PN-ABY-634
90673

FERTILITY, LITERACY, AND THE INSTITUTION OF CHILD LABOUR

by

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June 1996

ABSTRACT

This paper considers the fertility choice of risk-averse parents when child mortality rates are significant and child labour is deemed a socially acceptable institution. The paper demonstrates how the institution of child labour can generate a poverty trap when fertility is driven by the need for old-age security. High child mortality rates render education in children a risky investment and induce parents to have more uneducated children instead of fewer, educated children. The institution of child labour facilitates this trade-off. Based on the implications of the model, the paper suggests two complementary policies that would contribute to the eradication of child labour: the universalization of access to health care services in order to reduce child mortality rates, and the legislation of compulsory education. The former would work by altering the risk-return tradeoff in favour of educated children, and the latter by countering the reluctance of parents to educate children who are deemed less important for old-age security, namely, daughters.

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* I am grateful to Jonathan Kesselman and Bharat Ramaswamy for useful comments on an earlier draft. This research was made possible through the support provided by the U.S. Agency for International Development and Cooperative Agreement No. DHR-0015-A-00-0031-00 to the Center on Institutional Reform and the Informal Sector (IRIS) and administered by the Office of Economic and Institutional Reform, Center for Economic Growth, Bureau for Global Programs, Field Support and Research. I would like to thank Hashmat Khan for research assistance.

A

I. Introduction

Child labour is an institution that is prevalent in many developing countries, but one that is particularly entrenched in South Asia. The evidence indicates that child labour renders the lot of the poor somewhat more tolerable to them than it would be otherwise. Nevertheless, the institution has some serious long-term consequences. As long as parents find it worthwhile to have their children work for a substantial number of hours each day either inside or outside the home, children's education inevitably suffers. Apart from perpetuating an uneducated labour force, the institution also renders a reduction in fertility less likely. This paper examines these issues in an old-age security model for fertility,[1] in which the opportunity cost of child labour is taken to be foregone education. It is demonstrated here that when the institution of child labour is legal and is deemed socially acceptable, risk-averse parents would tend to trade off the education of children in favour of greater fertility in order to ensure a more secure old age.

In many cultures, such as those of South Asia, old age in the absence of surviving children is an extremely undesirable prospect. Fertility is strongly motivated by the desire to ensure that at least one child (usually male) survives to adulthood. From the point of view of this pension motive, educated and uneducated children may both be desirable assets. However, the education of children not only requires expenditures on the part of parents but typically also requires parents to forego much of the economic contribution of children--whether at home or in formal labour markets. In an environment in which child mortality is significant, the expected return to education will be low and parents would tend not to educate their children, as observed by Rodgers and Standing (1981, page 26). Furthermore--and this is the focus of attention in this paper--educated children are also *riskier* assets, since the possibility of premature death exposes parents to the risk that their investment in the education of their children may not pay off in terms

[1] Standard references for the analysis of the old-age security motive for having children are Neher (1971), Cain (1983), Willis (1980), Zhang and Nishimura (1993), and Nugent (1983). An empirical verification of the hypothesis is provided in Jensen (1990).

of old-age support. Consequently, in developing countries in which child mortality rates are still significant, parents would tend to prefer many uneducated children to few educated ones. Risk considerations would generate such an outcome *even* when the private rate of expected return to parents of educating their children substantially exceeds the return to having uneducated children. Child mortality, in other words, induces a trade-off between the quantity and quality of children when the institution of child labour is deemed socially acceptable.

It is child and young-adult mortality rather than infant mortality that is relevant here, since parents swiftly compensate for infant fatalities by having additional children. More precisely, the emphasis here is on children who survive early childhood but fail to survive long enough to provide old-age security to their parents. It is possible to obtain a rough idea of the magnitude of this probability for developing countries. Using mortality tables, Murray, Yang, and Qiao (1992, Table 2-6) have computed that for India over the period 1970-83, the proportion of fifteen year old males (females) who failed to survive till they were sixty was 32.8% (29.4%).[2] In other words, during 1970-83 approximately one out of every three male children in India who lived long enough to be able to go through school died before providing old-age security for his parents for the entire length of their retirement.[3] The above source also reveals considerable variation in these proportions across the Indian states: the above proportion for males (females) goes from a maximum of 39.0% in Orissa (37.4% also in Orissa) to a minimum of 20.7% in Punjab (16.4% in Kerala). These are state-wide averages, covering urban and rural areas. One would expect the relevant proportions for rural areas to be higher than these averages because of the limited availability of rural health care facilities.

If adults had alternative means of handling the risk of facing old age without income support, they would be inclined to invest in their children's education (provided the return on this

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[2] The corresponding proportion for a developed country is considerably lower; e.g., for Canada in the period 1983-87, it was 14.3% (7.7%) [Table 2-4, *ibid.*]. Note, furthermore, that the pension motive is irrelevant to the determination of fertility in the developed countries.

[3] The same source computes the probability that a fifteen year old male (female) in India will not survive until age forty to be 8% (10%).

investment is sufficiently high). However, when access to capital markets is very limited and one's surviving offspring are the only means available for smoothing consumption over one's lifetime, the poor are essentially forced to trade off quality of children in favour of quantity. Child labour facilitates this trade-off by relieving the need to drastically curtail current consumption in order to increase family size.

This paper considers a scenario where education offers attractive private returns but parents can neither save for their retirement nor borrow against the future earnings of their children because they lack access to capital markets. It is shown that *even if education is completely subsidized by the State,* parents who are themselves educated are more likely to educate their children than are uneducated parents. This is because educated adults have higher present income, and the diminishing marginal current utility of income implied by risk-aversion renders them more amenable to risking the education of a child than are uneducated parents who earn a lower income. Thus, the institution of child labour, by facilitating risk-diversification for parents in the face of child mortality, is a poverty trap. This may partly explain why, despite significant returns to education and a substantial increase in the availability of schools in a developing country like India, progress in literacy rates is excruciatingly slow.

It is well-known that the inability of the poor in developing countries to borrow leads to the generation and perpetuation of class structure. Unequal access to capital has been shown to lead to class structure in production organizations [Roemer (1982), Eswaran and Kotwal (1986)]. In addition, by facilitating consumption-smoothing and risk absorption, access to consumption credit can promote the adoption of risky, but profitable, crops such as the high yielding varieties that spearheaded the Green Revolution [Eswaran and Kotwal (1989)]. In the present paper, it is seen that lack of access to credit markets leads the poor to perpetuate poverty in yet another--and possibly the most pernicious--manner: it forces them to breed children and leave them illiterate in order to facilitate the breeding of yet more children.

Finally, this paper discusses some policy implications that follow from the analysis. First, it is argued that government expenditures devoted to the delivery of health care targetted to the

reduction of child mortality rates can have substantial payoffs for society by rendering the risk-return combination for educated children more attractive than that for uneducated ones. Second, it is argued that the enforcement of compulsory education that is subsidized for one generation by the State could render the education of children completely compatible with the self-interest of parents in subsequent generations -- thus permanently eliminating the equilibrium in which children are bred but are deprived of an education. These two policies are complementary, since the former by itself could not counter the reluctance of parents to educate their daughters in many developing countries (like India) where the old-age security system relies only on support from sons.

Cain (1981) was the first to suggest that, in developing countries, the demand for children is motivated by parents' desire to counter the risk of being left without old age support, that is, parents view children as insurance against contingencies in old age when insurance markets are unavailable. Appelbaum and Katz (1991) have provided a formal model of the demand for children in the absence of capital and insurance markets, when this demand is motivated by risk and insurance considerations. The focus of their attention is the risk arising from uncertainty in the incomes of parents and children; child mortality is not explicitly addressed. In a paper investigating the relationship between child mortality and fertility, Sah (1991) has demonstrated with an elegant model that, consistent with empirical observations, the fertility of risk-averse parents can decline as child mortality rates decline. Eswaran (1995) has theoretically examined circumstances under which reductions in child mortality rates can induce demographic transitions in developing countries. In none of these studies, however, is the institution of child labour a serious consideration. One of the contributions of the present paper is the point that the viability of the institution of child labour in developing countries is intimately related to the prevalence of high child mortality rates.

The economic contribution of child labour and its role in determining fertility in developing countries is empirically well-documented.[4] In his study on the economic activities of children in the village of Char Gopal (Bangladesh), Cain (1977) concludes that high fertility is rational for parents on the basis of the economic contribution of children. He estimates that "male children become net producers by age 12, compensate for their cumulative consumption by age 15, and compensate for their own and one sister's cumulative consumption by age 22."[5] Assessing the economic contribution of children in the Nepalese and Javanese peasant societies, Nag, White and Peet (1978) concluded that the contribution was substantial in terms of both the household economy and also in terms of support for elderly parents. Examining data from six villages in the Marathwada region of Maharashtra, India, Nadkarni (1976) has corroborated Mamdani's (1972) thesis that poor households in India find their family labour to be an asset and is definitely not in surplus.

Rosenzweig and Evenson (1977) empirically tested the importance of children's earnings on fertility at an aggregate level. Using district-level data for 189 districts of rural India in 1961, they sought to explain variations in fertility, child-labour force participation, and school enrollment. They found that the wage rate of children significantly increased fertility and decreased enrollment in schools.[6]

The rest of the paper is organized as follows. The next section briefly describes some of the salient aspects of child labour in India, drawing from the voluminous literature on the subject (but citing only a representative sample of references). Section III spells out the model used to investigate the impact of child labour on fertility and literacy. Section IV presents some results generated from the model, and Section V discusses the policy implications of these results. Concluding observations are made in Section VI.

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[4] See Dinesh (1988) for a survey of this literature.
[5] See Mueller (1976) for an alternative view on the economic contribution of children.
[6] The next section outlines the evidence from India in somewhat greater detail.

II. A Case in Point: Child Labour in India

Child labour is a very pervasive phenomenon in India. Estimates of the number of child workers vary, depending on the source. The official estimate of this number in 1983 was 17.4 million children below the age 15 years. By including child labourers who work but are not paid, the Operations Research Group of Baroda arrived at an estimate of 44 million child workers [Weiner (1991, Ch.1)]. About 86% of the child labour in the country is engaged in family labour alongside parents in the agricultural sector. Of the remaining, part is in family enterprise such as handicrafts, etc., where the children assist their parents. The rest of the child labour is hired out to entrepreneurs, restaurants, etc. Some of the industrial activities in which child labour is pervasive are carpet-making, match-making, glassware and bangles, bidi (local cigarette), and brassware.

Work consumes a substantial fraction of the time of child labourers. A study of child labour in different occupations in Greater Bombay was undertaken by the National Institute of Public Cooperation and Child Development. The authors, Singh, Kaura, and Khan (1980, page 63) found that child labourers worked daily for an average of 8.5 hours in service establishments, 9 hours in garages and construction work, 11-12 hours in restaurants, and 8 hours in domestic work. In view of this, it is not surprising that their academic achievements are stunted. For example, in a study of child labour in metropolitan Delhi, Nangia (1987, pages 166-168) finds that one-third of his sample were illiterate, 43% of the sample child workers were literate but had not even attained primary level education. Only one-fifth of the sample had completed primary education and 2% of the children had completed middle-level education. This finding regarding the poor educational attainments of child labourers is replicated in numerous studies. At an aggregate level, around 51.7% of the 158.8 million children in the age group 6-14 years in 1981 did not attend school, despite the universal availability of neighbourhood schools [Weiner (1991, Ch. 5)].

Across families, child mortality rates are strongly correlated inversely with income levels [World Development Report (1993)]. Since child labourers hail from poor families, their

experience with child mortality is unusually high. For example, in the study of Nangia (1987) alluded to above, one-third of the child workers in the sample had lost brothers and two-thirds had lost sisters. This also reflects the pervasive and well-known fact that the mortality rates of female children in India are significantly higher than those of male children.

The contribution of child labour income to the family income, typically, is quite substantial. In a micro-level study of child labour in four districts of the state of Tamil Nadu in 1986-87, Sumangala and Nagarajan (1993, page 121) found the following distribution of the contribution of child labour income to the family income in their sample of 400 child workers and their families. In 15.25% of the families the contribution was up to 10% of family income, in 41.5% of the families between 11-20%, in 23.73% of the families between 21-30%, in 12.5% of the families between 31-40%, in 4.75% of the families between 41-50%, in 1.25% of the families between 51-60%, in 0.75% of the families between 60-70%, and in 0.25% of the families the contribution was above 71%. This distribution is consistent with those found in several other studies conducted in other parts of India.

Not only do child workers contribute substantially to family income, their role in holding the family above the poverty line is significant. For example, in a study of child labour in the urban informal sector of the city of Patiala in the mid-eighties, Sharma and Mittar (1990, page 109) found the following incidence of poverty in their sample.[7] The percentage of households below the poverty line when child labour income is included (excluded) was 22.2% (77.8%) for households of size 3-4, 58.7% (85.3%) for size 5-6, 64.0% (75.8%) for size 7-8, and 69.7% (87.9%) for size 9 and above. A significant proportion of the families with child labourers, therefore, manage to stay above the poverty line by means of income derived from child labour. The authors also find that there seems to be a positive relationship between the size of the family and the proportion of families below the poverty line, a relationship that is stronger if the income from child labour is excluded.

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[7] The poverty line was computed by assuming that the income level ensures a minimum consumption of 2,383 calories per person.

Female child labourers typically tend to hail from families that are poorer than those from which male child labourers come. This is seen, for example, in a study conducted in the eighties by Patil (1988, page 141) of 600 child workers in the city of Bangalore. The male (female) child labourers' share of the family income, 4.82% (1.64%) contributed nothing to the family income, 23.64% (9.01%) had a share up to 10%, 28.24% (22.13%) had a share between 11% to 25%, 17.99% (32.78%) had a share between 26% to 50%, 17.16% (22.95%) had a share more than 50% but less than 100%, 5.64% (9.01%) had a share of 100%, 2.51% (3.28%) had no idea of their contribution. The contribution of female child labourers is higher than that of their male counterparts in the upper end of the distribution. Thus the share of family income attributable to female child workers is higher than that attributable to male child workers. As Patil points out, this is so because more of the female child workers come from poorer families than do male child workers.

Child workers typically come from large families. A recent study of child labour in the carpet-producing belt in the state of Uttar Pradesh in India confirms this. It was found that of the working children sampled, none came from families of size 1-3; 14% came from families of size 4-6; 65% came from families of size 7-10; the remaining 21% came from families of size exceeding 10 [Vijayagopalan (1993, page 18)]. As mentioned in the Introduction, at an aggregate level, Rosenzweig and Evenson (1977) find a positive correlation between fertility and the child wage rate in rural India of 1961.

There is considerable legislation in India intended, in principle, to protect the interests of child workers.[8] Indeed, the Constitution of India bans child labour and promises compulsory education for all children. In reality, however, enforcement has been all but nonexistent, and in 1986, in enacting the Child Labour (Prohibition and Regulation) Act, the Government of India conceded that child labour cannot be abolished in the current stage of the country's development. In this piece of legislation, the government sought, rather, to institute regulations intended to

[8] The history of this legislation is comprehensively traced and documented in Weiner (1991, Ch. 5).

ensure that children are not exploited and to improve their conditions of work. Furthermore, although there is legislation allowing for the possibility of local bodies implementing compulsory education, it does not require education to be compulsory. Indeed, the procedure prescribed for implementing compulsory education is such that it cannot withstand the opposition of the parents of child labourers, should they find that their vested interest is in having their children work.

In summary, child labourers in India tend to come from large, poor families to whom the income from child labour represents a significant contribution. Child labourers are poorly educated, if at all, and these children typically experience high mortality rates. Legislation regarding child labour and compulsory education, while on the books, are perceived to be unenforceable.

III. The Model

In this section, a simple model is set out in which parents' choices regarding fertility and the education of their children in the presence of child mortality are endogenously determined in terms of the pension motive. The model is a simplified version of the framework set out recently in Eswaran (1995), but to which the possibilities of child labour and education are added.

Each agent (assumed sexless but referred to as "he") is assumed to live for three periods. In the first period, the person is a child. In the second period of his life, the person earns an income by working. In this period, the person is bound by altruism to take care of his parents by transferring some of his income to them. In the second period, the agent also makes fertility decisions. In the third period, the agent is in retirement and lives on the income he receives from his surviving children.

The preferences attributed to a generation t adult, $t = 0,1,2,...$, are assumed to be represented by the additive utility function:

(1) $$U(c_3^{t-1}, c_2^t, c_3^t) = u(c_3^{t-1}) + u(c_2^t) + u(c_3^t),$$

where c_i^t denotes the consumption of an agent of generation t in period i, i = 1,2,3, of his life. The von Neuman-Morgenstern utility function u(.) is assumed to be a strictly concave: all agents are risk averse. The first term on the right hand side of (1) captures, as in Zhang and Nishimura (1993), the altruism of an adult towards his elderly parent: it represents the utility that an adult receives from seeing his parent consume c_3^{t-1} in his retirement. This is also the utility the parent gets from his consumption in his last period. Note that while altruism towards parents is captured in these preferences, altruism towards children is not. This is a simplification, but one that is appropriate to invoke when considering the old-age security motive for having children.

The cost of raising n children, $B(n)$, is assumed to be given exogenously by a non-decreasing, convex function:[9]

$$(2) \qquad B(n) = B_1 n^{\theta}, \quad B_1 > 0, \ \theta \geq 1.$$

An essential feature of the model is the fact that not all the children an agent has will live to be adults. It is assumed that infants who die are swiftly and costlessly replaced. Denote by q the probability that a child who has survived early childhood will live to be a working adult. (This will subsequently be referred to as the *survival probability.*) The survival probability is taken to be exogenous and independent of the parent's income. Moreover, it will be assumed that the probabilities of different children dying before reaching adulthood are statistically independent. Then the probability, $p(q;n,m)$, that m of n children will survive to adulthood is given by the binomial probability.[10]

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[9] Increasing returns to scale in raising a family may introduce a non-concavity in the objective function in (3) below and thus is assumed away here. However, the nature of the results is not expected to change if this assumption is dropped.

[10] More formally, $p(q;n,m) = \dfrac{n!}{m!(n-m)!} q^m (1-q)^{n-m}$.

In the model that is constructed here, it is presumed that there are no capital markets. As in Neher (1971), children are the only capital goods available, and so all saving is done through them. This is a very appropriate assumption to make for a substantial fraction of the population of many present-day LDCs.

All parents are dependent in their old age on income transfers from their children. It is assumed that the fallback utility of a person who in retirement is childless is $\bar{u}$. This is the utility of surviving by such means as living off the commons, living with distant relatives, living on alms, etc. Clearly, this fallback utility is deemed so low that having children is viewed almost as a necessity in this society.

In the first period of a person's life, the person is a child who is either sent to school to receive an education or is put to work at home or outside the home. In the second period, the person is an adult, earning an income that depends on whether or not he was schooled in the first period. Apart from making fertility decisions (how many children to have), the adult also makes schooling decisions (how many of the children, if any, are to be sent to school and how many put to work). In the third period, the agent is in retirement, and lives on the income he receives from his surviving children, if any.

The maintained assumption that children are the only avenue for savings implies that the education of children, if undertaken at all, must be entirely self-financed by curtailing current consumption. Even if education is provided free of charge by the State, as is assumed to be the case here, parents cannot borrow money to compensate for the child labour income foregone by sending the child to school.

The decision to educate a child will clearly depend on the extent to which a child can augment the family income.[11] Even if they deem education for their children to be worthwhile, there is no presumption that parents will choose to educate all of them. The likelihood of girls

[11] This presumes that children are not given an education on a part-time basis--in the evenings, for example. While this is possible in principle, the present approach has the virtue of underlining the fact that losing an education is most frequently the opportunity cost of child labour.

being educated in many developing countries is less than that of boys. Even amongst boys, it is fairly common for only some of them to be schooled while others in the same family are not. Suppose that of the n^t children an adult of generation t chooses to have, he educates n_e^t and leaves unschooled the remaining $n_u^t \equiv n^t - n_e^t$. Denote by m_e^t and m_u^t , respectively, the number of schooled and unschooled children who survive till adulthood;[12] these are the children who will provide old age support for the parent. From the point of view of a parent making decisions in his period 2, of course, these numbers are random variables.

The incomes of an unschooled adult, a schooled adult, and of a child are denoted by y_u, y_e and y_c, respectively, all exogenously given, with $y_e > y_u > y_c$. It is assumed that the income generated by a child's labour, y_c, is the same irrespective of whether the child works inside or outside the home. The assumption that the various incomes are assumed to be exogenous implies that the analysis is one of partial equilibrium. As will be seen, the intuition for the results obtained here is robust and thus very little is to be gained by conducting a general equilibrium analysis in which these incomes are endogenous.

In setting out an agent's optimization problem, a natural assumption will be invoked to simplify the problem while retaining the primary focus of attention, which is the pension motive as a determinant of choices regarding fertility and schooling. It will be assumed here that each surviving offspring is required to hand over a positive fraction α of his period 2 income to his parent, where α is exogenously determined by social and cultural traditions.[13] Since the filial obligations of a generation t+1 adult are prespecified, a generation t adult does not have to condition his choices on his expectations of his children's fertility. Severance from the past and the endogenous choices of the future implies that the optimization problem confronting an adult is not

[12] It is assumed here, for simplicity, that the survival probabilities of educated and uneducated children are the same. One might expect that, in reality, greater parental care may be directed towards the educated children in order to protect their investment.

[13] Neher (1971) makes the assumption that consumption levels of all people in the extended family are determined by an exogenous rule he calls the "share-alike ethic," in which all members of the family receive an equal share of the income. However, Neher's model is not equipped to deal adequately with the effects of child mortality on fertility and educational choices.

generation-dependent; the model has no inherent dynamics. (Hence the time superscript will be dropped subsequently.) Since the incomes of schooled and unschooled adults are different, however, these two types of agents (denoted by e and u subscripts) will need to be be distinguished.

Under the assumptions made above, an adult of type $i \in \{e,u\}$ solves:

$$(3) \qquad \max_{n,n_e} \; u[(1-\alpha)y_i - B(n) + (n-n_e)y_c] \; + \; p(q,n_u,0)\, p(q,n_e,0)\, \bar{u}$$
$$+ \sum_{\substack{m_u,m_e \\ m_u+m_e \geq 0}} p(q;n_u,m_u)\, p(q;n_e,m_e)\, u[\alpha(m_u y_u + m_e y_e)].$$

The first term in the objective function in (3) represents the current period utility of the adult making the decisions: this is the utility derived from current consumption, given by total income (inclusive of child labour income) less the transfer to one's parent and the cost of rearing one's children. The second term represents the expected utility of the adult in retirement when none of his children survive to adulthood. The last term represents the adult's expected utility in retirement from income transfers received from his surviving children. On invoking the assumption that an adult transfers a fixed proportion of his period 2 income to his parent, the utility derived by the adult from his parent's consumption reduces to an additive constant independent of the adult's control and, hence, has been dropped.

IV. Results

The fertility rate, the number of children to educate and the number to leave unschooled are all discrete choice variables here. If these were treated as continuous variables, the risk to a parent arising from child mortality would be entirely eliminated, for one could infer with certainty that *exactly* a proportion q of one's children will survive. (Child mortality could then merely be seen as increasing the effective cost of raising a child to survive into adulthood.) The elimination

of the risk associated with child mortality is inappropriate here, since this risk is modelled here as an essential determinant of fertility and of educational choices. However, the discreteness of the choice variables renders difficult the derivation of analytic solutions. Neveretheless, we present below some analytic results and make some intuitively-robust inferences based on numerical simulations.

For very low survival probabilities, an adult would not have any children since the expected return from the consumption-smoothing service children may provide is too low to warrant the cost. When the only motive for having children is the pension motive, as is the case in the model under consideration, the survival probabilities have to be sufficiently large in order for fertility to be positive. Denote by q_i^u (q_i^e) the minimal survival probability required to induce an adult of type $i \in \{e,u\}$ to have one uneducated (educated) child. It is a simple matter to discern how these probabilities change with various parameters. At probability q_i^u (q_i^e), the adult is indifferent between having one uneducated (educated) child and having none. Thus the probability q_i^u is determined by the condition:

$$(4) \qquad u[(1-\alpha)y_i - B(1) + y_c] + qu(\alpha y_u) + (1-q)\bar{u} = u[(1-\alpha)y_i] + \bar{u}.$$

Likewise, the probability q_i^e is determined by the condition:

$$(5) \qquad u[(1-\alpha)y_i - B(1)] + qu(\alpha y_e) + (1-q)\bar{u} = u[(1-\alpha)y_i] + \bar{u}.$$

Some properties of the probabilities of q_i^u and q_i^e are recorded in the following propositions.[14]

[14] Proofs of these comparative static propositions are omitted because they are readily derived by totally differentiating expressions (4) and (5), respectively. The last parts of Propositions 1 and 2 below invoke the strict concavity of the von Neumann-Morgenstern utility function implied by risk-aversion.

Proposition 1: The smallest survival probability at which an adult will have one uneducated child is (a) decreasing in the child labour income, y_c, (b) decreasing in the uneducated worker's income, y_u, (c) increasing in the fallback utility in childless retirement $\bar{u}$, and (d) lower for an educated parent than for an uneducated one.

Parts (a) and (b) of the above proposition follow from the fact that higher incomes of a child labourer and of an uneducated worker both increase the parent's rate of return on an uneducated child for a given survival probability--the former by lowering costs and the latter by increasing the pension benefits. Part (c) follows from the fact that if the fallback utility without children in retirement is higher, an adult would require a higher expected return on children to be induced into having a child for pension purposes. Finally, part (d) follows from the fact that educated adults, by assumption, are currently earning higher incomes than are uneducated ones and, given risk-aversion, their marginal utility of current consumption is lower. Thus the desire for consumption-smoothing renders educated adults more willing to take the chance of having a child.

The analogue of Proposition 1 for a child who is educated is the following.

Proposition 2: The smallest survival probability at which an adult will have one educated child is (a) decreasing in the educated worker's income, y_e, (b) increasing in the fallback utility in childless retirement $\bar{u}$, and (c) lower for an educated parent than for an uneducated one.

The intuition for the above proposition is similar to that of Proposition 1. An important implication of part (c) of Proposition 2 is that educated (rich) parents are better able to take advantage of the high returns to children's education than are uneducated parents. The greater risk that the education of a child exposes parents to is a poverty trap: it discourages the poor from educating their children. This result underlines the point that economic development in the sense of higher per capita incomes would automatically reduce the incidence of child labour. The reason is *not* that richer people do not need the income from child labour: higher incomes increase a

parent's demand for consumption-smoothing, and this could be satisfied merely by having more uneducated children. Rather, the reason for this result here is that, as they get richer, adults are better able to handle the risk of losing the investment in their children's education. This result is analogous to one derived in Eswaran and Kotwal (1989), where it was shown that rich landlords were more apt to adopt the riskier but more productive HYV technologies during the Green Revolution, since they were better able to smooth consumption than were poor farmers.

The above discussion compares the probabilities q_i^u and q_i^e for parents of different incomes. It is not possible, however, to order q_i^u and q_i^e for the same adult; if the income of an educated child is so high that it more than compensates for the increased risk that educating children exposes parents to, adults may opt to have and educate a child at lower survival probabilities than they would have an uneducated one. By rearranging (4) and (5), it is easily seen that, for an adult of type $i \in \{e,u\}$, $q_i^u < q_i^e$ provided y_e is not too high relative to y_u. Since one rarely observes the return on education to be so high as to directly induce parents to have children and educate them, it is reasonable to assume that $q_i^u < q_i^e$ is the valid scenario.

For values of survival probabilities larger than that required to induce an adult to have one child, parents may opt to have more children. An increase in the survival probability not only increases the expected return on a child but also impinges on the risk parents face of being left childless in retirement. When the survival probability increases to sufficiently high levels, the reduction in risk may induce parents to actually reduce their fertility [Sah (1991), Eswaran (1995)]. More relevant to the discussion here, however, is the interaction between fertility and the education of children. Given the discreteness of the choice variables, the precise mix of educated and uneducated children a parent would find optimal to have cannot be determined analytically. It is clear that a parent will either educate all children or educate none when the survival probability of children approaches unity. In this limit, all risk arising from child mortality ceases, and the decision to educate children or to leave them uneducated is determined entirely by the relative rates of return. This is not the case, however, for intermediate values of the survival probability, as will be seen in the numerical results presented below. For given values of the

survival probability, y_c and y_u, the mix is likely to tilt in favour of educated children the higher is the value of y_e. Of course, if y_e is not high enough to induce parents to educate their children when $q = 1$, they will certainly not educate any when $q < 1$ since in the latter scenario education entails risk in addition to having lower expected returns.

In what follows, the sub-utility function appearing in (1) is assumed to be logarithmic:

$$(6) \qquad u(c_i^t) = \ln(c_i^t) \quad , \quad i = 1,2,3; \quad t = 0,1,2,\ldots$$

This function is particularly appropriate since it severely penalizes very low levels of consumption, a feature that is important to the phenomenon being investigated.

Figure 1 displays the optimal fertility and schooling choices of uneducated parents (lower panel) and of educated parents (upper panel) as a function of the survival probability, q. (The parameter values are indicated at the bottom of the Figure.) The two types of parents are distinguished here simply by their incomes. These incomes, in turn, impinge on their demands for consumption-smoothing and on their ability to bear risk. As q increases beyond about 0.6 in the Figure, uneducated parents start reducing the number of children they have. However, they do not educate their children until q reaches about 0.95, at which point one schooled child is the optimal choice of these parents. The broad features of the choices made by educated parents, shown in the upper panel of Figure 1, are different in some essential ways from those made by uneducated parents. Since the former earn higher incomes, they necessarily will have more (or at least as many) children in a world where no borrowing is possible.[15] As the survival probability increases beyond 0.26, educated parents also begin to have fewer children; as q approaches 0.6 they begin educating some of them; before q reaches 0.65, all the children of educated parents are educated.

Observe that the greater tendency exhibited by richer, educated parents to opt for the riskier asset (educated children) arises despite the fact the logarithmic sub-utility funtion (6)

[15] This result will be tempered by other considerations, as discussed below.

exhibits increasing absolute risk aversion. Here, as in Eswaran and Kotwal (1989), the consumption-smoothing behaviour of risk-averse agents is driven only by the concavity of the von Neuman-Morgenstern utility function.

Figure 1 also shows that fertility begins its decline at lower levels of survival probability for educated (rich) parents than for uneducated (poor) ones. This is because the former, earning a higher income, can have more children and thus more effectively protect themselves against the prospect of being left without support in old age. In other words, the prospect of facing retirement without surviving children ceases to be threatening at lower levels of survival probabilities for educated parents than for unschooled ones.

Since the type of economy being assumed here is one in which children are the only form of savings, it would not be surprising if rates of return on children are negative;[16] agents desiring consumption-smoothing would accept negative rates of return when that is the only option available. (This rate of return will depend, of course, on the survival probability q.) If the parameter θ in (2) is unity, the expected marginal rate of return on a child would be independent of the number of children there are in the family -- though it will depend on whether the child is educated or not. However, when $\theta > 1$ the expected marginal rate of return for each type of child will decline in the family size, since the marginal cost of a child is increasing in the number of children.

Denote by $r_e(n)$ and $r_u(n)$ the marginal rate of return *to the parent* on the n th child when the child is educated and uneducated, respectively. Denote by r_s the rate of return to the parent on the child's schooling.[17] For the parameter values indicated at the bottom of Figure 1, these rates of

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[16] Cain (1983) forcibly makes the point that empirical studies which argue that bearing children is irrational in developing countries when rates of return on children are negative are misguided, since parents choose a "safety first" strategy for having children.

[17] The expected marginal rate of return to the parent on the n th child is given by

$$r_u(n) \equiv \alpha q y_u / [B(n) - B(n-1) + y_c] \quad - \quad 1,$$

if the child is unschooled, and by

$$r_e(n) \equiv \alpha q y_e / [B(n) - B(n-1)] \quad - \quad 1,$$

if the child is educated. The denominators of the first terms on the right hand sides of these expressions are the respective increases in cost incurred by the parent in raising a family with an additional child; the numerators are

return to the parent for the very first child turn out to be given by $r_u(1) = 1.2q - 1$ and $r_e(1) = 1.4q - 1$. The parental rate of return on the schooling of children is given by $r_s = 1.6q - 1$. Thus the return to parents of their children's schooling becomes positive at survival probability 0.625. From Figure 1 it is seen that, despite the fact that the parental return to an educated child exceeds the return to an uneducated one for all positive survival probabilities, uneducated parents opt for the education of their children only when the survival probability reaches 0.95; at lower values of q, they would rather have more uneducated children than fewer educated ones. This is because the education of children would call for a drastic reduction in fertility, since the labour income of the children has to be relinquished. And this reduction in fertility would be unpalatable from the point of view of old-age security. Educated parents, on the other hand, begin to educate their children even before the expected return to schooling becomes positive, though they will not necessarily educate all their children for survival probabilities less than one.

These results may explain why parents may not opt to educate their children even when the private return on education is very high. When the survival probability is slightly below 0.95 in the above example, the parental return to the education of their children is 52%. In contrast, the true private rate of return to education is a staggering 660% in this case.[18] Thus, even when the rate of return on education is substantial, the institution of child labour generates a poverty trap. This is seen to be true here when the expenses of education are assumed to be borne entirely by the State. Were parents to incur school expenses, the argument made here would apply with greater force. In his survey of returns to education in over sixty countries, Psacharopoulos (1985)

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the revenues the parent expects to receive next period as pension from the child. The parental rate of return on a child's education is given by:

$$r_s \equiv \alpha q(y_e - y_u)/y_c - 1,$$

since once a child is born, by foregoing the child's labour income the parent receives a fraction of the expected increase in the adult earnings of the child.

[18] The true private rate of return on a child's education is the return accruing to the parent plus that accruing to the child, and is given by $q(y_e - y_u)/y_c - 1$. This is the private as opposed to the social rate of return, since education is assumed to be fully subsidized and so the cost to the State of providing the education is not factored in.

reports that the private rate of return to education in Asia as a whole is 31%, 15%, and 18% for primary, secondary and higher education, respectively.

In India, since Independence schools have been made available within each village. Despite this, the attendance rate of children is appallingly low. In aggregate, only 44.5% of the male children and 32.3% of the female children within the ages of 5-9 years were attending school in 1985-86. Furthermore, the combined dropout rate for male and female children from primary school was 47.6% and 64.4% for children in middle school [Kumar (1993)]. Thus not only is it difficult to persuade parents to send their children to school in the first place, it is also difficult for schools to retain a large proportion of the children who do begin schooling.[19]

Investment in the education of girls is frequently considered a waste, particularly in South Asia. For example, according to the 1981 Census of India, the male and female literacy rates in the country were 40.8% and 18.0%, respectively, in rural areas, and 65.9% and 47.8%, respectively, in urban areas. In the same year, of children in the school-going ages of 6-14, the number attending school was 47.9 million boys and 28.7 million for girls. It is easy to see why this arises in the South Asian context: old age security is largely provided by male children and hardly at all by female children. In terms of the above model, the parameter α for daughters is either zero or close to it; so the parental return to schooling is negative. Even if parents have no aversion to receiving financial help in old age from their daughters, the incentive to invest in the education of daughters would be diluted if, for whatever reason, the labour market discriminates against women, that is, if for equal education levels, y_e is lower for women than for men.

It must be noted, however, that there are several other important avenues that are not modelled here through which education impinges on fertility and schooling decisions. For example, educated parents are better able to recognize the life-threatening illnesses of their children and are able to take take timely steps to avert disaster. Education also brings home the

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[19] Of course, non-attendance in schools certainly cannot entirely be attributed to the riskiness of the investment. One reason often given by parents for not sending their children to school is the perceived irrelevance of education to earning a living.

importance of hygiene and of balanced nutrition. All these effectively increase a child's survival probability (which in the model is taken as exogenous to individuals). In other words, educated parents have the added advantage of being able to better protect their investment in children than uneducated parents. This reinforces the the tendency for educated parents to educate their children.[20]

In the model of this paper, the higher income accruing to educated adults cannot be invested in riskless, non-human assets which can be liquidated in retirement. Were this possible, a higher income in the working period would automatically translate into a higher fallback utility of childless retirement, $\bar{u}$. As income increases, agents will increase the number of children they have if the rate of return on children is high enough to compensate for the higher risk they entail than do the non-human assets. As the return on children decreases in the number of children, there will be a point beyond which all additional income will be invested in the non-human assets and in the education of children. Thus, ultimately higher incomes will not translate into commensurate increases in fertility rates but, rather, into higher education levels of children. If income levels determine the access an agent has to capital markets--a scenario that is very plausible in developing countries--it is entirely possible that fertility would, in fact, decline with income.[21] This could well be an important route through which economic development leads to a lower population rate of growth, rationalizing the belief that "the most effective contraceptive is development".[22] Neher (1971) has argued that the emergence of capital markets would lead to a decline in the steady-state population of a primitive economy, since children and savings accounts would be perceived as substitutes.[23]

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[20] Child labourers are exposed to higher mortality rates than other children, partly because of their greater expenditure of energy without a compensating increase in nutrition and partly because the work itself is frequently of a hazardous nature. This, through the pension motive, would reinforce the tendency of the poor to increase fertility--further entrenching the vicious circle of poverty and high fertility.

[21] The same outcome would obtain if one invokes the standard argument that the opportunity cost of children is increasing in the income of the mother because of the time required for childbearing and childrearing.

[22] This is the manner in which Chenais (1992, page 2, foonote 4) summarizes the view of people who see growth in income as a precursor of the demographic transition.

[23] This has been explicitly modelled recently by Zhang and Nishimura (1993).

Figure 2 displays the number of children parents find optimal to have and the number they send to school as a function of the income generated by child labour. Since child labour helps defray some or all of the costs of having children, parents of course opt to have more children and educate a smaller proportion of them as the child labour income increases. More interestingly, the Figure shows that for educated parents to completely cease from educating any of their children, the child labour income must be much higher than that required to persuade uneducated parents to withdraw all their children from school. This is consistent with the empirical fact that there is a greater preponderance of child labour in the families of uneducated parents than those of educated ones.

A higher income for child labour is not necessarily in the interest of children. To the extent that parents are driven to settle for short-term gains and a more secure retirement, the institution of child labour militates against the long run interests of children.[24] From Figure 2 we see that, when the child labour income is not excessively high, educated parents choose to curtail their fertility and to educate their children. Thus, enforced compulsory education for one generation would tend to induce a permanent transition to an equilibrium in which children are *voluntarily* educated in all subsequent generations.[25]

Developed countries have recently started contemplating a ban on the imports of the products which use child labour in developing countries. Such a ban, by lowering the return to child labour, may encourage parents to send their children to school. However, such a measure would affect only those industries in which the demand for child labour is derived from export

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[24] It might be argued that, following a wage increase for child labour, if parents opt not to educate the child, it is because they are better off by doing so; when the child becomes an adult, he can do the same with respect to his own children. Thus the child must also be better off in terms of lifetime utility when child labour income rises. This, indeed, is so in the partial equilibrium model. The fact that increased participation in child labour and the increased number of children brought forth has enormous general equilibrium consequences is not captured here. In particular, the privately rational higher fertility would lower the wage rate of labour if there is a fixed factor such as land [see Eswaran (1995) for an analysis]. If, in addition, the source of demand for child labour dries up in the future, the current generation children will be rendered unambiguously worse off.

[25] One possibility not modelled here is that children are useful for performing household chores, which releases time for parents to engage in income-earning activities outside the home. This possibility would temper but not eliminate the effect on educational choice of a reduction in the labour income accruing to children.

markets; the proportion of such industries may be quite small. If this is so, the elimination of export markets for some industries would result, most likely, in merely reallocating the existing child labourers amongst the industries serving only domestic markets, and the reduction in child labour earnings may be marginal. Furthermore, in the short-run this measure would make the lot of children worse; fertility would adjust only in the future. Thus, before implementing a ban on the imports of products produced with child labour, the developed countries should ensure that the developing countries' governments have in place some income-supplementing scheme for families with child labourers.[26] If not, a ban of this sort would hurt the very children it is intended to protect.

V. Two Policy Recommendations

The results of the simple model of fertility and schooling choices in a less developed country analysed above suggest that governments can play an important role in alleviating the problem of child labour. Two clear policy implications emerge.

I. Universalizing and Improving the Health Care Delivery System

Investment in health care is an important input into the determination of the mortality rates of children who are potentially capable of providing old-age support for their parents. This is particularly so since a large proportion of deaths between the ages of 15 and 60 years are health-related. For example, Table 2-14 in Murray, Yang, and Qiao (1992) reveals that in 1986, of the Indian males (females) who died between the ages of 15 and 60 years, 80% (84%) died of communicable, reproductive, and non-communicable diseases; the rest died due to injuries. Thus

[26] This would be particularly relevant, for example, to the carpet industry of India alluded to above, where the demand derives essentially from export markets. Child labour is especially deemed to be appropriate for the highly valued hand-knotted carpets, since the nimbleness of children's fingers, as opposed to those of adults, enables them to make more knots per unit area (which increases the value of the carpets).

there is considerable scope for reducing mortality rates in the relevant age groups by improving access to medical intervention.

A decline in mortality rates has important consequences for the incidence of child labour. Since, for a given fertility, more children are expected to survive to adulthood when mortality rates fall, parents need have fewer children to protect themselves against a retirement without any surviving children. Since current consumption thus is not excessively constrained by a large number of children, the need for parents to have their children augment the family income is diminished. Thus parents would be more disposed to send their children to school.

There is, however, a further effect of declining child mortality rates on the institution of child labour. We have seen that, at high levels of mortality rates, in terms of old-age security, unschooled children are deemed better assets than schooled ones, whereas the opposite is true at low mortality rates. Lower mortality rates alter the risk-return combination in favour of educated children and, hence, would lower the incidence of child labour. This suggests that efforts on the part of government through increased public expenditure on health care to reduce mortality rates would contribute to an increase in the population's literacy level.

It has been demostrated in Eswaran (1995) that, at reasonably high levels of survival probabilities, fertility rates can fall more rapidly than mortality rates, so that a society's population rate of growth can decline when mortality rates decline. Thus an increase in public expenditure directed at lowering child mortality rates in countries like India with high population growth rates would reduce the population growth rate and also effect a transition to a more literate population. It has certainly been recognized by policy makers that, empirically, reductions in fertility are closely linked to reductions in child mortality rates. For example, this was explicitly recognized in India after the Third Five-year Plan and, in subsequent Plans, family planning programmes have been linked to maternal and child health care programmes [see Srinivasan (1995, Ch. 2)]. The point being made here, however, is that the benefits of reducing child mortality go well beyond the fact that it induces reductions in fertility.

II. The Enforcement of Compulsory Education

It was argued above that, by making educated children a better asset than uneducated ones, a policy intended to decrease child mortality will contribute to a decline in the incidence of child labour. Such a policy, however, is not likely to completely eliminate the institution of child labour in the cultural setting of counries like India. As mentioned earlier, old-age security for parents comes from male children in Indian and some other cultures. Thus, even if the expected return to parents on the education of sons is substantial, that on the education of daughters will likely be perceived to be considerably lower. It is unlikely, therefore, that daughters would be educated to the same degree as sons. A policy of compulsory education--which will be politically acceptable only when mortality rates are sufficiently low--would address this problem.

Girls of school-going ages are frequently prevented from attending school because they are required to help around the house, while their brothers are sent to school. In effect, given the cultural norm of reliance only on sons in old age, the institution of child labour (within or outside the home) presses daughters into service to subsidize the education of sons, in alignment with their parents' self-interest.[27] Legislating compulsory education and enforcing it would have an additional benefit, apart from lowering fertility rates and generating a more educated labour force: it would go a long way towards reducing discrimination against girls.

There is also a very direct (and well-understood) benefit that society derives from the education of girls in terms of lower fertility. There is strong empirical evidence that educated mothers not only have fewer children, but also experience lower child mortality rates.[28] The effect of fathers' education on these variables is much less important. There are many persuasive reasons for this: marriages are later for educated women, opportunity costs of having children are higher,

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[27] Nadkarni (1976), in his survey of six villages in the Marathwada region of Maharashtra, India, found that the proportion of children who were prevented from attending school for the purpose of looking after their younger siblings and for doing household chores was 28.1% for boys and 58.6% for girls. Similar evidence can be found for Nepal in Nag, White, and Peet (1978).

[28] See, for example, *The World Development Report 1994* and the references cited therein .

more effective measures are taken against life-threatening illnesses of children, etc. It is ironic that a cultural bias in terms of old-age security militates against the education of the sex that matters more in the determination of fertility.

Demographers have argued that the demographic transition in the developed countries was hastened by compulsory education [Caldwell (1982, Ch. 10)]. In fact, Weiner (1991, Ch. 6) has argued that a ban on child labour is enforceable only when education becomes compulsory. The reason is persuasive: it is considerably more difficult to verify that no agricultural or industrial enterprise is secretly employing children than to verify whether all the children in a neighbourhood are attending the local schools. Historically, child labour has been in existence in almost all the now-developed countries; sooner or later, however, this institution was rendered illegal [Weiner (1991, Ch. 6)].

As an inducement to parents to educate their children, the subsidization of schooling would clearly be appropriate. If the subsidy extends so far as to compensate parents for the entire child labour income they forego by educating their children, getting children into school would be a relatively easy task but the burden on the public purse may be prohibitive. Subsidization to a partial extent may be feasible. Alternatively, the government could offer free education only for, say, the first two children of a couple, in order to encourage them to restrict fertility. This incentive scheme would work, however, only if parents perceive education to be essential for *all* their children. For reasons already discussed, this is likely to be so only when the mortality rates are low.

It must be noted that the expenditure of an education subsidy need be incurred by the State for a maximum of 12 years or so. It was seen in the previous section that, for sufficiently high survival probabilities, it is in the self-interest of educated parents to educate their children. Thus, if one generation of children is put through school, the higher incomes of this generation as adults would keep the momentum going. In other words, a once-and-for-all schooling subsidy could potentially move the economy permanently from an equilibrium of minimal literacy to one that has an educated labour force.

VI. Conclusions

This paper has considered the incentives of adults to have and to educate children in an environment characterized by significant child mortality and by an absence of capital markets. It has been argued that, in the presence of high mortality rates, the institution of child labour renders uneducated children a better risk than educated ones from the point of view of old age security. Consequently, even if the private return to parents on their children's education is substantial, they would opt for not educating children because this avenue affords better risk-diversification. Policies intended to reduce child mortality rates (a worthy goal in itself) will have the beneficial effect of undermining the institution of child labour by enhancing the value parents put on their children's education. These policies, however, need to be complemented by the legislation of compulsory education--especially in countries like India--to ensure that parents, driven by the pension motive, do not discriminate against daughters in the investment of education.

In his treatise on child labour in India, Weiner (1991) infers that poverty has little to do with the mass illiteracy that prevails in India. He argues that, rather, it is the "belief system of the state bureaucracy" that is a more relevant explanatory factor. This belief system, which he avers is widely subscribed to, views education as a means for maintaining a distinction between classes; universal education is seen as a threat since it would blur these distinctions and result in social upheaval. Without disputing the possibility that there may some truth in Weiner's sociological theory, this paper may be seen as offering an alternative view. It has been argued here that there are sound economic reasons, rooted in poverty, for the perpetuation of illiteracy in developing countries, particularly India. Consequently, there are sound economic policies that could contribute to the eradication of the institution of child labour.

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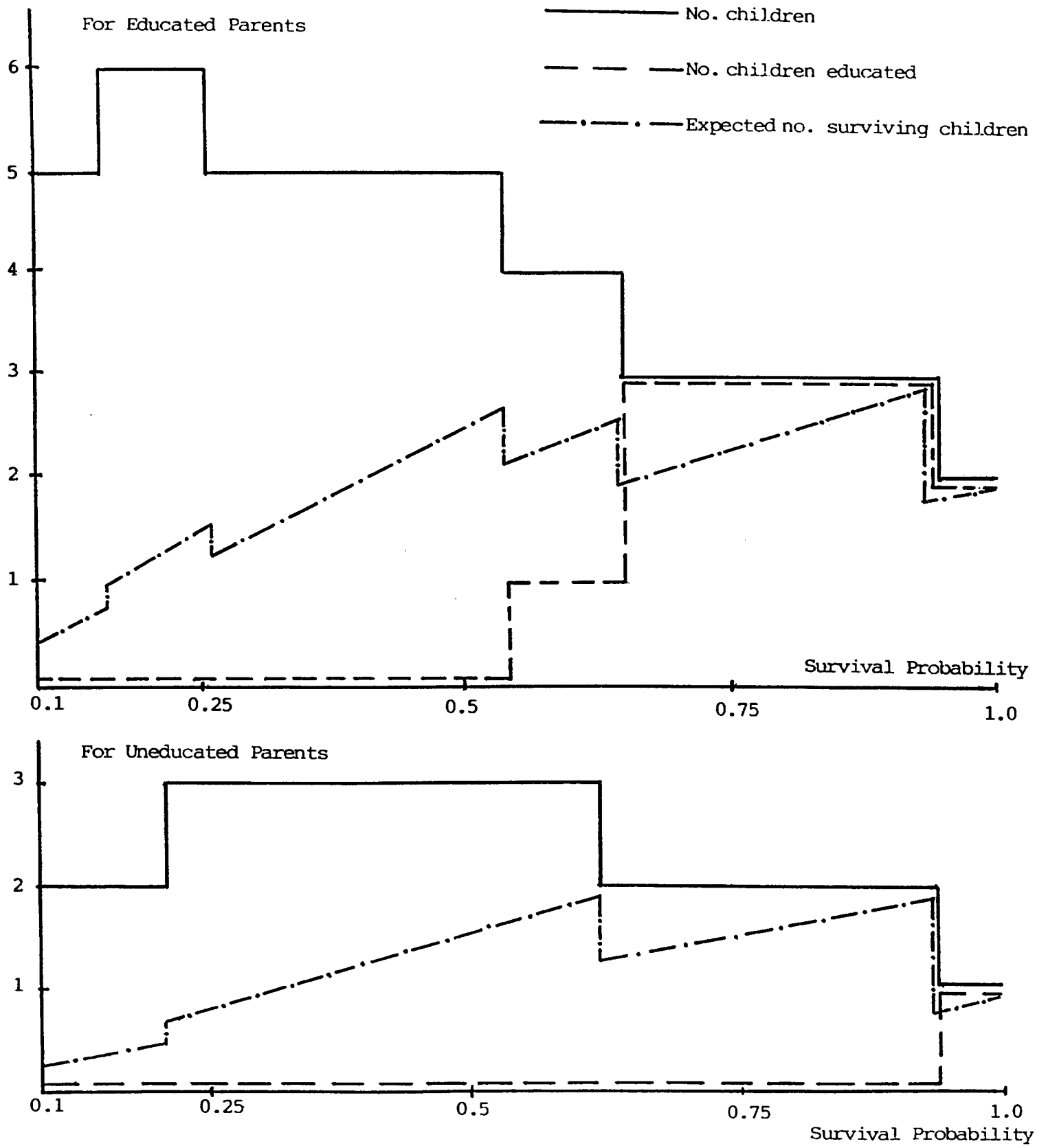

Figure 1: Fertility and schooling decisions as functions of the survival probability of children. (Parameter values: $\alpha = 0.2$, $y_c = 2$, $y_u = 12$, $y_e = 28$, B_1=4, $\theta = 1.1$, $\bar{u}$ =-5.)

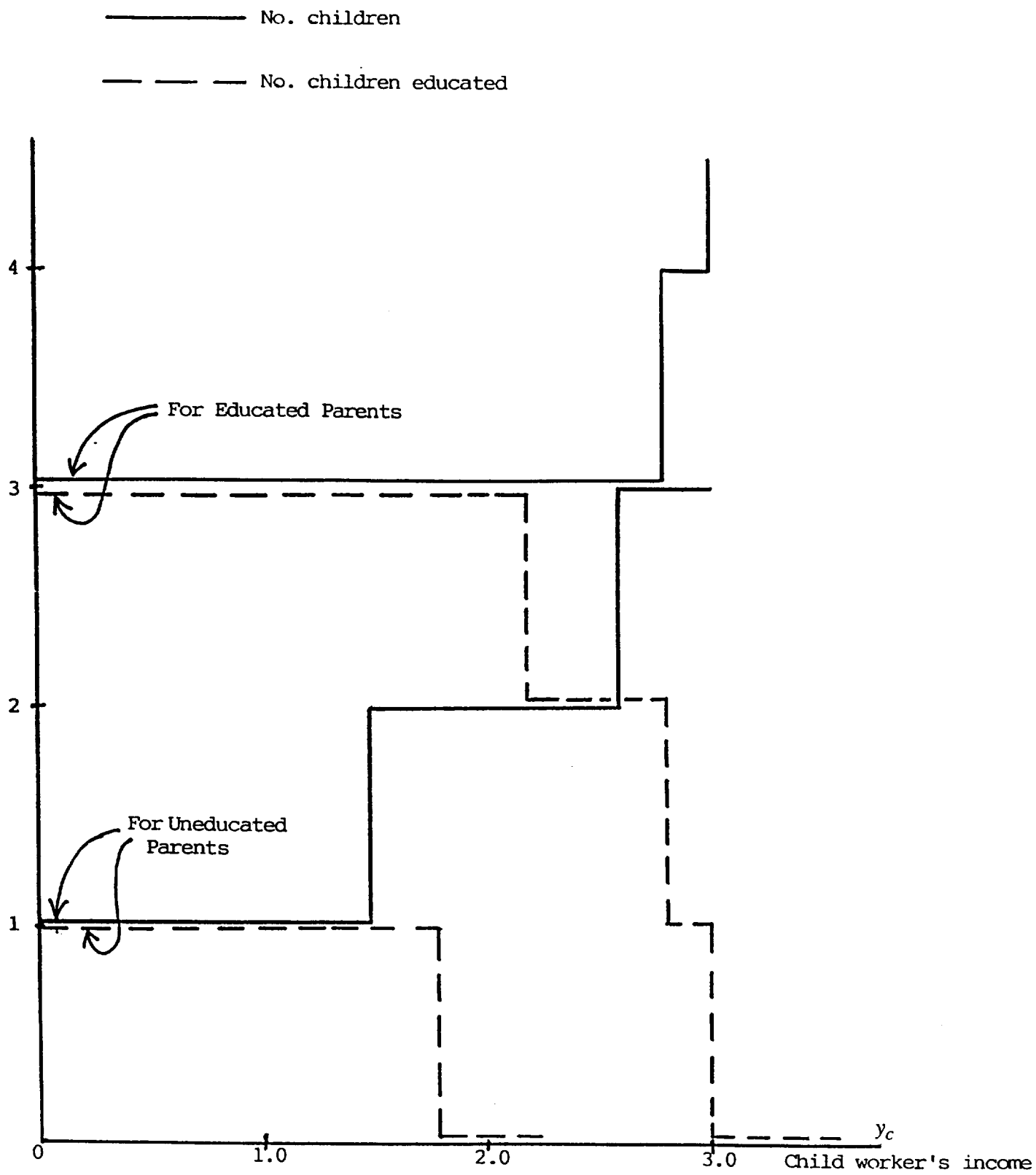

Figure 2: Fertility and schooling decisions as functions of the child labour income. (Parameter values: $\alpha = 0.2$, $y_u = 12$, $y_e = 28$, B_1=4, $\theta = 1.1$, $\bar{u}$ =-5, $q = 0.9$.)