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Child Labor, Nutrition and Education in Rural India: An Economic Analysis of Parental Choice and Policy Options

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ABSTRACT

The causes and consequences of child labor are examined within a household decision framework with survival uncertainty and endogenous fertility. The data come from a nationally representative survey of Indian rural households. The complex interactions uncovered by the analysis suggest that mere prohibition of child labor, or the imposition of school attendance, would make things worse, and would be difficult to enforce. Beneficially reducing child labor requires changing the economic environment to which the work of children constitutes, in the great majority of cases, the rational response. Suitable policies include capillary provision of schools, and public health improvements. The effects of these policies go far beyond direct impacts. They have favorable indirect repercussions on the school attendance, educational expenditure, labor participation, and nutritional status of children. They also discourage fertility. Women's education, and income re-distribution are also helpful, but land re-distribution may be counterproductive**.**

Keywords: child labor, education, fertility, mortality, anthropometry, household economic

Child Labor, Nutrition and Education in Rural India: An Economic Analysis of Parental Choice and Policy Options

Alessandro Cigno, Furio C. Rosati, Zafiris Tzannatos*

I. INTRODUCTION

Child labor is an emotive subject. Especially where very young children are concerned, it evokes images of maltreatment and exploitation. Such cases do exist and call for repressive measures, but there is not a great deal that the economist can say on the subject (beyond pointing to a possible trade-off between severity of the sanction and probability of detection). Quantitatively more important, however, are the cases where child labor is not the result of criminal intent, but a well-meaning response to material poverty. It may well be argued that, in these cases too, national governments and international agencies should do something to reduce the extent of the phenomenon, but the arguments for intervention have to be the standard ones: either some kind of coordination failure[1], which justifies public intervention on efficiency grounds, or social preferences such that some form of re-distribution (from parents to children, from rich to poor families, or from rich to poor countries) is deemed desirable. Either way, one has to start with a representation of child labor behavior, and of how this responds to policy.

Section 2 of the present paper provides an overview of child labor (or, more generally, of child engagement in activities other than study and play) through a survey of Indian households. Section 3 develops a theoretical framework for explaining the allocation of a child's time, and related decisions regarding fertility and the allocation of household budgets. Sections 4 and 5 contain an econometric analysis of the Indian data. Section 6 discusses the empirical findings in the light of the theory, and derives policy implications.

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[1] For an application of the argument to the present context, see Grootaert and Kanbur (1995).

II CHILD WORK, SCHOOLING AND WELFARE IN RURAL INDIA

Our data come from the Human Development of India Survey, carried out by the National Council of Applied Economic Research (NCAER) of New Delhi. This is a multi-purpose, nationally representative sample survey conducted during 1994 in the rural areas of India. A two-stage stratified and partially self weighting design was used to sample a total of 34,398 households spread over 1,765 villages and 195 districts in 16 states. Two separate survey instruments were devised, one to elicit the economic and income parameters from an adult male member, and the other to collect data on outcomes such as literacy, education, health, morbidity, nutrition, and demographic parameters from the adult female members of the household. The data are representative of rural population at the level of all India, according to states and population groups, and according to selected population groups for the selected states. Information on child work is obtained merging the "Children" file, relating to children aged 0-12, with information on individuals older than 12 years, contained in the "Individuals" file. Information about household level variables was added by merging the "Reproductive Information" file with the other two.

As shown in the last row of Table 1, school enrollment in India is relatively high. About 65 percent of children in the age range considered attend school, but gender differences are far from negligible. The enrollment rate of males is 15 percentage points above that of females.

Table 1
Child Labor Participation Rates (by sector) and School Enrollment Rates, by Sex

Activity	Male	Female	All
Agricultural	5.19	4.49	4.86
Non Agricultural	2.29	1.66	1.99
Household	5.27	10.45	7.70
Total Participation	12.75	16.6	14.55
School Enrollment	71.53	56.94	64.69

Source: Human Development of India Survey, 1994.

The questionnaire divides working children into three non-overlapping categories: working within the home, working in the agricultural sector, working in the non-agricultural sector. Of those working outside the home (nearly 7 percent of the 6-16 age group), about half are reported receiving wages (in money or in kind). We assume that the rest are employed in the family (usually farm) business. As most of the children reported working within the home are female, we assume that they perform household chores (including assistance to younger children).

Table 1 shows that about 15 percent of children in the 6-16 age group is reported to be engaged in paid or unpaid work. The household is the most common place of child work. While gender differences are not particularly relevant where work performed outside the home is concerned, the participation rate of girls in household work is twice as large as that of boys. There are, therefore, more boys than girls reported as not working. The unbalance reflects partly the fact that more of the boys go to school, but partly also the fact that more of the boys are reported as neither attending school, nor working (more about this later).

Table 2 presents information on child work and school enrolment, disaggregated by state. As is well known[2], there are large differences within India, with Kerala and Andhra Pradesh at the opposite ends of a wide spectrum. The age profile of child work (Table 3) shows a steep rise in participation after age 13. At any age, however, the place of child employment most frequently reported is the household. Leaving this out would thus seriously underestimate the work commitment of children', particularly of girls.

Table 2
Child Labor Participation Rates by Sector of Activity and School Enrollment by State

	Andhra Pradesh	**Bihar**	**Gujarat**	**Haryana**	**Himachar Pradesh**	**Karnataka**	**Kerala**	**Maharah**
Agricultural	10.75	3.18	7.35	3.95	2.27	8.77	0.63	7.87
Non agric.	4.21	2.70	1.48	1.30	0.48	2.13	1.26	1.50
Household	7.90	7.97	8.83	10.36	6.03	7.68	1.26	7.36
Total Partic.	22.86	13.85	17.66	15.61	8.78	18.58	3.15	16.73
School Enroll.	66.51	52.88	69.48	69.78	89.02	67.46	93.57	76.22
	Madhya Pradesh	**Orissa**	**Punjab**	**Rajasthan**	**Tamil Nadu**	**Uttar Pradesh**	**West Bengal**	**N.E. States**
Agricultural	6.51	4.41	5.29	1.93	5.65	2.31	3.11	1.39
Non agric.	1.37	2.63	2.43	1.81	3.17	1.49	3.42	2.60
Household	6.21	10.31	6.93	7.56	7.35	8.40	11.29	3.74
Total Partic.	14.09	17.35	14.65	11.3	16.17	12.2	17.82	7.73
School Enroll.	55.5	61.16	74.83	54.31	72.24	58.22	58.17	75.49

Source: HDIS, 1994

[2] See, for example, Dreze and Sen (1995).

Table 3
Child Labor Participation Ratesby Sector, Age and Sex

All	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Agric.	1.93	2.31	3.44	3.25	3.65	4.03	4.73	5.74	7.17	8.06	12.06
Non Agric.	1.02	0.88	1.44	1.35	1.64	1.67	2.28	2.26	2.82	3.11	4.39
Household	4.11	4.41	4.91	5.91	7.04	6.30	7.81	8.53	10.33	12.57	16.31
Total	7.06	7.6	9.79	10.51	12.33	12.0	14.82	16.53	20.32	23.74	32.76
Male	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Agric.	1.67	2.16	3.82	3.36	3.23	4.27	5.19	5.81	7.83	9.05	13.31
Non Agric.	0.82	0.80	1.38	1.49	1.47	1.82	2.47	2.43	3.59	3.96	6.12
Household	4.52	4.20	4.46	4.26	5.26	5.40	6.35	5.55	6.40	5.43	6.56
Total	7.01	7.16	9.66	9.11	9.96	11.49	14.01	13.79	17.82	18.44	25.99
Female	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Agric.	2.22	2.45	3.01	3.13	4.13	3.77	4.20	5.67	6.41	6.78	10.45
Non Agric.	1.25	0.97	1.51	1.19	1.84	1.51	2.05	2.08	1.93	2.01	2.19
Household	3.66	4.63	5.42	7.67	9.05	7.28	9.51	11.86	14.85	21.73	28.79
Total	7.13	8.05	9.94	11.99	15.02	12.56	15.76	19.61	23.19	30.52	41.43

Source: HDIS, 1994

Child work, in all its forms, appears to be negatively correlated with household income. School enrolment, by contrast, is positively correlated with income. In Table 4, labor participation and school enrolment are cross-tabulated with household income. The participation rate declines monotonically as income rises. For the highest income group, participation is about half that of the lowest income group. The enrolment rate rises from less than 57 percent in the lowest income group, to over 82 in the highest. There is thus a clear trade-off between work and education.

Table 4
Child Labor Participation Rates and School Enrollment Rates by Income Group

Activity	**Income Group**				
	1	**2**	**3**	**4**	**5**
Agricultural	5.61	4.73	3.37	3.59	2.51
Non agricultural	2.34	2.05	1.25	1.26	0.53
Household	8.53	7.44	6.43	5.68	5.38
Total Participation	16.48	14.22	11.05	10.53	8.42
School Enrollment	57.84	67.84	74.83	77.00	82.31

Source: HDIS, 1994

Work and study are not mutually exclusive categories, and do not exhaust the list of possibilities. Some children are reported attending school, while at the same time performing some form of paid or unpaid work. Others, as already mentioned, are reported doing apparently nothing (neither attending school, nor working). We created four mutually exclusive and exhaustive categories: work only, study only, work and study, neither work nor study. As Table 5 shows, the majority of children (over 60 percent) studies only. The second largest category (25 percent) is that of children reported as doing nothing. The rest works only (about 10 percent), or attends school and works at the same time (less than 5 percent).

Table 5
Work/Study Status of Children by Sex

	Male	**Female**	**All**
Work Only	7.90	13.28	10.42
Neither Work nor Study	20.57	29.78	24.90
Study Only	66.70	53.70	60.50
Work and Study	4.90	3.30	4.10
Total	100	100	100

Source: HDIC, 1994

Tables 6-8 show the allocation of children to the four work/study categories by state, age, household income. The probability that a child will work full time falls as income rises (the same is true of the probability that the child will, reportedly, do nothing). Conversely, the probability that a child will study (full or part time) rises with income. The proportion of children working full time rises with age, while that of children working and studying at the same time shows a U-shaped profile. This indicates that children enter the labor force without leaving school, but as they become older the probability that they will only work does increase. The large number of children doing apparently nothing is a puzzle. It could be that a sizeable share of the child population has no opportunity to perform any kind of work, paid or unpaid, and that (perhaps because of that) their parents are too poor to send them to school. Or, it could be that these children are actually working, but that for some reason their parents do not wish it to be known. We shall treat this group separately from the rest. The econometric analysis will show that the characteristics of this group are not dissimilar from those of children working full time.

Table 6
Work/Study Status of Children (%) by State

	Andhra Pradesh	Bihar	Gujarat	Haryana	Himachar	Karnataka	Kerala	Mahar
Work Only	17.42	11.74	13.04	10.22	4.12	12.95	1.19	11.11
No Work/No Study	16.06	35.38	17.48	20.00	6.86	19.59	5.24	12.67
Study Only	61.07	50.77	64.85	64.38	84.37	61.83	91.61	70.61
Work and Study	5.44	2.11	4.63	5.40	4.65	5.63	4.96	5.61
	Madhya Pradesh	**Orissa**	**Punjab**	**Rajasthan**	**Tamil Nadu**	**Uttar Pradesh**	**West Bengal**	**N.E. States**
Work Only	10.47	12.91	9.30	7.89	10.83	8.70	13.8	5.70
No Work/No Study	34.04	25.93	15.87	37.8	16.94	33.08	28.03	18.81
Study Only	51.87	56.71	69.48	50.90	66.90	54.73	54.15	73.46
Work and Study	3.63	4.45	5.35	3.41	5.34	3.49	4.02	2.03

Source: HDIS, 1994

Table 7
Work/Study Status of Children (%) by Income

INCOME	1	2	3	4	5
Work Only	12.24	10.17	7.15	6.02	4.66
No Work/No Study	29.92	22..00	18.03	16.98	13.04
Study Only	53.61	63.78	70.92	72.49	78.54
Work and Study	4.230	4.05	3.91	4.51	3.77

Table 8
Work/Study Status of Children by Age

Age	6	7	8	9	10	11	12	13	14	15	16
Work Only	4.77	3.96	4.98	4.98	7.29	6.66	9.36	12.35	16.02	21.31	30.49
No Work/No Study	47.62	27.29	23.78	16.39	20.51	15.31	21.06	20.43	23.24	25.16	26.23
Study Only	45.32	65.11	66.43	73.10	67.15	27.69	64.12	63.04	56.44	51.11	41.01
Work and Study	2.30	3.64	4.81	5.53	5.05	5.34	5.46	4.19	4.30	2.42	2.28

Source: HDIS, 1994

Tables 9-10 show how a biometric indicator of nutritional status, the body mass (weight divided by height squared), varies with the work/study status of the child. In addition to showing nutritional status, body mass is a predictor of the child's probability of

Table 9
Body Mass[3] by Age and Work/Study Status (Boys)

STATUS/AGE	6	7	8	9	10	11	12
Work Only	15.74	15.30	15.02	14.41	15.64	15.39	16.13
Study Only	14.87	14.88	15.19	14.99	15.26	15.41	15.54
Work and Study	14.50	14.35	14.62	14.70	14.83	15.36	15.53
Neither Work nor Study	15.20	14.99	15.16	15.39	15.41	15.24	15.91

Source: HDIS, 1994

Table 10
Body Mass by Age and Work/Study Status (Girls)

STATUS/AGE	6	7	8	9	10	11	12
Work Only	15.30	15.64	14.79	15.11	15.24	15.04	15.49
Study Only	14.82	14.66	14.78	14.71	14.85	15.08	15.63
Work and Study	14.77	14.43	15.05	13.95	14.64	15.02	15.43
Neither Work nor Study	14.80	15.75	14.91	15.09	15.05	15.41	15.40

Source: HDIS, 1994

survival to (and, more generally, health status in) subsequent stages of life[4]. Since the probability of survival (or its complement, the probability of death) is arguably the best synthetic indicator of economic success or failure (Sen, 1995), this anthropometric measurement gives us very valuable information. Looking at the raw data, we cannot say that working children fare worth than children attending school. Working girls up to the age of 10, and working boys up to age 7, have higher body mass than their contemporaries attending school (children working and attending school at the same time fare worst of all). At higher ages, there is no clear pattern. Of course, a child engaged in energetic forms of work is likely to have a higher ratio of muscles to fat[5], and thus to weigh more, than a non-working contemporary with the same body volume. On the other hand, other things being equal, a

[3] Weight/height squared

[4] See, for example, de Onis and Habicht (1996), Klasen (1996), Waaler (1984). Fogel (1993) argues that weight and height enter separately into the determination of the survival probability, so that the same body-mass ratio could be associated with different survival rates. Indeed, Fogel and Waaler report evidence that the relationship between survival and body mass is U-shaped where adults in developed countries are concerned. Given the age-range we are considering, however, and the fact that practically all the children in our sample are undernourished by western standards, we may reasonably take the relationship to be monotonic in our case.

[5] Also, a child born with more muscle is more likely to be selected for energetic work activities (Dasgupta, 1997).

working child needs more food to reach any given body volume. It thus seems unlikely that, of two children with the same sex, age and body mass, the one who works will have received less nutrition than the one who does not.

To sum up, the data show that child work is an important phenomenon. How important depends on what we call work: little important if we only count children reported working for a wage or in the family business (7 percent), important (14 percent) if we add those performing household chores, very important (over 39 percent) if we also include those that are reported doing nothing, but which we suspect may be actually working. Working children appear to fare better, in terms of current nutrition and future health, than children who study; but will enter adulthood with a smaller stock of human capital than children who study. Children who study will have more human capital, but probably poorer health, than working children[6].

III AN EXPLANATORY FRAMEWORK

Assuming that infants and children are under the control of parents, any analysis of why a child might work must start with a model of parental decisions. Since the decision of whether or not to send a child to work is closely interrelated with that of whether or not to send the child to school, of how much to spend for the child (and in which way) at various points of the life cycle, and ultimately of how many children to have, all of these must considered within a unified framework. We shall see that, not only the effects of policies directly aimed at improving children's welfare, such as free or subsidized provision of school facilities, but also those of more broadly aimed policies, such as sanitation or preventive medicine, depend on how parental decisions are modified in response to such policies.

The decision problem has the following structure. Parents decide whether or not to procure an extra birth[7], and decide how much to spend for each pre-school child, under conditions of uncertainty about whether he or she will reach school age. If the child survives,

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[6] While the trade-off between work and study is obviously one-to-one, the trade-off between the outputs of these activities (respectively, current consumption and future human capital or consumption) may be lower. The evidence (e.g., Psacharopoulos, 1997; Patrinos and Psacharopoulos, 1997), however, is somewhat discordant.

[7] Strictly speaking, we should be saying that parents-to-be condition the probability distribution of an extra birth by choosing the frequency of intercourse, whether to use contraception, etc. But, the mechanics of fertility determination are not the focus of the present paper.

parents decide how much to spend for him or her, and how to allocate his or her time between work and study[8]. We do not go into the issue of the balance of power between father, mother and other adult family members at this stage, but we are aware that the weight of the mother in decision making may rise (and the quality of decisions regarding child welfare may improve) with her education and outside earnings. We shall come back to this point in the interpretation of the empirical results.

We examine the issue in the context of two alternative models, one assuming altruism and the other self-interest on the part of parents towards their children. Throughout, we assume that parents control fertility, and condition the survival probability of their children at various points of the life-cycle through expenditure on certain items. Since the model must serve to explain household data on rural India, we allow for the possibility that parents own or rent land.

Altruistic Model

The life-time utility of parents depends on their own life-time consumption, on the consumption of their pre-school and school-age children, and on the amount of human capital with which each of these children will enter adult life[9]. The list of goods consumed by children includes food and medical care, but excludes educational inputs (which are considered separately). The amount consumed in the pre-school period is assumed to have a positive effect on the probability that the child will survive to school age and, more generally, on his or her current and future health prospects. Since the amount that a person is able to earn, as an adult, is positively related to the person's health (dependent on past consumption) and personal skills (dependent on human capital), saying that parents care

8 Given the nature of the data we shall want to explain, it seemed reasonable to assume that the real competition for the use of the child's time is between work and study. Leisure (or playtime) is treated as a residual, something that is done at times of the day, or of the year, when there is nothing else for children to do.

9 Since time spent in education reduces time spent working hour-for-hour, the marginal rate of substitution of human-capital for consumption may reflect not only willingness to trade present for future consumption, but also physical complementarity between work and food consumption. Suppose, for example, that the marginal rate of substitution were 3. This might simply mean that the child (or his parents for him) is willing to give up three units of present consumption in exchange for one unit of human capital (future consumption). Or, it could be the case that the child would have been willing to trade food for human capital one-for-one if work and study had the same calories requirement, but is actually willing to give up another two units of food on account of the fact that studying uses less calories than working.

about their children's current consumption and future human capital is equivalent to saying that they care about their children's lifetime welfare.

Human capital is partly a reflection of native talent and partly the fruit of education. The second part is "produced" with time (which includes not only school attendance, but also study outside school hours), and other educational inputs (books, tuition and writing material, but also travel to school). The opportunity cost of time spent in education is equal to the child wage rate, or to the marginal product of child labor in the family farm, whichever is higher. The marginal cost of human capital is constant[10] up to the point where the child's time if fully employed in education. From that point onward, it increases with human capital, as more and more has to be spent for educational inputs in conjunction with a fixed amount of time.

The relationship between the marginal cost of human capital, denoted by q, and the stock of human capital, denoted by h, may be interpreted as a supply curve. Fig. 1 shows how this curve is affected by changes in the prices of educational inputs, or in the opportunity-cost of time spent in education. The broken line through point I represents the supply of human capital for a particular configuration of prices of educational inputs, and opportunity-cost of time. If the opportunity-cost of time rises, the supply curve becomes the one through point *H:* the horizontal segment of the curve shifts upwards, but the amount of human capital that can be produced with full-time education increases, because parents economize on their children's time. Next, take the curve through point *H* as the initial situation, and consider the effect of a rise in the prices of educational inputs. The horizontal segment will again shift upwards, but the human capital produced with full-time education will now decrease, because parents economize on educational inputs.

[10] Assuming constant returns to scale in the production of human capital of the individual child.

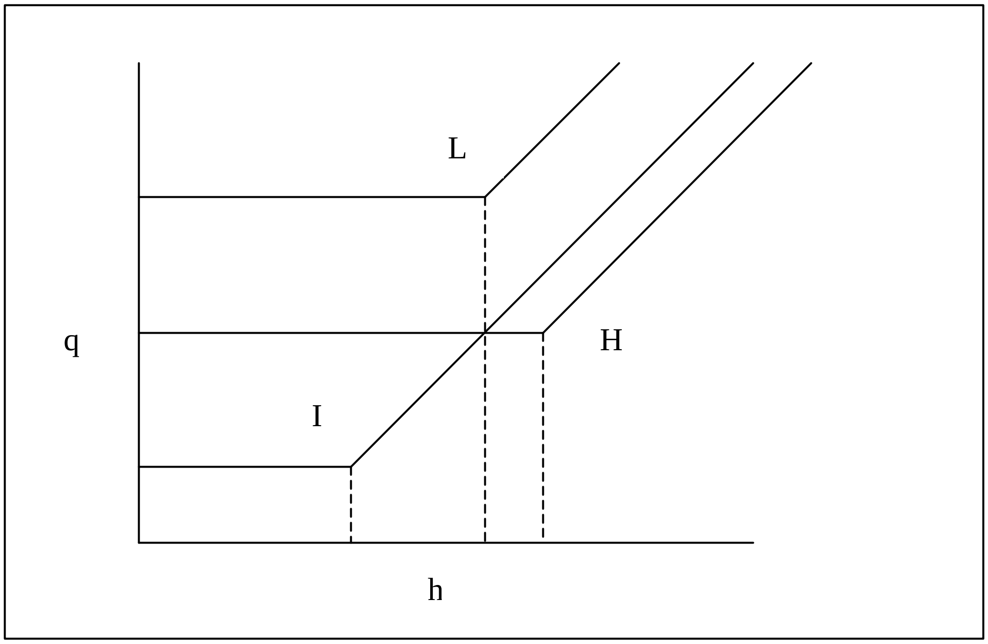

Figure 1

Decisions concerning school-age children. Parents decide how to allocate the time of their school-age children, and how much to spend for each of them, so as to maximize their own utility (which, remember, takes into account that of the children), subject to the family budget constraint. The possible solutions are illustrated in Fig. 2, where c stands for the consumption of a school-age child.

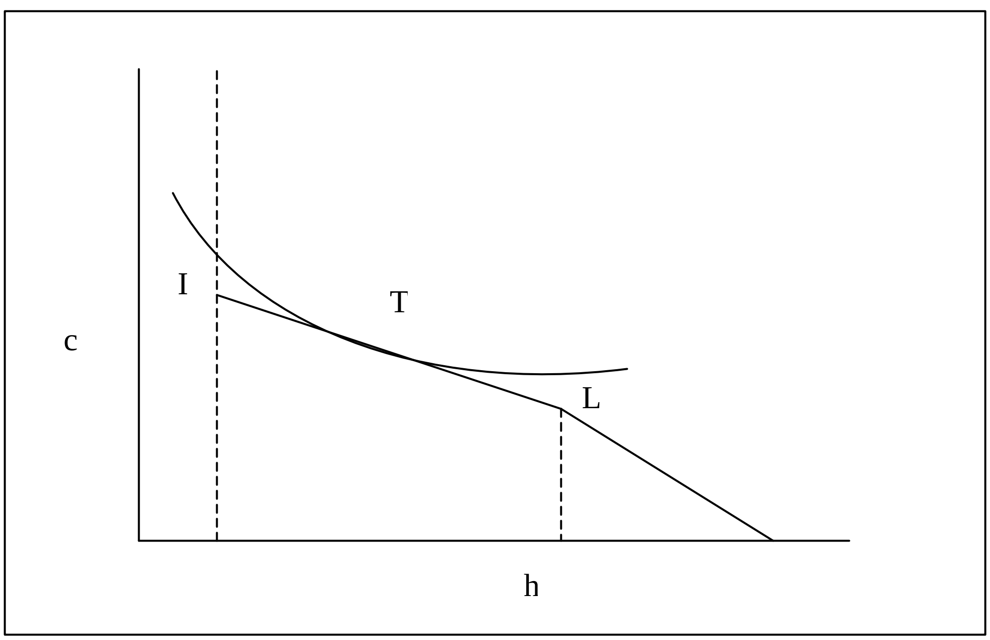

Figure 2

The broken line through points I and L is the production frontier. The abscissa of point I is the amount of human capital that the child would have in the absence of education ("natural talent"). To the right of point L, the child's time is fully occupied in education. The slope of the production frontier, equal to the marginal cost of human capital, is constant to the left of point L, increasing to the right of it. The choice set is delimited by the vertical line through point I to the left (parents cannot sell off their children's natural talent), and by the production frontier upwards. The slope of the indifference curve through point I is the price of human capital above which parents are not willing to bear any cost for their children's education. The slope of the indifference curve through point L is the price of human capital below which parents want their children to study full time.

The first type of solution is at point I, where the marginal cost of human capital is higher than the maximum that parents are willing to pay. If that is the type of solution, the child is made to work full time. The second type of solution is at any point between I and L (e.g., at point T), where the marginal cost of human capital is equal to its marginal rate of substitution for consumption. If that is the case, the child works and studies at the same time. The third type of solution is either at or to the right of point L, where the marginal cost of human capital is lower than the minimum below which parents want their children to study full time. If that is the case, the child does not work at all. If parents send their children to school at all, they also spend for educational inputs.

A lump-sum increase in family income raises current consumption and the future stock of human capital for every child[11], but it also raises the maximum that parents are willing to pay for an extra unit of human capital, and the minimum below which they want their children to study full time. Since the marginal cost of human capital is not affected, the probability that a child will work full time will then fall, while the probability that the child studies full time will rise. The probability that the child works and studies may go either way.

[11] Assuming that consumption and human capital are normal goods.

Fig. 3 illustrates the effects of an increase in the price of an educational input, or in the opportunity-cost of time in education, holding full household income constant[12]. Take

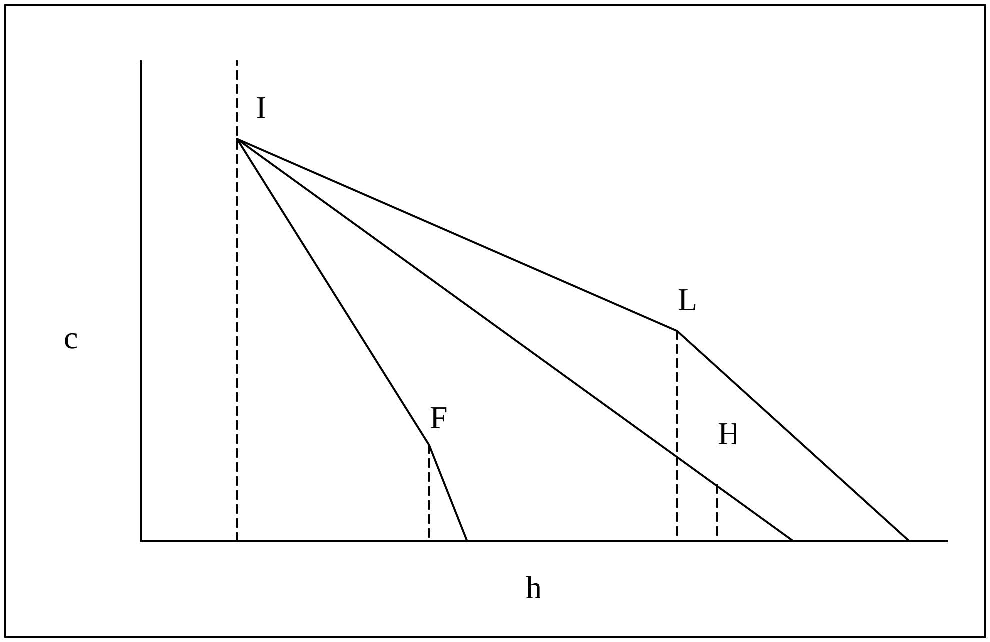

Figure 3

the broken line through point L as the frontier before the change. By raising the marginal cost of human capital, an increase in either of those variables makes the frontier steeper everywhere. Unless the child already is a full-time worker (i.e., the initial solution happens to be at point I), this will lead to a rise in the child's consumption. Other effects will depend on whether the increase was in the opportunity-cost of time or in the price of an educational input. If the former, the new frontier will be like the one through points I and H. As the price of human capital below which parents want their children to study full time falls, and that above which they want children to work full time stays the same, the effect of a rise in the child wage rate (or, if the child works for his parents, in the domestic productivity of child labor) is to raise the probability of full-time work, and to lower the probability of full-time study; the effect on the probability of part-time work is ambiguous. The effect on the

[12] That is to say, assuming a compensatory lump-sum transfer to the household if prices rise, from the household if the opportunity-cost of time rises. The reason for holding income, rather than utility, constant is that, as we have seen, the data contain income information, which we shall want to exploit.

demand for educational inputs (other than the child's own time) is also ambiguous because, on the one hand, the demand for human capital falls, but on the other, each unit of human capital is produced with more educational inputs and less time. By contrast, if the price that has risen is that of educational inputs, the new frontier will be the one through points I and E. The price of human capital below which children study full time may rise or fall, that above which they work full time is again unaffected. Therefore, if the price of, say, books or travel to school goes up, the probability of full-time work increases, but we cannot say whether the child is more likely to study full or part time. The effect on the demand for the input is clearly negative.

The number of siblings raises the cost of providing each child with one more unit of human capital. Holding full family income constant, a rise in the number of school-age children makes the frontier steeper everywhere. As the amount of human capital for which the marginal cost starts to rise remains the same, the price of human capital below which children study full time will fall. Having more brothers and sisters of school age then makes it less probable that a child will study full time, and more probable that will study part time. The probability that the child will work full time is not affected.

Fertility choice, and decisions concerning pre-school children. Parents decide whether to procure an extra birth, and how much to spend for the new child until he or she reaches school age, under conditions of uncertainty about whether the child will live to school age. For any given set of environmental and hereditary conditions, the child's survival probability will be positively conditioned by health-enhancing public policies (sanitation, mass immunization, etc.), which parents take as exogenous, but also by the amount consumed between birth and school age[13], which is decided by the parents. We are thus saying that a child's chances of reaching school age depend not only on external conditions, but also on actions taken by the child's own parents[14]. We assume that, in choosing their fertility behavior and allocating consumption to the children that are born, parents are aware that their decisions will affect the probability of survival of those children, and take account

[13] This, remember, includes nutrition and medical care.

[14] This contrasts with much of the economic literature on child fertility/mortality, where mortality is generally assumed to be exogenous. Cigno (1998) examines the implications of endogenizing mortality in a household decision model, and shows that this assumption is necessary in order to explain the observed positive correlation between fertility and infant/child mortality.

of how the time of the same children will be allocated between study and work if they do reach school age.

The maximization of expected utility yields demand functions for number of births, and consumption of pre-school children[15]. Under plausible conditions (see Cigno, 1998), directly health-enhancing policies such as public expenditure on health, sanitation, etc., or a rise in the prices of the goods consumed by pre-school children, would reduce fertility and raise pre-school child consumption if public expenditure is a net complement for pre-school child consumption; raise fertility and reduce pre-school child consumption if it is a net substitute. If it is a net complement, fertility and infant mortality move in the same direction as the empirical evidence seems to suggest[16].

Non-Altruistic Model

As an alternative, suppose that people are selfish: derive utility from their own lifetime consumption only. Since children are costly but, under present assumptions, do not yield direct utility, adults will be parents only if they expect to get a return on their investment. Such a return would be forthcoming if there were rules, by which all members of the same family abide, prescribing that a grown-up child must support his or her parents in old age, and if the level of support were positively related to the earning capacity of the child[17]. Since earning capacity depends, in general, on health and personal skills, old age support from each grown-up child will increase with the amount that the parents have spent for the consumption and the education of the child. The amount spent for consumption affects also the number of grown-up children (the probability that a child lives to be an adult).

In deciding how to allocate the time of each school-age child between work and study, and how much to spend for his or her consumption and education, non-altruistic parents will then take into account the effect that this will have on their own old-age

[15] Assuming that the trade-off between births and child consumption falls more slowly than the marginal rate of substitution, otherwise we get a corner solution with the number of births equal to either zero or the physiological maximum.

[16] For further discussion, cf. Cigno (1998).

[17] Cigno (1993) derives conditions under which some such rules are self-enforcing, in the sense that it is in everyone's interest to comply with them, and to make others comply. Such conditions are more likely to hold if, as in the case under consideration, there is no public pension scheme, and asset markets are highly imperfect, so that there is little alternative to filial support in old age.

consumption. The properties of the solution are analogous to those we found in the case of altruistic parents, but with an important difference. As the probability that the child will survive to adulthood, and will thus be able to pay parents their due, depends on, among other things, the presence of health-enhancing policies, parental decisions are affected by these policies. This was true, in the case of altruistic parents, with regard to fertility decisions and to the treatment of pre-school children, but not where the treatment of school-age children is concerned. The effect of these policies on school-age consumption is analogous to that it had on pre-school consumption in the altruistic model, and similarly ambiguous. This is because, on the one hand an exogenous increase in the probability that a child will survive long enough to provide old-age support lowers the expected marginal cost to the parents of achieving any given level of support, but on the other hand reduces the amount of school-age consumption required to achieve any given probability of survival.

The effect on human capital, by contrast, is unambiguously positive, because school-age children are viewed by non-altruistic parents as assets. An exogenous rise in survival probability (a fall in the probability of default) thus raises the incentive for parents to invest in a child's education. This property may allow us to discriminate empirically between altruistic and non-altruistic motivations.

Parental decisions regarding fertility behavior and pre-school consumption are affected by changes in the exogenous variables in qualitatively the same way as in the altruistic case, because the formal structure of the expected-utility maximization problem is exactly the same.

IV ESTIMATES AND TESTS

We have conceptually decomposed the decision problem faced by parents into two stages. Parents make fertility decisions. and allocate resources to each new-born child under conditions of uncertainty about whether he or she will live to school age. For each child that survives to school age, parents decide whether he or she should work, study, or both. Since it so happens that most of the mortality occurs up to age 5, and school begins at age 6, it seemed natural, in moving from the theory to the data, to identify the interval between the two decision stages with the first five years of life of the child.

Where school-age children are concerned, the model predicts how much a child consumes, and the probability that the child will work or study (part or full time), as functions of full household income, number of siblings, marginal cost of human capital, opportunity-cost of time spent in education, and various policy variables. It also makes predictions regarding educational expenditure. Where pre-school children are concerned, the model predicts fertility (the demand for births) and the consumption of each child as functions of full household income, price of child-specific goods, and health-enhancing policy variables, as well as of all the variables that will later affect decisions on school-age children.

We estimated equations predicting the probability that a school-age child will work full time or part time, educational expenditure for each child attending school, consumption by pre-school and school-age children, and the probability of an extra birth. Time use by school-age children is represented by a variable taking value 1 if the child is reported working and not attending school, 2 if the child goes to school and works, 3 if the child attends school and does not work (we shall come to the no-work, no-school category in a moment). Demand for educational inputs (other than time) is represented by educational expenditure per child attending school. Having no direct information on consumption by children of either age group, we proxied consumption by the body mass index, which, as mentioned in Section II, is at once a measure of nutritional status, and a predictor of the probability of survival to the next stage of life. Fertility is represented by a dichotomous variable taking value 1 if a birth occurred in the two years[18] preceding the interview, 0 if it did not.

The explanatory variables reflect, as closely as data permit, those figuring in the theoretical analysis. Descriptive statistics are reported in Table 11.

Income is measured as the sum of the value of own-farm production and outside earnings by all household members, including school-age children. Subsidiary income information is provided by Tenure and Poverty. The former is a dichotomous variable, taking value 1 if the household owns the land it works, 0 if it does not. The latter is an

[18] Two rather than one because there is a certain margin of error in the recording of the exact date of birth of each child (and also because it gives us more observations).

expert-group classification of households according to relative poverty (as it takes values from 1 for poorest, to 4 for least poor, it should be interpreted as "absence of poverty").

Table 11
Descriptive Statistics for the Variables Employed in the Regressions

	Mean	Std. Dev.	Min	Max
Sex	0.44	0.49	0	1
Child's Age	10.80	3.03	6	16
Child's Age^2	12.60	67.00	36	256
Poverty	2.60	0.98	1	4
Tenure	0.29	0.45	0	1
Land Size	2.23	1.44	1	5
Income	25139	19259	677	99000
Household Size	7.16	3.01	2	19
Siblings	3.82	1.57	0	12
Siblings (6-16)	3.01	1.50	1	10
Siblings (0-5)	0.92	1.15	0	10
Type of School Available	1.60	0.95	0	3
Hindu	0.83	0.38	0	1
Muslim	0.11	0.31	0	1
Christian	0.02	0.15	0	1
Other	0.04	0.19	0	1
Father's Education 1	0.53	0.49	0	1
Father's Education 2	0.28	0.45	0	1
Father's Education 3	0.13	0.34	0	1
Father's Education 4	0.06	0.38	0	1
Mother's Age	34.80	5.83	18	49
Mother's Education 1	0.75	0.42	0	1
Mother's Education 2	0.18	0.39	0	1
Mother's Education 3	0.03	0.21	0	1
Village Survival Rate	0.90	0.06		

With so few children overtly working in the market, information on child wage rates is too sparse to be of much use. Given the number of household members, land size may be taken as a proxy for the marginal productivity of child labor employed in the family farm. As the marginal product of children (mainly girls) employed in domestic chores, and the wage rate of children (mainly boys) working in the labor market must be at least as high as the marginal product of own-farm work, land size is a reasonable indicator of the opportunity-cost of time spent in education. For land size, we used a categorical variable taking values from 1, for landless households or marginal farmers, to 5, for households with the largest farm size.

Individual and household characteristics are represented by the age (Age and Age Squared) and sex (taking value 1 for a girl, 0 for a boy) of the child, the mother's age, dummies describing the level of education of the child's father and mother (respectively, Father's education i and Mother's education i, where i takes value 4 for completed high school or higher, 3 for middle school, 2 for primary, 1 for less than primary), total number of household members (Household size), number of pre-school children (Siblings 0 - 5), and number of school-age children (Siblings 6 - 16). Where age structure is not significant, we use the total number of children (Siblings). We also use dummies for the religion (Hindu, Muslim, etc.) of the household head[19].

Health policies and local environmental conditions are proxied by the village level aggregate survival rate to age 6 (Village survival rate). By using this as a regressor, we are in effect saying that parental action (and household characteristics) cause a dispersion of individual probabilities of survival around the village-level mean[20]. As the mean of the village survival rates is around 90%, there is clearly plenty of scope for parental action to improve the survival chances of *their own* children. In view of the high degree of correlation among survival rates to all ages, this variable is also a predictor of aggregate survival rates to subsequent ages.

The effect on fertility is particularly important because its sign gives information on whether the health policies proxied by the aggregate survival rate are a substitute or a complement for parental expenditure on pre-school children. In the absence of statistical information on the price of child-specific goods, which also would convey information on the matter, that is all we have to go by.

Educational policies are represented by the variable School available, which takes value 0 if there is no school in the village where the child lives, 1 if there is only a primary school, 2 if there is a primary and a middle school, 3 if there is also a high school. The

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[19] Caste (represented by the variable Social) was also tried, but proved significant in only a few regressions.

[20] Ideally, we would want to get at the information, up to the date of conception of each child, that helped form parental expectations of these village means. That would require a large panel data set. As that is not available, we decided to exploit cross-sectional variations in survival data at village level. We computed village-level mean survival rates from individual data. If cross-village differences have not changed widely over time, our estimates should be a reasonably good measure of inter-village differences in parental expectations. Since, for some villages, there are only a few individual observations, we also computed and tried district-level survival means to check the robustness of our results. Results were unchanged.

presence of a school ready at hand constitutes a reduction in the price of educational inputs. State dummies (Andhra Pradesh, Bihar, etc.) allow for other differences of policy, as well as of climate, ethnic mix, etc.

Since, as mentioned in Section II, we are not sure about the real status of children reported as neither attending school nor working, we exclude these children from the estimates presented in this section. The characteristics of the "missing children" will be examined in a section of their own.

Time Use

To model the study-work choice, we estimated a multinomial logit model for the probability that a school-age child will "work only" or "work and study", as against "study only" (the reference state). Estimates are reported in Table 12.

Table 12
Time Use of School-Age Children
Multinomial Estimates, Reference Group: Study Only
N° of Observations=33124, Chi^2(66)=5580, Pseudo R^2=0.15

	Work Only		**Work and Study**			**Work Only**		**Work and Study**	
	Coef.	**z**	**Coef.**	**z**		**Coef.**	**z**	**Coef.**	**z**
Sex	0.94	24.72	-0.17	-3.40	Andhra				
Age	-0.64	-12.93	0.22	3.13	Pradesh	0.78	5.37	0.83	3.97
Age^2	0.04	18.44	-0.01	-3.17	Bihar	0.37	2.55	-0.18	-0.80
Poverty	-0.11	-4.07	-0.13	-4.14	Gujarat	0.38	2.54	0.57	2.62
Tenure	-0.02	-0.40	-0.23	-3.51	Haryana	-0.06	-0.37	0.63	3.00
Land Size	0.15	10.86	0.05	2.87	Himachal Pradesh				
Income	0.00	-6.21	0.00	-0.80		-1.12	-5.79	0.31	1.36
Siblings (0-5)	0.20	7.69	-0.02	-0.72	Karnataka	0.53	3.78	0.77	3.85
Siblings (6-16)	0.13	7.04	0.28	12.60	Kerala	-2.13	-7.16	-0.17	-0.63
Household Size	-0.11	-9.28	-0.07	-5.10	Maharshtra	0.24	1.67	0.65	3.22
Type of School	-0.14	-6.77	-0.04	-0.45	Madhya Pradesh	0.23	1.63	0.24	1.17
Village Surv. Rate	-2.13	-6.55	-2.03	-4.60	Orissa	0.50	3.40	0.54	2.52
Mother Ed. 1	2.04	2.81	0.10	0.25	Punjab	-0.16	-0.87	0.63	2.53
Mother Ed. 2	-0.35	0.48	-0.66	-1.66	Rajasthan	-0.07	-0.46	0.19	0.87
Mother Ed. 3	-0.63	-0.80	-1.60	-3.44	Tamil Nadu	0.19	1.13	0.80	3.53
Muslim	-0.29	-2.39	-0.12	-0.72	Uttar Pradesh	0.05	0.39	0.16	0.81
Christian	0.31	2.38	0.17	0.91	West Bengal	0.35	2.32	0.45	2.05
Other	-0.94	-3.89	-0.78	-2.39	Cons	-0.84	-0.98	-1.76	-2.42

Girls are more likely to specialize fully in either work or education than to do both, and more likely to specialize in work than boys[21]. The probability of working full time is decreasing in age for children up to 8 years old, increasing for older children. The probability of studying and working at the same time increases with age up to the 12th year, then decreases.

Consistently with the theory, the estimated coefficients of the various income measures indicate that belonging to a richer household reduces the probability of working. Land size raises the probability that a child will work (relative to not working at all), and the probability that work will be full time rather than part time. Since land size proxies the opportunity cost of time in education, this too is consistent with the theory, and provides valuable indirect information on the return to child labor. The effects of household size and composition are more complex.

An increase in total household size reduces the probability that a school-age child will work at all, and makes it more likely that work will be part time. With the number of children (up to age 16) controlled for, this is the same as saying that the number of adults in the household reduces the probability of a child working. This is another labor productivity effect: the greater the number of adults working on a given piece of land, the lower the return to getting another child to work on it.

The number of pre-school children raises the probability that a school-age child will "work only", relative to the probability that the child will "study only", but has no significant effect on the probability of "work and study"[22]. Given that pre-school children are too young to work, and that an increase in their number is thus equivalent to a lump-sum reduction in full income (an income-dilution effect), this finding is consistent with the theoretical prediction that a lump-sum increase in full income raises the probability of full-time work, lowers that of full-time study, and has ambiguous effect on that of part-time work.

[21] A "bootstraps" explanation is provided in Cigno (1991, Ch.5). Parents perceive the return to educating girls as lower than the return to educating boys, because they observe that women are less likely to work, and thus to profit from their education, than men. Women work less than men, however, because they are less educated and, therefore, in the marital division of labor, have a comparative advantage in specializing in housework.

[22] Patrinos and Psacharopooulos (1997) find the same in Peru.

The number of school-age children raises the probability that a child in that same age range will "work only" or "work and study", but the effect on the probability of "work only" is not as large as that of the number of pre-school children. That is consistent with the theory, according to which an increase in the number of school-age children, holding full income constant, raises the probability of part-time work, and lowers that of full-time study, but has no effect on that of full-time work (while the number of pre-school children reduces it).

The probability that a child will study full time increases with the presence of a school in the village, and with the grade of education this school offers. These are price effects. Having a school of any grade ready at hand reduces the marginal cost of, and thus raises the demand for that grade of education. The fact that having a higher-grade school in the village raises the probability of attending not only that grade of school, but also the lower grades, requires some explanation. Drawing on evidence from Ghana, Lavy (1996) maintains that returns to completing primary education and stopping there are low relative to completing secondary and higher education. A lower cost of access to secondary education thus increases the returns to investing in primary education. To check the validity of this inference, we re-estimated the model for children aged 6 to 15 using two separate dummies, one for the presence of a primary school, the other for the presence of a higher level school. Since the coefficients of both these dummies have positive sign, the interpretation seems legitimate. These findings are consistent with the theoretical predictions of both the altruistic or the non-altruistic model, that a reduction in the price of education raises the probability of going to school, and lowers the probability of working.

Consistently with the theoretical prediction of the non-altruistic model, the village-level aggregate survival rate has a positive effect on the probability of studying full time (relative to working full or part time). Therefore, public policies (sanitation, mass immunization, etc.) aimed at improving the health and survival rates of children have the desirable side-effect of inducing more parents to send their children to school. We shall see in Section V that, as is to be expected, this effect is not present when children attending school are excluded from the sample. Since this effect is not present in the altruistic model, this finding may be taken as an indication that the non-altruistic model (see Section III) provides the more appropriate explanatory framework for the phenomenon under consideration.

The mother's own level of education appears to influence the decision to make a child work or study. Children whose mothers have less than primary education are more likely to work full time, than to study full time. Children whose mothers have more than primary education are less likely to work and study than to study full time. By contrast, the father's education does not exert a significant influence. With total household income controlled for, the explanation for the effect of the mother's education has to be found outside the theoretical framework presented in Section III.

A possible explanation is that education confers on the mother greater weight (moral authority or, if education translates into income, bargaining power) in family decisions. If, as some assume, mothers care for their children more than their fathers do, the mother's education tends to increase the welfare of children (Folbre, 1986). Given the trade-off between education and current consumption, however, this does not necessarily mean that children of more educated mothers are more likely to go to school. Indeed, depending on circumstances, caring mothers might insist on their children working, and the additional income being used for the children's nutrition, rather than education.

Another consideration is that education increases the probability that the mother will find outside employment, and thus that her children will be called upon to substitute for her at the home (Basu, 1993). That is particularly true of girls who, if they do work, are likely to do so within the home (looking after younger siblings, or in some other way substituting for their mothers in the performance of domestic chores).

Yet another possibility is that the mothers time is an input into the education (production of human capital) of their children, and that the mother's own level of education raises the productivity of this input. According to this argument (Behrman et al., 1999), the mother's own level of education raises the demand for her services as a home tutor, rather than as a market laborer, and thus raises the return to the time that her children spend in education. The possible coexistence of some or all of these mechanisms may explain the finding of an effect of the mother's education on the probability that her children will go to school, but also that this effect is not as pervasive as sometimes assumed (the probability of full-time work is not affected by educational levels above, and that of part-time work by educational levels below, completed primary education).

Educational Expenditure

Given that educational expenditure is only incurred by parents who choose to send their children to school, and there is thus a problem of self-selection, we used the Heckman two-stage estimation procedure (see Table 13). The appropriateness of this approach is confirmed by the significance of the selectivity parameter *lambda*.

Table 13
Educational Expenditure
Heckman Selection Model
N° of Observations=44129, $Chi^2(52)=1300$

	Probit					Probit			
	Coef.	**z**	**Coef.**	**z**		**Coef.**	**z**	**Coef.**	**z**
Sex	-0.04	-2.89	-0.17	-13.62	Karnataka	-0.15	-3.75	-0.07	-1.80
Age			0.27	17.39	Kerala	0.23	4.95	0.17	3.44
Age^2			-0.01	-18.61	Maharshtra	-0.07	-1.75	-0.03	-0.79
Income	0.02	1.28	0.03	1.80	Madhya Pradesh	-0.19	-4.97	-0.22	-5.73
Siblings (0-5)	-0.02	-2.99	-0.06	-6.76	Orissa	-0.07	-1.68	-0.04	-0.91
Siblings (6-16)	-0.04	-6.38	-0.01	-2.28	Punjab	0.17	3.69	0.02	0.46
Household Size	0.01	2.37	2.37	6.66	Rajasthan	0.14	3.46	-0.11	-2.57
Poverty	0.05	3.69	0.06	4.17	Tamil Nadu	-0.01	-0.25	0.07	1.33
Land Size	0.00	0.58	-0.02	-3.97	Uttar Pradesh	-0.02	-0.53	-0.13	-3.34
Type of School	0.02	2.23	0.05	6.64	West Bengal	0.03	0.62	-0.01	-0.26
Class Attended	0.19	15.33							
Village Surv. Rate	0.40	3.48	0.51	4.56	Constant	4.54	25.47	-1.58	-8.39
Andhra Pradesh	-0.13	-3.07	-0.10	-2.32					
Bihar	-0.06	-1.58	-0.15	-3.59					
Gujarat	-0.11	-2.51	-0.07	-1.57					
Haryana	0.25	6.06	-0.03	-0.61					
Himachal Pradesh	0.33	7.25	0.22	4.43					

The first-stage (probit) results are coherent with the time-allocation predictions of the multinomial logit that we have just examined, and confirm the explanatory power of the non altruistic model. Girls are less likely to go to school than boys. The probability of attending school increases with age up to the 10th year of life, then decreases. Household size raises the probability of attending school, the number of younger (0-5 years old) brothers and sisters reduces it, the number of 6-16 years old has no significant effect. Land size (labor productivity) reduces the probability of going to school, household income increases it. School availability (and grade), and the village-level aggregate survival rate, also have a positive effect.

The second-stage estimates show that the level of educational expenditure, given that the child goes to school, is lower if the child is female, and increases with the grade of school attended[23], household income, the village-level aggregate survival rate, and school availability. As was to be expected, land size is not significant, because labor productivity (the opportunity-cost of time spent in education) affects the decision to send a child to school, not how much to spend given that the child is going to school.

The positive effect of the aggregate survival rate on the probability and level of educational expenditure is coherent with the finding of a positive effect of this variable on the decision to send a child to school, and makes it more likely that the model generating the data is non-altruistic (see Sub-Section 3.2).

Nutrition and Anthropometry

With age and sex controlled for, body mass is an indicator of nutritional status[24], but also, as pointed out in Section II, a predictor of individual survival probability. Following advice from the anthropometric literature[25], we estimated separate equations for pre-school and school-age children.

Table 14 shows the results for school-age children[26]. Their nutritional status appears to be higher in richer households (Income and Tenure are not significant, but Poverty, i. e. being less poor, has a significantly positive effect). For any given household income and size, children with more brothers and sisters have lower body mass (an income dilution

[23] In the second (level) stage of the estimation procedure, it seemed more appropriate to substitute age with school grade, whîch reflects not only age, but also other factors (e.g., talent. past morbidity, etc..) affecting school achievement.

[24] In this respect, the body mass index could be an overestimate or an underestimate. On the one hand, children performing physical work are likely to have more muscle, and thus to appear better fed, than their brothers engaged in sedentary activities like studying. On the other, working children expend more calories, and thus require more food to achieve the same body weight. Similar ambiguities occur in the interpretation of sex differences. The negative coefficient of Sex in tables 16 and 17 indicates that girls have lower bodymass than boys of the same age. But, constitutionally, girls tend to have less muscle than boys. It is thus not clear whether the observed difference in body mass can be taken as evidence of sex discrimination in the intra-household allocation of nutrients (see Behrman, 1988), or of phyisiological differences between the sexes.

[25] For example, de Onis and Habicht (1996), Klasen (1996), Waaler (1984).

[26] Since height and weight information is only available for children aged up to 12, school age is re-defined, for present purposes, as 6-12.

effect). Land size has a positive effect on nutrition. Since the quantity of land (labor productivity) raises the probability that a child will work full time, this explains the observation that working children tend to be better nourished (Tables 9-10). School availability also raises nutrition, suggesting that the income effect of this cost-reducing variable dominates the cross-substitution effect. All these findings are consistent with the theoretical predictions of Section III[27], and further substantiate the proposition that the effects of the different policies extend well beyond immediate impacts. We see, for example, that educational policies affect not only school attendance, but also nutrition, and thus health and individual survival.

Table 14
Body Mass of School-Age Children
N° of observations=21568, F(29.21538)=55, R^2=0.07

	Coef.	t		Coef.	t
Sex	-0.18	-3.21	Bihar	-3.13	-18.41
Age	-0.61	-4.25	Gujarat	-3.97	-21.71
Age^2	0.04	4.97	Haryana	-3.48	-20.08
Mother's Age	0.13	2.63	Himachal Pradesh	-3.61	-18.86
Mother's Age^2	0.00	-2.43	Karnataka	-3.04	-18.67
Poverty	0.11	3.16	Kerala	-4.51	-22.81
Tenure	0.10	1.52	Maharshtra	-5.15	-31.50
Land Size	0.11	5.23	Madhya Pradesh	-3.37	-20.87
Income	0.00	0.60	Orissa	-4.07	-23.20
Siblings	-0.06	-2.88	Punjab	-4.12	-21.17
Household Size	0.02	2.22	Rajasthan	-4.22	-24.03
Type of School Available	0.08	2.54	Tamil Nadu	-4.78	-23.08
Village Survival Rate	1.00	2.02	Uttar Pradesh	-4.10	-25..73
Andhra Pradesh	-4.31	-24.12	West Bengal	-4.21	-22.88
			Constant	17.61	15.61

The village-level survival rate has a positive effect on the nutritional status of school-age children. The very presence of this effect on the body mass of this age group reinforces the point, already made in connection with the finding of a similar effect on time use and educational expenditure, that the non-altruistic model (see Section III) might be the more appropriate analytical framework for examining our set of data. Interpreting this rate as the result of health-enhancing policies (as well as climatic and other environmental factors),

[27] But school availability may be acting, here, also as a proxy for the relative development of the village.

the finding of a positive effect tells us that private expenditure is a net complement for public expenditure. As pointed out in the theoretical discussion, this has the important policy implication that public action stimulates and is reinforced by private (parental) action.

Biometric measures of pre-school children (not reported) are much less reliable than for the older age-group. All explanatory variables, other than age, sex and state, have very low levels of significance.

For both age groups, the state dummies have highly significant effects on nutritional status. No doubt, these effects pick up climatic and ethnic differences (other things being equal, children are likely to be more strongly built in Punjab, than in Maharashtra). The sign pattern (children fare better in Andhra Pradesh than in Kerala) does, however, suggest that they may also reflect differences in state policies, other than those accounted for by the survival rate or the availability of schools at the village level.

To account for genetic differences not reflected in observed household characteristics, we re-estimated the equations allowing for household-level random and fixed effects, but it made no difference.

Fertility

For the probability of an extra birth, we estimated a probit model. The explanatory variables include, in addition to those used for the other estimates, also the order of birth, and the proportion of school-age children (in the household) who work. The latter is intended to serve as a proxy for the probability that the structure of incentives facing the household when the new-born child reaches school age will be such, that he or she will be made to work. The results are shown in Table 15.

Table 15
Probability of a Birth in the Last Two Years
Probit Estimates
N° of Observations=13249, $Chi^2(31)=2662$, Pseudo $R^2=0.15$

	Coef.	z		Coef.	z
Work Only	0.41	9.33	Andhra Pradesh	-0.40	-5.01
Mother's Age	-0.05	-4.06	Bihar	-0.24	-3.09
Mother's Age^2	0.00	2.28	Gujarat	-0.27	-3.35
Social	-0.06	-2.92	Haryana	-0.04	-0.51
Income	0.00	8.95	Himachal Pradesh	-0.31	-3.68
Tenure	-0.09	-2.90	Karnataka	-0.50	-6.68
Land Size	-0.02	-1.72	Kerala	-0.43	-5.01
Poverty	-0.22	-14.79	Maharshtra	-0.21	-2.88
Father's Education 1	-0.04	-0.64	Madhya Pradesh	-0.22	-2.96
Father's Education 2	-0.06	-1.07	Orissa	-0.10	-1.23
Father's Education 3	-0.08	-1.42	Punjab	0.09	0.84
Muslim	0.16	1.81	Rajasthan	-0.02	-0.20
Christian	0.49	5.04	Tamil Nadu	-0.27	-0.09
Other	-0.09	-0.80	West Bengal	-0.41	-4.94
			Constant	1.95	6.05

As usual in this type of estimates, mother's age and birth order have negative effects on the probability of a birth. Income has a positive effect on fertility, but being less poor has a negative one. This apparent contradiction between the effect of the level of income, a continuous variable, and that of the poverty category may be an indication of non-linearity in the income-fertility relationship[28].

The mother's education is not significant. That is not unusual, because the birth order picks up the effects of the variables, including the mothers education, that affect the demand for completed (lifetime) fertility. If completed fertility (approximated by regressing the total number of births on the age of the mother at the interview date), rather than the probability of an extra birth, is taken as the dependent variable, and birth parity is consequently dropped from the list of regressors, we find that the mother's education comes out significantly negative as expected.

Interestingly, the higher the probability that a child will work when older, the higher the probability of an additional birth. This positive (and highly significant) connection

[28] See Atella and Rosati (1999).

between fertility and probability of work brings further support to the hypothesis that the data are generated by a non-altruistic model, because it suggests that parents may be looking for an extra source of income, or for an extra pair of arms.

Availability of schools and the village-level survival rate are not significant, and are excluded from the estimates. That is hardly surprising, in view of the fact that we are using as a regressor the probability of full-time work if the child reaches school age, because we know from the time-use estimates that this probability is significantly affected by the availability of schools, and by the rate of survival at the village level. The finding of a positive effect of the probability that the new-born child will work full time when of school age on the probability of an extra birth, combined with the finding of negative effects of school availability and the village-level survival rate on the probability of full-time work by school-age children, seems to indicate that pro-education policies and public health improvements discourage fertility[29].

V. THE MISSING CHILDREN

It is difficult to dismiss the case of school-age children reported as neither working nor attending school as a mere oversight. Local experts argue that, in certain circumstances, children have such low productivity that it is not worth employing them in any work activity, and that (partly as a consequence) their parents are too poor to send them to school. That may well be the case, but we do not find it plausible that so many children, one in four, are left totally idle by choice. It is thus worth investigating whether their characteristics bear any similarities with those of children reported doing something.

As a first step in this direction, we re-estimated the multinomial logit for the time use of children (Table 12) with the addition of a new category, "neither work nor study". The results, reported in Table 16, show that the probability of falling in this category is affected by the explanatory variables in pretty much the same way as the probability of "work only".

[29] As pointed out in the theoretical discussion, a negative effect of directly survival-enhancing policies on fertility implies that public health expenditure is a complement, rather than a substitute, for parental expenditure on pre-school children. The theory predicts that, if this is the case, fertility should be positively affected by he price of child-specific goods. We cannot verify this with our data, but Cigno and Pinal (1999) find, for another part of the world, a significantly negative effect of the aggregate survival rate, and a significantly positive effect of the price of child-specific goods, on the desire to have children.

Table 16
Time Use of School Age Children

	Work Only		School and Work		Neither	
	Coef.	z	Coef.	z	Coef.	z
Sex	0.90	24.45	-0.18	-3.58	0.75	29.57
Age	-0.76	-15.72	0.19	2.68	-1.32	-41.86
Age^2	0.05	21.27	-0.01	-2.83	0.06	41.83
Poverty	-0.12	-4.47	-0.13	-4.20	-0.21	-12.61
Land	0.00	0.07	-0.23	-3.52	-0.01	-0.42
Land Size	0.14	10.62	0.05	2.87	0.11	11.97
Income	0.00	-5.76	0.00	-0.73	0.00	-4.69
Siblings (0-5)	0.18	7.15	-0.03	-0.87	0.24	14.44
Siblings (6-16)	0.09	5.30	0.29	12.71	0.17	14.00
Household Size	-0.11	-9.15	-0.07	-5.13	-0.12	-15.92
Type of School	-0.14	-6.73	-0.04	-1.37	-0.14	-9.25
Muslim	-0.30	-2.50	-0.13	-0.80	0.16	1.70
Christian	0.29	2.27	0.15	0.82	0.64	6.28
Other	-0.82	-3.47	-0.76	-2.32	0.04	0.24
Village Survival Rate	-1.88	-5.93	-2.03	-4.60	-1.27	-5.85
Mother Education 1	2.14	2.94	0.13	0.33	1.47	4.30
Mother Education 2	0.42	0.58	-0.63	-1.58	0.06	0.16
Mother Education 3	-0.53	-0.68	-1.56	-3.35	-0.15	-0.41
Andhra Pradesh	0.71	5.02	0.81	3.83	-0.36	-3.69
Bihar	0.44	3.17	-0.20	-0.88	0.55	6.30
Gujarat	0.35	2.38	0.55	2.53	-0.37	-3.72
Haryana	-0.04	-0.29	0.60	2.89	-0.28	-2.96
Himachal Pradesh	-1.11	-5.82	0.29	1.27	-1.54	-11.77
Karnataka	0.53	3.87	0.75	3.76	-0.09	-0.97
Kerala	-2.17	-7.36	-0.17	-0.61	-1.65	-10.94
Maharshtra	0.21	1.49	0.65	3.18	-0.71	-7.44
Madhya Pradesh	0.28	2.05	0.22	1.10	0.44	5.26
Orissa	0.47	3.37	0.52	2.43	0.10	1.13
Punjab	-0.23	-1.23	0.62	2.47	-0.39	-3.10
Rajasthan	-0.09	-0.62	0.18	0.82	0.51	5.83
Tamil Nadu	0.12	0.75	0.80	3.51	-0.40	-3.56

We find, in particular, that where the effects of the child's sex and age, of household composition, and of the mother's education have different signs for "work only" and "work and study" ("study only" is again the reference group), the signs for "neither work nor study" are the same as for "work only"[30].

The next step was to estimate separate body-mass equations for these, reportedly idle, children, and for the "work only" category. The estimates, not reported, are extremely poor (all explanatory variables, other than the geographical dummies, have very low significance). There could be a problem of sample size (the two groups account for, respectively, a quarter

[30] Similar results (not shown) are obtained, not surprisingly, estimating a separate probit for each category.

and a tenth of the total child population), or something specifically to do with these categories of children. Although it is extremely unsafe to draw inferences from such estimates, it is nonetheless worth reporting that, as in the time-use estimates just examined, the sign pattern is the same for both categories of children. Most importantly, where there is a sign difference between the "work only" equation and the equation estimated putting together all children except those reportedly doing nothing, the sign in "neither work nor study" is the same as in "work only". This strengthens the impression that the two groups may be one and the same thing or, at least, that the "neither work nor study" category contains a substantial proportion of children who are actually working full time.

VI. POLICY IMPLICATIONS

The empirical analysis of sections IV and V shows a high degree of consonance among the estimates, and between these and the theoretical framework (particularly in its non-altruistic version) of Section III. Taken together, the two levels of analysis prompt a number of considerations. A very general one is that child labor cannot be viewed in isolation from educational, health and fertility issues. Another is that, barring extreme forms of exploitation (difficult to detect in the data), child labor should not be regarded as an aberration, but rather as the rational household response to an adverse economic environment - and, notice, this is true irrespective of whether parents are moved by altruistic or selfish motivations. We now go on to examine the specific policy implications of our analysis.

(i) Forbidding children to work, or making school attendance compulsory, would, if effectively enforced, reduce school-age consumption, and discourage fertility.

We have found that children working full time tend to have better nutritional status than children who study, and that children who attend school and work at the same time fare worst of all. Therefore, the policy would have ambiguous effect on the welfare of children (who would end up with more human capital, but poorer health), and negative effect on the welfare of their parents (forced to depart from their optimal choices). Parents would consequently be tempted to evade the rules. Prohibiting work or insisting on school attendance, without changing the economic environment that makes child work and non-school attendance in the interest of the parents, and possibly of the child, is thus difficult to enforce. It is possibly not in the interest of society either[31]. We have identified a number of policies that would change the environment in the desired direction. Table 17 shows the marginal effects, calculated at the sample mean, of a number of policy variables. Table 18 simulates the effects of more radical policy changes, consisting of raising a policy variable from its minimum to its maximum value.

(ii) Capillary school provision reduces the incidence of child labor, and raises educational expenditure for school attendants. It also discourages fertility, and improves child nutrition.

The specific measure on the effects of which we have empirical evidence is that of providing schools at village level. Nearly all villages (95 percent) have at least a primary school. Table 17 shows that providing a middle school to a village where there was only a primary one would reduce the probability that a schoolage child works by 1.2 percentage points. Raising provision from nothing to secondary level (Table 18) would raise the probability of full-time school attendance by 3.6 percentage points, mainly because of the reduction of the number of children that both work and attend school[32]. These effects are very important in themselves, and also because, as we have seen, the presence of a school nearby, and the consequent reduction in the probability that a school-age child will work, induce parents to procure fewer births, and to better feed and care for each child. Furthermore, every school-age child that attends school attracts higher educational expenditure. School provision affects, therefore, much more than education: it improves school attendance, but also reduces child work (the two, remember, are not mutually exclusive) and is likely to reduce morbidity and mortality through the lifecycle.

(iii) Universal income subsidies for parents are an expensive way of discouraging child labor, because some of the subsidy will end up as adult consumption, and a countereffective one in families where children would otherwise study full time. Income

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[31] Basu (1999) argues that prohibition to employ children would be beneficial (and self-enforcing, once the new equilibrium is in place) if the labor market had two possible equilibria, one with low wage rate and employment of children, the other with high wage rate and only adults employed. That is indeed true, but the very fact that prohibition has not worked where it has been tried suggests that the assumption of a virtuous equilibrium waiting to be implemented may not hold universally. Furthermore, it seems scarcely relevant in our context, where the overwhelming majority of the children that work is reported working in the home or in the family farm.

[32] See also Rosati and Tzannatos (1999).

subsidies targeted at poorer families, where full-time study in the absence of policy is unlikely, are more cost-effective. Therefore, income redistribution could help reduce child labor, encourage school attendance, and improve the nutritional status of children.

Table 17 shows that moving a household up a class on the (inverse) poverty scale (making the household a little less poor) would have very modest effects on the probability that a child belonging to that household will stop work, or attend school. Even raising the household from the poorest to the least poor category (Table 18) would reduce the probability of work by a modest 4 percent, and raise that of attending school by just 1.6 percentage points, but the probability of studying full time would increase by nearly 4 points.

Table 17
Marginal Effects of Policy Variables

	Work Only	Work and Study	Study Only
Poverty	-0.52	-0.78	1.30
Tenure	-0.99	-0.06	1.04
Land Size	1.25	1.11	-1.29
Type of School Available	-0.12	-1.08	1.20
Mother's Education 1	-0.07	10.09	-10.02
Mother's Education 2	-2.43	3.14	-0.72
Mother's Education 3	-3.70	-3.53	7.23

Table 18
Policy Simulations

	Work Only	Work and Study	Study Only
Poverty	-1.56	-2.36	3.92
Land Size	0.71	4.88	-5.59
Type of School Available	-0.36	-3.26	3.62
Village Survival Rate	-3.47	-6.81	10.28

(iv) Land redistribution could increase the incidence of child labor, because it would raise the productivity of labor in households that receive additional land, and reduce it in those from which land is taken away, thereby increasing the probability of work for children of lower-income households (and reducing it for children of higher-income households, where parents are unlikely to make their children work anyway).

At the mean, bringing the quantity of land farmed by the household up one class raises the probability that a school-age child will work by 1.4 percentage points. The probability of school attendance falls hardly at all, but that of full-time study becomes 1.3 percents lower. The probability that a child belonging to a household with a farm in the top size class will work is about 5 percentage points higher, other things being equal, than that of a child belonging to a landless or marginal farming household (Table 18).

(v) Survival-enhancing policies reduce the probability that a school-age child will work, and raise the probability that the child will go to school. They also raise school-age consumption, and the amount spent for the education of each school attendant.

The effects of these policies are captured in our data by the village-level survival rate. Raising this rate from the minimum, 60 percent, to the maximum, 100 percent *(i.e.,* deploying health policies such that children receiving from their parents the average amount of nutrition and health care are certain to live at least to age 6) would reduce the probability that a school-age child is sent to work by more than 10 percents, and raise that of full time school attendance by the same amount (Table 18). In the same way as the effects of education policy extend beyond education, so the effects of health policy (public expenditure on sanitation, mass immunization, etc.) thus extend beyond health[33]. The policy in question lowers the probability that a child will work, and raises the probability that a child will be sent to school. Indeed, these side-effects of public health policy appear to be rather powerful. The reason is, as we have seen, that the policy induces parents to spend more not only for the education, but also for the nutrition of each school attendant. The policy thus reduces morbidity and mortality not only directly, but also indirectly through induced parental action. The finding of an effect on parental decisions concerning children in this age-group is a symptom that the household decision model generating our data may be non-altruistic.

(vi) Raising the education of women has positive but uneven effects on school attendance, and school-age work. It has no effect on fertility, nutrition, and educational expenditure per school attendant.

[33] Our empirical findings are broadly consistent with those of Rosenzweig and Wolpin (1982), who also adopt a household economics framework. but are not directly concerned with child labor.

In general, the education of women is a powerful engine of progress. Where school enrolment and school-age work in rural India is concerned, however, it appears to be an important, but probably not crucial factor (see Table 17). Raising the mother's education from less than completed to completed primary school level would reduce the probability of her children working by almost 9 percentage points, and raise the probability that they will study full time by the same percentage. Raising her education from primary to middle-school level would reduce the probability that her children work by over 7 percentage points. As pointed out in Section IV, the reason for this uneven pattern may be that the mother's education affects decisions about the allocation of her children's time in several different and, in some respects, conflicting ways.

A word, finally, about the so-called missing children, those reported neither working, nor attending school. Despite expert opinion that many of these children really do nothing, or very little, we have found signs that a sizeable proportion of them may be actually working full time. Their nutritional status is reported to be, on average, better than that of children attending school, and no worse than that of children reported working full time, but additional information and a more thorough statistical analysis are required before any firm conclusion can be reached.

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