that it is a

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<sup>3</sup>Basu and Van (1998) refer to the substitutability between adult and child labour as *the substitutability axiom*.

<sup>4</sup>Acemoglu and Johnson (2007: 975) conduct an empirical investigation into the relationship between life expectancy and GDP growth have conclude that “There is no evidence that the increase in life expectancy led to faster growth of income per capita or output per worker. This evidence casts doubt on the view that health has a first order impact on economic growth.” This anomaly is explained in terms of the impact of life expectancy on population: As life expectancy increases so does the population size and this reduces growth at least in the short run.

child health endowment. Thus the above results suggest that parental investments in children vary inversely with child health endowments i.e. parents compensate children who are worse off in terms of their health, with more schooling. This could be interpreted as a “preference for equality”<sup>5</sup>. This relationship can be summarized by the following proposition:

**Proposition 4** *Under the assumption (A1) and given equations (2.9) and (2.10), an exogenous increase in the health endowment of a child:*

1. *Increases the incidence of child labour (decreases schooling time) and leaves fertility unchanged if parental schooling is greater than  $\tilde{e}$ .*
2. *Leaves child labour unchanged but increases the fertility rate if parental schooling is below  $\tilde{e}$ .*

*Proof* The proof follows from optimal fertility and schooling decisions in (2.9) and (2.10) above.

Notice that the proposition does not rule out the possibility that improvements in  $P$  - through some endogenous mechanism- could alleviate the child labour problem. The results only suggest that exogenous increases in  $P$  are insufficient to generate such changes. To understand the point, let us assume that  $P$  is actually endogenous. Following Azarnert (2006), let us endogenize the mortality risk function as follows:

$$P(H_t) = \begin{cases} 1 & \text{if } H_t \geq \tilde{H} \\ (H_t)^\delta & \text{if } H_t < \tilde{H} \end{cases} \quad (2.11)$$

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<sup>5</sup>See Behrman, Pollak and Taubman (1982) for a discussion

Where  $P(H_t)$  is an increasing function of  $H_t$ . Substituting this function into (2.9) we see, that as each generation becomes more educated, infant mortality declines until the economy reaches a point where it becomes zero ( $P$  becomes unity). What is important is that the reductions in child labour are not driven directly by increases in infant mortality, but by increases in human capital.

In recent times there has been a proliferation of philanthropic initiatives aimed at child welfare (The Gates Foundation is one such example). In light of the above findings these policy makers and activists need to contend with intricate behavioural responses of poor families while designing and executing welfare policies. Improving health is an important end in itself and ought to be a crucial component of development policies. However the results suggest that these policies in themselves cannot replace direct and concerted efforts at reducing child employment. Two important insights can be drawn from the results presented above. First, since schooling is a normal good, an exogenous increase in family income (funded by foreign aid for instance) should increase schooling and thus decrease child labour. However, the implications of such measures on schooling and fertility decisions will depend largely on the incentives -mediated via complex income and substitution effects- that it generates. Second, the results suggest that increases in human capital constitute the primary driving force behind reductions in child labour. This implies that human capital augmenting policies like compulsory schooling laws could be extremely effective in tackling the problem of child labour. These insights form a background to our subsequent analysis of policy interventions.

## 2.3 Child Labour and Compulsory Education: The Role of Foreign Aid

The elimination of child labour has a long and complex history. In the 19th and 20th centuries, the problem of child labour in Britain and United States was so severe that its elimination became a priority amongst legislators, abolitionists and trade unions alike. Anti-child labour legislations - from outright bans on child labour to minimum age restrictions - became an integral part of child labour eradication strategies across these countries. A popular and effective anti-child labour legislation was compulsory schooling. The experiences of both Britain and the United States confirm the success that these policies have had in reducing child labour (Stambler 1968, Weiner 1991, Hindman 2002).

Compulsory schooling, though directed at improving a nation's human capital, has an indirect effect on child labour by effectively reducing its supply. In countries with large informal sectors harsher restrictions like bans or international sanctions tend to *in-formalize* child labour, making children more rather than less vulnerable in the long run (Humphries 2003). Examples are numerous. In the early 20th century, the child labour abolition movement in America had reached a fever pitch. Shifting industrial production directly to the homes of poor families provided a convenient way for employers to make use of child labour without facing any liabilities associated with it (Hindman 2002). More recently, in 1996, Bangladeshi child labourers were forced into hazardous occupations (including prostitution) after the garments industry fired a number of them under the threat of international boycotts (UNICEF 1997).



The success of compulsory education however, depends on a host of factors, including a sound legal system that is capable of enforcing laws, public awareness about the importance of education, effective educational infrastructure, etc. Additionally, in countries where education is unaffordable or returns to private education are too low, an effective policy would require additional subsidies to augment household incomes making schooling more attractive. Resources for such a massive effort can come from a variety of sources. In recent years foreign aid has become an important source of funding development projects. Foreign aid directed towards education is now an important part of foreign aid flows. DAC countries for instance have increased annual aid flows by 1332 percent between 1993-1996 and 2002-2004 (Asiedu and Nandwa 2007). Foreign aid has been particularly effective in reducing child labour and increasing schooling in Africa (ILO 2010).

This section analyses the role of foreign aid and cash transfers in tackling child labour. Following Azarnert (2008), we assume that total foreign aid  $F_t$  can be spent in two forms: a cash transfer conditional on the number of children i.e. a child support scheme ( $T_t$ ) or as an investment in the public education system ( $G_t$ ) that guarantees a certain mandatory level of education  $\mu_t$ . This implies:

$$F_t = T_t n_t P + G_t \tag{2.12}$$

Compulsory education effectively reduces child labour participation rates by an amount  $1 \geq \mu_t \geq 0$ . Even though it is not entirely realistic, we assume laws are enforced without any transaction costs. The human capital

technology is given by a simple linear function:

$$H_{t+1} = \gamma(1 + \mu_t + e_t). \quad (2.13)$$

The technology is linear in private education  $e_t$  and the compulsory education level  $\mu_t$ . This is similar to the human capital production function adopted by Azarnert (2010) in the sense that this technology treats private education and compulsory education as substitutes. The optimization problem for an adult agent becomes:

$$\underset{e_t, n_t}{\text{maximize}} \quad U(c_t) + \beta U(c_{t+1})$$

s.t.

$$c_t = w(1 - \mu_t - e_t)n_tP + (1 - \alpha)(1 - z_1n_t)H_t + T_t n_t P$$

$$c_{t+1} = \alpha P n_t H_{t+1}$$

$$0 \leq e_t \leq 1 - \mu_t, \quad n_t \geq 1, \quad e_t + l_t = 1 - \mu_t$$

Assuming  $U(\cdot) = \ln(\cdot)$ , the optimal schooling and fertility decisions are<sup>6</sup>:

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<sup>6</sup>Subject also, to the time constraint  $1 - z_1 n_t \geq 0$

$$e_t = \begin{cases} \frac{\beta}{1+\beta} \left( \frac{T_t}{w} + \frac{1-\alpha}{wP} (1-z_1) H_t \right) + \frac{(\beta-1)}{(1+\beta)} - \mu_t & \text{if } e_{t-1} \geq e^{**} \\ 0 & \text{if } e_{t-1} < e^{**} \end{cases} \quad (2.14)$$

$$n_t = \begin{cases} 1 & \text{if } e_{t-1} \geq e^{**} \\ \frac{\beta}{1+\beta} \left( \frac{(1-\alpha)H_t}{(1-\alpha)H_t z_1 - T_t P - wP(1-\mu_t)} \right) & \text{if } e_{t-1} < e^{**} \end{cases} \quad (2.15)$$

Where  $e^{**} = \frac{2wP+T_tP}{(1-\alpha)z_1\gamma} - 1 - \mu_{t-1}$ . The optimal solutions lead us to the following proposition:

- Proposition 5**
1. *Above  $e^{**}$  and for a given  $\mu_t$ , an increase in child support transfers ( $T_t$ ) reduce the incidence of child labour. These transfers do not affect fertility which are at their lower bound.*
  2. *Below  $e^{**}$  and for a given  $\mu_t$ , an increase in child support transfers ( $T_t$ ) increases fertility.*
  3. *Below  $e^{**}$  foreign aid funded compulsory education ( $\mu_t$ ) decreases fertility.*

*Proof* Follows from the optimal schooling and fertility decisions.

The positive relation between education aid and schooling is supported by a number of studies (Dreher, Nunnenkamp and Thiele 2008, ILO 2010). Interestingly, unlike the model of foreign aid funded schooling in Azarnert (2008), here cash transfers to households in the form of child support, increases human capital by increasing schooling at least for those households where parental education is above  $e^{**}$ , even while increasing fertility for the lower income classes. This makes it difficult to judge the efficacy of such

policies since fertility increases are often associated with higher dependency ratios. Fertility increasing effects of foreign aid, however, need not necessarily be interpreted as a failure of foreign aid policies as long as educational attainment is increasing. Nag (1980: 580), for instance argues that:

“In making predictions about fertility and in evaluating the fertility impact of any development or family-planning program, the fertility-increasing effects of modernization are often overlooked. The tendency of the fertility level to remain the same or even to rise should not necessarily be interpreted as a failure of a development program to generate any demand for birth control or of a family-planning program to provide any effective service”.

Note that, child subsidies distort the income distribution:  $e^{**}$  increases with  $T_t$ . In contrast compulsory education ( $\mu_t$ ) leaves  $e^{**}$  unchanged. It is also worth noting that an increase in  $P$  lowers human capital by reducing private schooling  $e_t$ , but has no effect on  $\mu_t$ . This implies that if health interventions are supplemented by compulsory education, then the negative relation between human capital and  $P$  disappears.

Having said this, it must be noted that the impact of aid on child labour and fertility crucially depends on the way aid policies are designed. In the example above the impact of cash transfers can be very different if they are made conditional on child schooling, i.e.  $F_t = G_t + T_t e_t n_t P_t$ . Here cash transfers to families depend on the time spent by children in school. In this case the optimal solutions for schooling and fertility are (under the

assumption  $w > T_t$ ):

$$e_t = \begin{cases} \frac{\beta}{1+\beta} \left( \frac{w(1-\mu_t)}{w-T_t} + \frac{(1-\alpha)}{(w-T_t)P} (1-z_1)H_t \right) - \frac{(1+\mu_t)}{1+\beta} & \text{if } e_{t-1} \geq \hat{e} \\ 0 & \text{if } e_{t-1} < \hat{e} \end{cases} \quad (2.16)$$

$$n_t = \begin{cases} 1 & \text{if } e_{t-1} \geq \hat{e} \\ \frac{\beta}{1+\beta} \frac{(1-\alpha)H_t}{(1-\alpha)H_t z_1 - wP(1-\mu_t)} & \text{if } e_{t-1} < \hat{e} \end{cases} \quad (2.17)$$

Where  $\hat{e} = \frac{2wP-T_tP(1+\mu_t)}{(1-\alpha)z_1\gamma} - 1 - \mu_{t-1}$ . Notice that though cash transfers no longer effect fertility they continue to have a positive impact on schooling<sup>7</sup>. Our results suggest that the effect of foreign aid on schooling and fertility finally depends on the economic incentives that it generates. Once cash transfers are made conditional on schooling adult agents have a greater incentive to increase schooling without distorting their fertility decisions. Moreover,  $\hat{e}$  is decreasing in both the cash transfer,  $T_t$  and compulsory education,  $\mu_t$ . Previous empirical studies have shown that conditional cash transfer schemes are effective in reducing child employment (Schultz 2004, Miller and Tsoka 2012). The results presented above support this claim.

## 2.4 Conclusion

This paper has investigated the relationship between child labour and foreign aid in a model with infant mortality and endogenous fertility. The results show that exogenous increases in health endowments alone, cannot

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<sup>7</sup>Analysing enrolment and fertility data, Schultz (2004) observes that conditional cash transfers increase schooling without affecting fertility. Zhang(1997) analyses the impact of tax financed school subsidies and finds that these policies reduce fertility and increase human capital

increase child schooling. These results suggest that the goal of eradicating child labour can be better served through policies that directly confront barriers to human capital accumulation and schooling. Foreign aid could have an important role to play in this regard. In particular, cash transfers and compulsory education funded through foreign aid have a negative effect on child labour. The impact of foreign aid on fertility however, depends on the way the welfare program is structured. Cash transfers that are conditional on the time spent in school, do not affect fertility while unconditional cash transfers in the form of child support have a positive effect on fertility.

## CHAPTER 3

# FDI IN BRAZIL AND INDIA: A COMPARATIVE ANALYSIS

### 3.1 Introduction

The relationship between institutions and economic development has been at the center of development economics since the times of Adam Smith. Recently there has been a resurgence of interest in this area. North (1991, p. 97) defines institutions as “humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions and codes of conduct), and formal rules (constitutions, laws, property rights)”. Given the inherent uncertainty and complexity of modern economies, appropriate economic institutions make markets more efficient. This is also the case of foreign direct investment (FDI), as has been stressed in the literature (Dunning 1998, Görg 2005, Busse and Hefeker 2007, Meon and Sekkat 2007, Seyoum 2011).

For those who believe that “institutions matter”, two questions emerge: How do alternative institutional arrangements affect the quality and pace of economic development? How do such institutions emerge in the first place? The answer to the first question may be obtained by comparing alternative experiences. The answer to the second question requires a historical perspective. It is within this framework that we present a comparative analysis of Brazil and India’s past and recent experiences with FDI.

Acemoglu, Johnson and Robinson (2001, 2002, 2005) investigate the impact of colonialism on institutional and economic development of nations. They argue that the biggest impact of colonialism was on economic institutions. In settler colonies, the colonizing nations established institutions that protected property rights for broad masses. This resulted in an egalitarian distribution of political power. By doing so, basic ingredients for development were put in place. In other colonies, where European settlements were restricted, the colonizing power established “extractive” institutions that were inimical to progress. These political and economic structures once established persisted even after the colonies became independent, resulting in divergent patterns of growth.

In this paper we concentrate on FDI and argue that the contrasting FDI policies in Brazil and India can be traced back to differences in the respective colonial (or semi-colonial) experiences of the two nations during the 19th century. However our analysis differs from the “colonialism-institutions hypothesis” in several ways. Colonialism in Brazil and India lead to two divergent processes: On the one hand, regressive political and economic institutions (slavery, regressive land tenure systems, lopsided distribution of political power etc.) emerged. On the other hand, colonial exploitation led to another set of consequences: disenfranchisement amongst the masses and sections of the elite (especially the industrial elite) who sought to break from the international division of labour that had restricted their economies into exporters of primary commodities. One therefore finds that after independence, though a number of colonial institutions remained, a number of others were dismantled.



The emergence of a proactive state and the initiation of import substituting industrialization were the biggest institutional changes that were introduced in the 20th century. However, the specific differences in historical experiences led these countries to adopt different sets of policies even within a state lead ISI framework. In Brazil, the state and domestic class interests aligned themselves in such a way so as to provide space for FDI in the industrialization process. In contrast, in India the post-colonial society established institutions that restricted FDI in the economy until the neo-liberal era. The basic scheme of our argument can thus be explained as follows:

19th century historical factors → Institutional persistence and institutional rupture → role of FDI in the economy → Industrial growth

In the first two sections of this article we shall briefly review the function of foreign investments both prior to and during the process of import substituting industrialization (ISI) in each country. The following section we analyze the changing role of FDI in the neo-liberal era, when ISI was abandoned. Following this, we then analyze the contemporary role of FDI in the respective economies, and then examine the advantages and disadvantages the different policies towards foreign capital have had on the development process of each country.

## 3.2 FDI in Historical Perspective

### 3.2.1 Brazil

In the early years after independence (from 1822 to the 1850s) foreign investments (mostly of British origin) were mainly concentrated in finance and trade. The production of export products (coffee and sugar) was dominated by local residents, while the shipping and the financing of trade was in the hands of foreigners. In the second half of the 19th century the Brazilian government encouraged foreign capital to build the country's infrastructure railroads, ports, and urban public utilities. Much of these investments were designed to better integrate Brazil into the world's trading network as a supplier of primary goods. In 1880 the total stock of foreign investments were estimated at US \$ 190 million; this expanded to US \$ 1.9 billion by 1914 and to US \$ 2.6 billion by 1930. Prior to 1930 Britain was the dominant foreign investor; it still accounted for 50 percent of foreign investment in that year, though the United States share was rapidly increasing, already accounting for 25 percent of total foreign investments.

Although foreign investments contributed resources and technology to Brazil in the years prior to 1930, many observers had misgivings about the type of growth it helped to foster and its often overlooked costs to the country. Railroads and ports were built to integrate more effectively the agricultural sectors of the interior into the international economy. By doing this, however, the resulting national transportation system did not link together various geographical regions and thus did not create a large internal market.

It was the Brazilian government (at both the central and state levels) who

took the initiative in getting foreign groups to invest in the country by offering various types of incentives. In the case of railroads, for example, foreign companies were granted guaranteed rates of return on their investments<sup>1</sup>. The early construction of electricity generation plants and distribution systems were dominated by foreign firms, which were attracted by the government's willingness to allow high electricity tariffs.

By the 1930s, however, the Brazilian government changed its attitude towards foreign investors in public utilities. Tariffs on electricity, telephone services and public transportation were more tightly controlled and were not readjusted to the likings of the foreign concession owners<sup>2</sup>. After World War II, until the 1990s, most public utilities were taken over by either the federal or state governments. The public sector also took over most of the exploitation of natural resources.

With the adoption of Import Substitution Industrialization (ISI) as the country's main strategy of economic development, FDI was given a central role for creating new manufacturing sectors behind protective walls.

### 3.2.2 India

Foreign investment in India in the 19th and 20th centuries was dominated by British investment. British capital was mainly invested in export oriented sectors such as jute, tea and coal. It also had the major role in the construc-

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<sup>1</sup>The burden of guaranteeing a minimum rate of return to foreign-owned railways became so onerous that the government began to borrow money abroad after the turn of the century to gradually buy them. By 1929 almost half were in government hands and by 1953 94 percent had been nationalized. See Villela and Suzigan, (1973, p. 397-399).

<sup>2</sup>In the case of Brazil foreign investments in public utilities -like railroads and electricity generation and/or distribution - was allowed under a regime of concession contracts, which granted temporary monopolies to provide services.

tion of railways and had a substantial presence in trade and finance. While exact data regarding foreign investments in India during the colonial era is not available, in a rigorous reconstruction of Indian balance of payments, Banerji (1963) puts foreign investment in India at US\$ 61 million for the year 1921 and US \$ 83 million in 1938<sup>3</sup>. The Reserve Bank of India (Central bank of India) analyzed foreign capital in India for the year 1948 and estimated it to be between US \$ 46 and 64 million (Tomlinson 1978). In view of the above estimates, it would be safe to conclude that foreign investment in India during the 19th and early 20th century was negligible and that it did show signs of increasing during the early decades of the 20th century (Tomlinson 1978).

The first half of the 20th century witnessed two important changes in the structure of foreign investment in India. First, foreign investments in the pre-1920 period were essentially in the form of portfolio capital. Moreover it was heavily concentrated in the primary sector and in utilities and transport sectors. By the 1930's there seems to be evidence suggesting that FDI, as opposed to portfolio investment, had started to dominate total private foreign investment (Tomlinson 1978). Second, the favourable terms of trade in the pre-World-War I era, followed by the economic depression of the 1930's, allowed Indian firms to gain access to sectors that were previously dominated by foreign firms. In 1914, 70 percent of banking deposits were under the control of foreign firms, but by 1947 this was reduced to 17 percent (Mukherjee and Mukherjee 1988). Similarly Indian companies had started to dominate the insurance sector (Mukherjee and Mukherjee 1988).

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<sup>3</sup>As quoted in Tomlinson (1978). The British shares were 80% and 73% respectively.

The crucial feature of 20th century India was the rise of an industrial elite, who viewed colonialism as the biggest obstacle to their advancement. The history of industrial development in India had convinced the ruling classes of the importance of state protection in providing stimulus to industrial growth. As a result, they favored extensive state regulation of the economy.

### 3.3 FDI in the Import Substitution Era

#### 3.3.1 Brazil

With the adoption of ISI as Brazil's main development strategy, foreign investments shifted to the manufacturing sector (rising from 23.7 percent in 1929 to 74.6 in 1998), while its share in public utilities declined from 50 percent in 1929 to 2.4 in 1992). This was due to various types of incentives given to foreign investors, as policymakers felt that rapid ISI was possible only with a substantial contribution of foreign finance and technical know-how. The decline of FDI in public utilities was due to both government regulations that made investments in that sector unattractive and the fear of nationalist reactions to the foreign control of strategic sectors.

Reliance on FDI in promoting ISI was due to the government's pragmatism. The availability of domestic entrepreneurs with the financial and technical capacity to create new production facilities was limited, and the perception was that leaving things to domestic "trial and error" would waste resources and require too much time.

Within the manufacturing sector foreign investment was especially strong

in chemicals, transport equipment, food and beverages, and machinery.

In the initial phase of ISI the dominant source of FDI was the U.S., which accounted for 44 percent in 1951, followed by Canada (30 percent) and the U.K. (12.1 percent). Since that time there has been a substantial diversification of sources. In 2005 the U.S. accounted for only 21.6 percent of FDI, Canada 6.7 percent, the U.K. for 1.5 percent, while Japan had grown from almost nothing to 15.5 percent.

### 3.3.2 India

The arguments favoring state-led industrialization were fuelled by the belief that the Indian economy should be treated as if it were an “infant economy” (Patnaik 1979). Rather than depending on the international economy, domestic consumer demand and heavy public investment were to provide the necessary stimulus for industrialization. Even in cases where foreign investment were necessary, it was the states duty to protect the interests of domestic entrepreneurs.

The initial policy stance of the Indian government was to be wary of foreign investments. The industrial policy statements of 1948 and other legal measures like The Capital Issues Control Act were aimed at restricting foreign investment. Despite the restrictions on foreign investments, FDI stock increased from USD 114 million to USD 185 million, between 1964 and 1974 (Kumar 1995). In the 1970’s, increased regulation on foreign capital resulted in a stagnation of FDI inflows<sup>4</sup>. The stock of FDI increased from USD 185

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<sup>4</sup>For example, in 1973, the Foreign Exchange Regulation Act (FERA) was promulgated with a view to reduce the role of foreign capital in the domestic market. FERA put a ceiling of 40% on foreign equity participation.

million in 1974 to USD 189 million in 1980. The share of total FDI in manufacturing increased from 20 percent in 1948 to 86.9 percent in 1980 (Kumar 1995). The data shows that British FDI declined from over 75 percent of all foreign investments in the 1960's to around 50 percent by 1987, while shares of Germany, Japan and US steadily increased.

India's ISI policy was riddled with contradictions. The assumption that domestic consumer demand and heavy public investment could support industrial growth was clearly misplaced. In reality, a skewed income distribution and negligence of agricultural development in the early planning process meant that domestic consumption could never play an important role. Moreover, the resources for massive public investment were raised by deficit financing and indirect taxation (Patnaik 1979). As a result, public investment was inflationary and unsustainable in the long-run. Thus, by the late 1970's, the planning process was already showing signs of breaking down. The 1980's witnessed a worsening trade balance owing to growing oil imports and a slow-down of exports. By 1990/91 the Indian government took the decision to liberalize its economy and undertake structural adjustment programs. An important part of this liberalization process was a much greater emphasis on attracting FDI.

## 3.4 FDI in the Neo-Liberal Era

### 3.4.1 Brazil

After the debt-crisis of the 1980s, Brazil was persuaded to adopt neo-liberal policies. These consisted of drastic reductions in protective tariffs, privatiza-

tion of state enterprises and the opening of many sectors for private foreign investments. These policies resulted in a notable re-appearance of FDI in public utilities and in the exploitation of natural resources. Foreign firms were allowed to participate in auctions for concession contracts in various fields of public utilities. Thus, public utilities which had accounted for 50 percent of the stock of FDI in 1929 and had dropped to 2.4 percent in 1992, rose to 25 percent in 2000 and then declined again to about 10 percent in 2010.

### 3.4.2 India

The 1990's marked a major shift in India's FDI policy. After having followed a restrictive policy towards foreign investment for four decades, India undertook major reforms in its economic policy. The new industrial policy of 1991 abolished industrial licensing requirements and eased restrictions on foreign equity participation.

As a result of these policies, FDI inflows increased steadily during the 1990's and reached US\$ 3.6 billion in 1997. After a brief stagnation following the Asian crisis, FDI inflows picked up steam from 2003 onwards. During this period the share of manufacturing in total FDI stock declined from 85 percent in 1990 to 48 percent in 1997 (Kumar 1995, 2005). This trend continued even during the 2000-2010 period, with the share of manufacturing in total FDI inflows declining from 41 percent in 2005 to 20 percent in 2008 (Rao and Dhar 2011). At the same time infrastructure and services (banking and financial services, software and telecommunications) have increasingly attracted FDI inflows (Nagaraj 2003, Kumar 2005).



## 3.5 FDI: A Comparative Analysis

Both Brazil and India adopted an industrial development strategy based on import substitution. However, the policies towards foreign investment and FDI in particular have been very different. In the following section we compare and evaluate the impact of the two approaches.

### 3.5.1 Political Economy of ISI in Brazil and India

A comparative political economy of FDI policies of Brazil and India has not been adequately analyzed in economic literature. In order to study the two countries one has to highlight the role of political and social institutions in molding public policy. To do this, we return to the historical experiences of the two countries before World War II.

Brazil gained its independence in 1822. Britain acted as a guarantor of its independence in return for which it obtained privileged access to its markets and was influential in shaping various types of policies. Many observers have therefore referred to this period as a “semi-colonial” one. At that time the main source of wealth was export earnings from primary production (mainly coffee). As a result, both the agrarian elites and the urban elites preferred an open economy with limited state intervention. Even the industrial growth which began by the late 19th century was influenced by international factors: the incomes generated via coffee exports provided necessary resources to support early industrial growth (Kohli 2004, Baer 2008, p. 29). At the same time, immigrant labor brought with it entrepreneurial and organizational skills that were crucial for the establishment of industrial enterprises (Kohli 2004, Baer 2008, ch. 2 and 3). By the 1930’s, the weak-

ening of the international economy and rising nationalist sentiments drove the Brazilian leadership to adopt defensive policies which were of an early import-substituting nature. Although Brazil gradually restricted activities of foreign investors in some of the sectors where they made an early appearance (mainly public utilities), it never treated them with the same suspicion as did India and the ISI policies left considerable room for foreign investment in new sectors, especially manufacturing.

In the case of India, the British colonial experience lasted for over two centuries. By the late 19th century, a major anti-colonial struggle had begun. Repatriation of profits, guaranteed returns to investments in railways, discriminatory tariffs against Indian textiles and the inadequate development of infrastructure had convinced Indian nationalists about the dangers of integrating a “infant economy” in the world trading system. The rise of a “national industrial bourgeoisie” during the 20th century, which bitterly opposed colonialism, strengthened nationalist sentiment in India. The aversion to foreign rule translated into an aversion for foreign investment (Naoroji 1901).

Thus for large sections of the society, independence meant freedom from foreign domination, not just in the political and social arenas but even in the economic sphere. The post-colonial state that emerged in 1947 was a product of this anti-colonial sentiment.

The difference in perceptions of various groups in both countries regarding foreign capital should not come as a surprise. Britain did extract special trading privileges from Brazil. However, as it was an independent state, it

enjoyed certain albeit limited flexibility regarding economic policies (Topik 1979, Kohli 2004). The state protected coffee plantations through a price support scheme known as valorization and was instrumental in setting up banks and schools (Kohli 2004). Even in the construction of railways, while the Brazilian state might have provided concessions to private investors, it was still able to exercise considerable control over its development (Topik 1979). Moreover, once these concessions started to become burdensome, Brazil's government borrowed funds from foreign countries to nationalize most of the railroad system.

In the case of India, a classic colony by all definitions, the use of monopoly power by Britain was much more explicit. Britain restricted access by Indians to finance, land and labor by legal and extra-economic methods. In the case of the Indian railways, Indian entrepreneurs were not allowed to invest in them (Bagchi 2002). Further, despite public outrage, guaranteed returns were not abolished. Thus, in India foreign domination left little room for domestic classes to bargain with British interests, which, in turn, generated animosity towards foreign presence in the economy. In Brazil, in contrast, a sovereign state protected domestic interests (at least for the domestic elites) creating a conducive and accommodating atmosphere for foreign capital.

It is thus evident that historically, the evolution of political and social institutions followed different paths in the two countries. These differences translated into two distinct FDI policies. By the 1980's both nations were confronted by severe macro-economic imbalances. In Brazil there was a growing sentiment against the state both within the middle class and the business elites (Amann and Baer 2002). Similar changes were taking place in India.

Big business houses, which were once opposed to foreign investments, had by now matured and strengthened their positions in the economy (Kohli 1989). A sum of all these changes resulted in the adoption of neo-liberal policies starting in the 1990's.

### 3.5.2 FDI: Trends and Patterns

Data indicates that Brazil has been much more successful than India in attracting FDI between 1970 and 2010. While the differences between FDI inflows to the two countries have declined in the neo-liberal era, India continues to lag behind Brazil in terms of FDI inflows. As a percentage of GDP, FDI inflows to Brazil stood at 3.3 percent in 2002 and 2.3 percent in 2010. In case of India FDI inflows were 1.1 percent of the GDP in 2002 and reached 1.5 percent by 2010.

In the case of Brazil, the US had been the largest contributor to FDI throughout most of the 20th century. In 1951 the share of the United States in Brazil's FDI stock was 43.9 percent, gradually declining to 24 percent in 2000 and to 17 percent in 2005. By the latter year the share of many other countries became significant, including Germany, Japan, the U.K., France and Spain. In the case of India, Europe, especially Britain has always been a major source of FDI. However, in the neo-liberal era, FDI sources have diversified. USA and Singapore have become important sources of FDI. Tax havens like Mauritius, which accounted for 50 percent of FDI inflows in 2005-2009, have become substantial sources of FDI (Rao and Dhar 2011).

A striking feature of the neo-liberal era is the phenomenal increase in FDI

outflows from both India and Brazil (Amann and Baer 2010). FDI outflows from Brazil increased from USD 0.7 billion in 1994 to USD 11.5 billion in 2010. For India the figures were USD 82 million in 1994 and USD 14.6 billion in 2010.

What explains these tremendous differences in FDI inflows in the neo-liberal era? Economic and location factors such as market size and literacy rates are crucial determinants of FDI (Wheeler and Mody 1992, Zhang 2000, Chakrabarti 2001). With a bigger GDP and a more developed industrial base, Brazil was bound to be a more attractive destination for investors<sup>5</sup>.

Apart from purely economic factors, the institutional framework of a nation is also an important determinant of FDI flows. This seems to be true for Brazil and India where the institutions and perceptions developed during the ISI era have persisted even in the neo-liberal period. Indian policy making is still marked by export pessimism and gradualism that characterized its ISI strategy (Ahluwalia 2002, Balasubramanyam and Mahambare 2003). Unlike Brazil, India never undertook massive privatization programs. Its tariff rates remained higher than Brazilian ones until the first decade of the 21st century. Taxes on international trade (import duties, export duties, exchange profits, etc.) in Brazil accounted for 4 percent of total revenue in 2000 and 2 percent in 2009. For India, the figures were 19 percent in 2000 and 11 percent in 2009 (World Development Indicators). According to UNCTAD's inward FDI potential index covering 141 countries, for the period 2000-2002, Brazil was ranked 68 while India was placed at 89. The greater extent of liberalization

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<sup>5</sup>In 1991 Brazil's and India's GDP was approximately USD 768 billion and 356 billion respectively. And by 2010 the GDP had reached USD 2.1 trillion and 1.7 trillion respectively for Brazil and India.

has been an important factor attracting more foreign investment into Brazil than into India.

### 3.5.3 Quality of FDI inflows

One of the important functions of FDI is to serve as a tool of financing development. However, FDI cannot be treated as a homogenous concept. The extent to which FDI flows contribute to development depends largely on its quality. By quality, some economists (Kumar 2002, 2005) refer to the positive impact of FDI on productivity, employment and output. Two important measures of quality are the mode of entry (Greenfield or M&A) and the sectoral composition of foreign investments<sup>6</sup>.

Greenfield FDI adds to real resources of an economy by augmenting domestic capital formation and is associated with strong productivity spillovers. FDI flows in the form of M & A's, however, have a smaller impact on productive capacity of an economy since they usually involve only a change in ownership (Mencinger, 2003).

Sectoral composition of FDI is an equally important indicator of FDI quality. It is generally accepted that FDI directed towards sectors with extensive backward linkages is more likely to produce sustained growth. The growth and employment generating potential of FDI in the primary sector tends to be limited due to lack of linkages with the local economy. On the other hand, FDI in the manufacturing sector tends to create extensive positive externalities for the local economy. The impact of service sector FDI, on

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<sup>6</sup>UNCTAD (2000) defines M&A as “acquiring or merging with an existing local firm” and Greenfield investments refer to the setting up of new firms. See UNCTAD (2000) for a description of M&A related FDI

total aggregate GDP growth rates is ambiguous (Alfaro 2003, Chakraborty and Nunnenkamp 2008).

Table 2.1 shows the ratio of M & A sales to total FDI inflows in Brazil and India<sup>7</sup>. The figures indicate a predominance of M & As in FDI. In 2000, M& A related sales were more than 50 percent of FDI flows to Brazil and were 30 percent of FDI flows to India. It should be noted, however, that one quarter of all FDI inflows into Brazil during 1996-2000 were related to privatizations, which were concentrated in that period.

In terms of sectoral composition there have been major structural shifts for both India and Brazil. During the early 20th century, FDI was mainly in the extractive and natural resource sectors and in public utilities. In the ISI period, both India and Brazil were able to direct foreign investment into manufacturing, especially into technology intensive sectors. The neo-liberal era has seen a re-emergence of FDI flows in services and public utilities<sup>8</sup>. The share of FDI stock in the manufacturing sector has declined steeply.

### 3.5.4 FDI Performance: Productivity and Industrial Growth

The relationship between productivity, growth and FDI is an ambiguous one. While there are numerous instances of countries that have successfully used FDI to develop their industrial base (United States and Australia during the late 19th century), the history of Korea, which minimized reliance on foreign investments, should convince us that FDI is a necessary but not a sufficient

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<sup>7</sup>These ratios are not an accurate reflection of the quality of FDI since M&As need not always result in FDI inflows.

<sup>8</sup>This is in complete contrast with the East-Asian experience, where bulk of the FDI was directed towards export oriented manufacturing sectors.

condition for successful industrialization (Mardon 1990).

In the ISI period industrial growth of Brazil outpaced that of India. Even in terms of GDP, Brazil grew at a much faster pace (see Table 2.2 and 2.3). The extent to which differences in the FDI policies explain the divergence in economic performance in the two countries is difficult to quantify. In certain sectors, however, FDI seems to have played a major role.

The case of the automobile sector is one such example where FDI did have an important role<sup>9</sup>. The Indian government, unlike that of Brazil, severely restricted FDI and kept strict control over technology transfer. By 1980, Brazilian car production was 20 times that of India's (Humphrey et al. 1998). The Brazilian strategy had another added advantage. Specifically, competition from MNCs and transfer of technology helped develop an efficient automobile component producing sector. In India, these spillover effects were limited because of restrictions imposed on foreign investments, resulting in less efficient component manufacturers (Humphrey et al. 1998). Even in the electronics goods industry, Brazilian pragmatism benefited industrial growth<sup>10</sup>.

After the economic reforms of the 1990's, GDP growth rates in Brazil and India have been increasing steadily (especially after 2003). The service sector has been the biggest contributor to GDP. Until 2003, industrial growth was

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<sup>9</sup>It might be argued that the automobile industry did not have a large enough internal market in India and thus would not have had a substantial impact on the economy anyway. The possibility of exploiting external markets however, weakens this argument.

<sup>10</sup>While both India and Brazil restricted MNC's in this sector, the Brazilian approach was marked by pragmatism and caution. India, on the other hand, was much harsher on MNC's so much so that in 1976 IBM was forced to withdraw from its Indian operations. See Sridharan (1996)



disappointing. In Brazil manufacturing value added grew at an average of 1.5 percent during 1990-2003 and 3 percent from 2003-2010. In India manufacturing value added grew at 5.7 percent in the 1990-2003 (which was slower than the 1981-1990 growth rates)<sup>11</sup> and at 9 percent during 2003-2010. Table 2.2 and 2.3 show the trends.

What explains the slow growth of the industrial sector in 1990-2003? To a large extent, industrial performance can be explained by the changes in the institutional structure of these economies. Historically, industrial growth was financed by public investment in India and a combination of public and foreign investment in the case of Brazil. In a liberalized economy, however, public spending is constrained: an increase in fiscal deficits leads to inflation which, in turn, causes depreciation of the currency. Faced with the prospect of weakening currencies, foreign investors are less likely to invest. The case of Brazil and India has been no different as public investment declined during this period (Mohan 2008, Afonso, Arajo and Jnior 2005).

In such a scenario, foreign investment becomes crucial to finance industrial growth. In reality, not only has the share of FDI in manufacturing declined (in addition to the growing proportion of M&As in total FDI), even the volume of inflows have been relatively small. For instance, in 1995 FDI inflows to Brazil and India were 1.2 percent and 0.6 percent of world FDI inflows compared to China's 11 percent. By 2005 the shares were 1.5 percent, 7.3 percent and 0.8 percent for Brazil, China and India respectively. These trends, coupled with declining public investments are a big factor behind the

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<sup>11</sup>Manufacturing value added grew at an average rate of 6.2% in that period.

lackluster performance of industries during the first decade of reforms<sup>12</sup>. It is no surprise therefore that increases in manufacturing growth rates after 2003 have coincided with increases in public investments in India. Even in Brazil aggressive government spending in crucial sectors like infrastructure have played an important role in stimulating industries. Public investment in infrastructure was the main thrust of the PAC (“growth acceleration program”) program in Brazil (OECD 2011, p. 27).

Industrial productivity in both economies has improved in the last two decades (Bonelli 2002, Ferreira and Rossi 2003, Unel 2003). MNC’s have played an important role in this regard. There are two channels through which, in theory, FDI could contribute towards industrial productivity. First, in the presence of MNC’s, local firms could be forced to invest in R&D in order to remain competitive. As a result, firms might take part in innovative activities. FDI could thus provide a stimulus to the economy to modernize many of its leading sectors (Amann and Baer 2010, Kumar 2005). Second, MNC’s might play an important role in R&D in both countries. For example, TNC’s like Motorola, General Motors in Brazil and Novartis GlaxoSmithKline and Microsoft in India, have set up R&D facilities. In fact, in Brazil, of the total patents granted to residents by the USPTO, 42 percent were on account of foreign affiliates in 2001-2003. In the same period in India, 40 percent of patents granted by the USPTO were associated with foreign affiliates (UNCTAD 2005, p. 135).

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<sup>12</sup>Doytch and Uctum (2011) find evidence suggesting that a decline in the share of manufacturing in total FDI (especially if this decline entails a shift towards non-financial services) could be detrimental to the manufacturing sector, and could even result in de-industrialization.

Despite the increasing importance of foreign investments in the economy, the levels of R&D have been modest. R&D as a percentage of GDP amounted to 1.1 percent of GDP in Brazil and 0.8 percent in India, compared to 2.7 percent in the U.S. The impact of the modest amount of R&D in both country means that dependence on foreign technology by them will continue to be substantial. This can be measured by examining the patent applications of Brazil and India, compared to industrial countries. It will be noted that whereas in 2007 patent applications of China amounted to 153,060 and of the U.S. 241,347, the total amount for Brazil in that year was 4,023 and for India 6,296.

### 3.6 Conclusion

Our comparative analysis of FDI in Brazil and India shows the importance of historical and institutional awareness in gaining an understanding of the manner in which each society perceived the role of foreign investments in their societies. By doing this, we gained an understanding of the reasons these countries adopted different attitudes and policies towards foreign capital.

We have shown how historical experiences of both countries shaped both, formal (laws and regulations) and informal institutions (perceptions regarding foreign investment) in the post-independence era. During the ISI era, FDI came to play an important role in the industrial development of Brazil. In the case of India the colonial experiences, in addition to political and social restrictions, prevented it from fully exploiting the advantages of FDI.

In the neo-liberal era, though both countries have opened their doors to foreign investments, the institutions established during the ISI era have persisted. In comparison with Brazil, the Indian liberalization policy continues to be marked by export pessimism and gradualism. As a result, Brazil has been far more successful at attracting FDI than has India: in 2010 FDI stocks in Brazil were more than twice the FDI stocks in India.

Though FDI is an important ingredient of development, the extent to which FDI contributes to economic development depends not only on the quantity of inflows but also on its structural composition and its spillover effects on the domestic economy, or what has been come to be known as FDI quality. By analyzing two key determinants of FDI quality- the sector wise distribution of FDI and its mode of entry- we find that the structure of FDI has undergone tremendous changes in the neo-liberal era. First, there has been a shift of FDI away from manufacturing sector towards public utilities and services. Second, M&A related FDI inflows have become predominant in Brazil and to a lesser extent in India.

FDI may have contributed in part to the high industrial growth rates of India and of Brazil's recovery from its slow growth rates in the last decades of the 20th century. Yet as we have noted, that a strong presence of the state can also influence the effectiveness of foreign investments by increasing public spending in infrastructure and other key sectors of the economy. From a policy perspective our analysis makes it clear that an effective FDI policy is one in which state intervention and foreign investments complement each other, thereby maximizing the potential for industrial growth and development.

### 3.7 Tables

Table 2.1: Cross-Border M&A Sales for Selected Years (Millions of dollars)

	1990	1996	2000	2005	2010
Brazil	- 32 (n)	2987 (27.67 %)	17274 (52.69 %)	2993 (19.86 %)	8874 (18.32 %)
India	5 (2.10%)	141 (5.50%)	1064 (29.65%)	526 (6.90%)	5537 (22.47%)

Source: World Investment Report(UNCTAD), Various Years

Table 2.2: Macroeconomic Indicators of Brazil

	1981-1990	1991-2000	2001-2010
GDP (% annual growth)	1.6	2.6	3.6
Gross fixed capital formation (% of GDP)	20.8	17.9	6.9
Industrial value added (% of GDP)	44.6	31.5	27.7
Manufacturing value added (% of GDP)	32.6	20.0	17.0
Manufactures exports (% of merchandise exports)	45.8	55.4	48.5
Services value added (% of GDP)	45.8	61.8	66.1

Source: World Development Indicators

Table 2.3: Macroeconomic Indicators of India

	1981-1990	1991-2000	2001-2010
GDP (% annual growth)	5.6	5.5	7.8
Gross fixed capital formation (% of GDP)	20.6	22.7	28.8
Industrial value added (% of GDP)	26.2	26.4	27.3
Manufacturing value added (% of GDP)	16.6	16.2	15.3
Manufactures exports (% of merchandise exports)	61.3	74.9	69.55
Services value added (% of GDP)	42.50	46.6	53.3

Source: World Development Indicators

# APPENDIX A

## PROOFS

Here we provide the proof for proposition 3. The human capital dynamics in a private education regime is given by (drop the superscripts for convenience):

$$h_{it+1} = A(h_{it}) = \begin{cases} A_2(h_{it}) = \Delta^2(h_{it})^{1-\beta} & \text{if } h_{it} \geq \tilde{h} \\ A_1(h_{it}) = \tilde{\Delta}^2(h_{it})^{1-\beta} & \text{if } h_{it} < \tilde{h} \end{cases} \quad (\text{A.1})$$

In a public regime, the dynamics are:

$$h_{it+1} = B(h_{it}) = \begin{cases} B_2(h_{it}) = \Delta^1 \bar{h}_t^\alpha (h_{it})^{1-\alpha-\beta} & \text{if } h_{it} \geq \tilde{h} \\ B_1(h_{it}) = \tilde{\Delta}^1 \bar{h}_t^\alpha (h_{it})^{1-\alpha-\beta} & \text{if } h_{it} < \tilde{h} \end{cases} \quad (\text{A.2})$$

$$\text{Where } \Delta^1 = (\tau w_t)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1-\tau+\gamma)}{b\bar{\psi} + \beta(1-\sigma)}\right)^\beta$$

$$\tilde{\Delta}^1 = (\tau w_t)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1-\tau+\gamma)}{b\psi(h_{it}) + \beta(1-\sigma)}\right)^\beta$$

$$\Delta^2 = (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma)}{b\bar{\psi} + (\alpha+\beta)(1-\sigma)}\right)^{\alpha+\beta}$$

$$\tilde{\Delta}^2 = (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma)}{b\psi(h_{it}) + (\alpha+\beta)(1-\sigma)}\right)^{\alpha+\beta}$$

Consider the private education dynamics. We shall proceed in three steps:

- Following assumption A1,  $\psi(0) = \psi^0 > 0$  which implies  $h^* = 0$  is clearly a solution to the dynamical system.
- When  $h_{it} < \tilde{h}$  the relevant dynamics are given by  $A_1(h_{it})$ . To analyse the dynamics of this function, define two continuous functions:

$$f_1(h_{it}) = h_{it}^\beta \text{ and } f_2(h_{it}) = (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma)}{b\psi(h_{it}) + (\alpha+\beta)(1-\sigma)}\right)^{\alpha+\beta}.$$

The dynamical system can be written as  $f_1 = f_2$ . Note that,  $f_1(0) = 0$ ,  $\lim_{h \rightarrow +\infty} f_1(h_{it}) = \infty$  and  $f_1(h_{it})' = \beta h_{it}^{\beta-1} > 0$  for  $h_{it} > 0$ . Similarly,  $f_2(0) > 0$  and under (A1),  $f_2(h_{it})' < 0$ . This shows that both functions can intersect at one point  $h^P > 0$ . Thus  $A_1(h_{it})$  can have only one non-trivial fixed point,  $h^P$ .

- When  $h_{it} \geq \tilde{h}$  the relevant dynamics are given by a concave function  $A_2(h_{it})$ . It is easy to see that there is only one possible non-trivial fixed point:

$$h^R = \left( (w_t \alpha)^\alpha \left(\frac{\beta}{\gamma}\right)^\beta \left(\frac{(1-\sigma)(1+\gamma)}{b\bar{\psi} + (\alpha+\beta)(1-\sigma)}\right)^{\alpha+\beta} \right)^{\frac{1}{\beta}} \quad (\text{A.3})$$

If  $A_1(\tilde{h}) \leq \tilde{h}$  and  $A_2(\tilde{h}) \leq \tilde{h}$  then 0 and  $h^P$  are the only equilibrium (Figure 1.3). If  $A_1(\tilde{h}) \leq \tilde{h}$  and  $A_2(\tilde{h}) \geq \tilde{h}$  then there are multiple equilibria 0,  $h^P$  and  $h^R$  (Figure 1.1). Finally if  $A_1(\tilde{h}) \geq \tilde{h}$  then 0 and  $h^R$  are the only equilibrium (Figure 1.2).

Similarly for the public education regime, in an identical manner we can show that proposition 3 holds. It is easy to see that for both  $B_1(h_{it})$

and  $B_2(h_{it})$ , 0 is a fixed point. Moreover by the same reasoning as above we can argue that  $B_1(h_{it})$  and  $B_2(h_{it})$  have unique non-trivial steady states. SO we can conclude: If  $B_1(\tilde{h}) \leq \tilde{h}$  and  $B_2(\tilde{h}) \leq \tilde{h}$  then 0 and  $h^P$  are the only equilibrium (Figure 1.3). If  $B_1(\tilde{h}) \leq \tilde{h}$  and  $B_2(\tilde{h}) \geq \tilde{h}$  then there are multiple equilibria 0,  $h^P$  and  $h^R$  (Figure 1.1). Finally if  $B_1(\tilde{h}) \geq \tilde{h}$  then 0 and  $h^R$  are the only equilibrium (Figure 1.2).



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