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Child health, labor and primary school enrollment in rural India

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〈Abstract〉

The present study examines the determinants of primary school enrollment in rural India. Taking account of demand and supply side factors of education, we attempt to assess the impact of child health on parent decision for child education. Although it is an important factor determining whether or not a child

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is sent to school, its impact has been relatively overlooked. It is observed from that a better health is likely to increase the probability of girls' enrollment while reducing the likelihood of school participation for boys. Given the prevalence of child labor as an important income source for household, our findings suggest that rural Indian households might weight current income from their sons. Extending the dichotomous analysis, the present study also investigates the role of child health on child status – 'enrolled only', 'enrolled and work', 'work only' and 'no where – neither in school nor at work' and confirm a strong association between girls' health status and schooling.

Key worlds: Gender, Child labor, Health, School enrollment, India

I. Introduction

It is widely acknowledged that not only does education have its own intrinsic value, but it is also an important input to realize human capabilities in the process of economic and social development (e.g. Sen, 2000).Education investment in children is associated with higher earnings in adulthood through the productivity increase and with other social returns such as improved health etc. There has been therefore a surge of interest in examining the impact of education on various dimensions of development such as income, health status or fertility (e.g. Case, 2006; Duraisamy, 2002; Knight, Shi and Quheng, 2010). Given its positive impacts, education has been centered on the Millennium Development Goals (MDGs) where two of eight goals are on education: (i) the provision of universal access to primary education and (ii) gender equality at all levels of education (Glewwe and Kremer 2006).

India, where primary education has been historically given less attention than tertiary education and government expenditure have relatively concentrated on the tertiary sector (Bhalotra and Zamora, 2008), introduced *Sarva Shiksha Abhiyan* (Education for all) in 2001 in order to ensure a universal access to primary education, targeting children aged between 5-14. Although the government effort made some progress benefitting many of

those not participating in primary schools, the enforcement encountered a difficulty due to socioeconomic and cultural conditions, and there are still over 7 million of children at primary school age were not in school (Huisman, Rani and Smits, 2010). Table 1 presents poverty headcount ratio, school enrollment ratio for children in the age group 5-14, and percentage of household where at least one child does not attend school.

Table1. Poverty & School Enrolment ratio

	Poverty head count ratio*	Children enrolment ratio (Age group: 5-14 years)	Percentage of households of which at least one child is not enrolled
Male headed	24.8	84.9	22.1
Female headed	25.2	85.3	19.6
SC	24.1	86.1	21.9
ST	32.9	72.9	34.8
OBC	27.9	84.6	22.6
OC	17.7	88.8	16.2
Boy	-	87.1	-
Girl	-	82.4	-
Rural-All	24.9	85.0	21.9
Kerala	5.5	97.3	4.0
Karnataka	8.1	82.4	23.2
Maharashtra	19.8	89.7	15.3
Gujarat	14.4	88.2	18.4
Madhya Pradesh	39.1	79.9	28.7
Rajasthan	37.4	85.1	24.8
Haryana	31.0	79.1	28.5
Punjab	9.1	88.7	14.6
Himachal Pradesh	25.4	92.6	14.8
Uttar Pradesh	44.1	84.1	26.1
Bihar	52.1	73.4	44.6
West Bengal	35.0	83.0	26.4

Jharkhand	53.4	75.2	34.0
Chhattisgarh	44.8	82.8	25.4
Orissa	23.9	83.9	24.6
Andhra Pradesh	9.1	90.6	13.5
Tamil Nadu	3.4	98.1	2.2

Source: Authors calculation from REDS 2006

*Nominal household expenditure was deflated using state CPI for agriculture and rural laborers. Monthly per capita expenditure calculated from the deflated household expenditure was compared to 2004 rural poverty line given by Hirmanshu (2007)

Other Caste (OC) households show the lowest poverty ratio and the highest school enrollment rate, followed by Scheduled Castes (SC), Other Backward Castes (OBC) and Scheduled Tribe (ST) households respectively (Column 2). However, in state level, the richer the state the higher the child enrollment rate. In the present study, we use two indicators of child schooling at individual and household units – the former is defined as whether a child attends school whereas the latter is defined as whether a household sends all their children to school. SC households have slightly lower enrollment rate than OC but higher than OBC households at individual level. When compared at household level, the percentage that at least one child, not attending school for SC households, is almost same as that of OBC households but much higher than that of OC households. This might imply that children who do not participate in school are more widely spread among OBC and SC households while distribution of children out of school is relatively concentrated in some poor households in OC group. i.e., some of OC households have proportionately more children without primary education than SC households in general. A similar observation is also found from Gujarat, Punjab, Himachal Pradesh. Although the school enrollment rate in Gujarat and Punjab are similar, the percentage of household in which not all children attend school is much higher in Gujarat. In contrast, whereas school enrollment rate is higher in Himachal Pradesh that in Punjab, the share of households that send all children to school is similar in both states. Given the prevalence of out of school children, there has been a large volume of studies examining household decision in school participation (Dreze and Kingdon 2001; Dostie and Jayaraman 2006; Bhalotra and Zamora 2008; Huisman, Rani and Smits 2010). However, due to data constraint, most of

the previous studies in this area failed to take account of an impact of child health, an important determining factor in child schooling decision, which would lead to omitted bias.

The main contribution of the present study to the literature is that it empirically assess the impact of child health proxied by Body Mass Index (BMI) measure on school enrollment status alongside other household and village characteristics as demand side factors for child schooling.[1] Given the prevalent child labor which contributes to household welfare in various aspects, the opportunity cost of child schooling, which might be partly determined by child health status, could be far greater than expectation. Nonetheless, there has been little empirical examination with regards to the effect of child health on schooling decision due to data constraint. The second contribution of the present study is that we investigate the role of household and village characteristics on detailed child activities such as 'enrolled only', 'enrolled and work', 'work only' or 'no where– neither in school nor at work'. The most popular framework for educational enrollment from the literature is a dichotomous analysis that treats the decision to send children to work same as the decision to keep them at home. This robust aggregation of two distinct decisions into one – no enrollment – does not properly capture household behavior when parent regard differently the decision to let children participate in work from their decision to make children do noting (Duraisamy 2007). Thus, the disaggregated child status in the present study would bring more useful information in understanding child school enrollment in rural India. With this in mind, the present study is structured as follows: We review the earlier literature in Section 2. Section 3 describes data and Section 4 outlines econometric methodology. The empirical results are reported in Section 5 followed by conclusions in the final section.

[1] Choosing a BMI index as a proxy for child health is partly because REDS data does not contain any other information such as nutritional intake (e.g. calorie) or having particular diseases etc. The BMI index nevertheless may be intuitively more reliable proxy in this context as it might represent a child's physical strength at a glance as all parents would do, whereas nutritional intake may involve medical examination, which is not likely for parents to use for their children's education decision (e.g. a blood test). The median BMI of the sample is 21.5, and the proportions of boys and girls deemed healthy is 71.8 and 70.9 respectively.

II. Literature Review

Drèze and Kingdon (2001) examine the factors influencing child primary school enrollment and observe the provision of mid-day meal program is a major determinants amongst various household, school and village characteristics such as parent motivation or caste background. According to their analysis, school meal is found to halve the proportion of girls out of school. Dostie and Jayaraman (2006), focusing on the village contextual effects, observe that the improved village infrastructure is likely to increase the probability of school enrollment while caste composition has a mixed effect.

While there exists a vast literature on associations between child health and schooling performance, little has investigated the impact of child health on schooling decision. Amongst, Glewwe, Jacoby, and King (2000), though not for India, explore the impact of child nutrition on child schooling decisions and grade achievement, and conclude that malnourished children enter school later and perform more poorly on cognitive achievement tests than their better-nourished counterparts. Likewise Alderman et al. (2001), using Pakistan data, point out that child health is associated with household choice in the presence of unobserved factors such as preferences and health endowments and therefore it might be taken account for when parent decide if they send children to school.

Regarding gender gap in school enrollment, Kingdon (2002), studying the gender gap in educational enrollment and attainment in India, finds that the most important determinants of educational attainment for girls are parental background, household wealth and the quality of primary school etc. It is also observed that nearly 75% of gender disparity in educational attainment is explained by gender discrimination or the differentiated treatment in intra-household resource allocation (Kingdon 2002). Kambhampati and Rajan (2008) attribute to India's patrilocal family structure as an important determining factor in gender disparity in school attendance. This explains why parents might have less incentive to educate girls: as girls depart the family after marriage, the future earnings from a girl's education do not accrue to her own parents.

The prevalence of out of school children in India is partly explained by child labor. Child labor is not only an important income source for poor households, but also a means of consumption smoothing during the occurrence of adverse income shocks (Jacoby and Skoufias 1997). Therefore, schooling often competes with low paying labor-intensive jobs for children especially in poor households (Ravallion and Wodon 2000). According to National Sample Survey (NSS) statistics (cited in the U. S. Department of Labor report 2014) 2009-2010, approximately 4.3 millions of children aged between 5-14, was engaged in child labor and 80% of them reside in rural India.[2] The supply side factor of child labor is predominantly the lack of sufficient household income, leading the poor household to send their children to labor market rather than school. On the other hand, the demand side factor is segmented labor market with pervasive low paying labor intensive jobs for children. However, child labor and school attendance are not inversely related as many children are engaged in both schooling and working (Bhalotra and Tzannatos 2003). Swaminathan (1998) finds that high economic growth was associated with an expansion of child labor in western India and argues that economic growth alone is not a sufficient condition for the reduction of child labor. Similarly, Kambhampati and Rajan (2005) confirms that child labor rises with economic growth in India. These findings are contrary to popular hypothesis that growth would reduce child labor and suggest the non-linear relationship between economic growth and child labor.

III. Data

We use the most recent ARIS/REDS survey of the NCAER for the present study conducted in 2006which covers 9500 households spread across 242 villages of 17 states. The survey is designed to be a nationally representative multi-purpose rural household and village surveys. Consisting of three parts (listing, household and village sections) the

[2] The working children is mostly found from agricultural sector (69.5%) followed by Industry (17.5%) and Services (13%).

survey collects detailed household and village information spread across various states in rural India.

The listing section collects information on a number of key variables such as household income and demographics. The household survey provides information on its member characteristics, school enrollment, labor participation, detailed incomes by source, household expenditure, agricultural activities and assets etc. The village survey contains information on economic and political structure, availability of schools, infrastructure and other public goods at village level. In particular, village questionnaire on school facilities enable one to investigate the effect of school facilities (supply side) on child schooling. These include number of schools, number of classrooms and blackboards, or pupil-teacher ratio at village level.

The survey was first collected in 1971 and subsequent rounds were collected in 1982, 1999, and 2006. The current study draws upon household (and its members) survey in 2006 in which data on children aged 5-14 are available. Due to missing observations, the final sample sizes are 2542 households and 5765 children.

We create 4 categories of the status of children: 'enrolled only', 'enrolled and work', 'work only' or 'no where'. The state-wise frequency ratio of the distribution of children by these status categories is given in Table 2.

Table2. The status of children aged 5-14 *

State	Gender	Enrolled only	Enrolled & Work	Work only	No where
Kerala	Boy	74.8	24.4	0.4	0.4
	Girl	57.1	40.6	0.6	1.7
Karnataka	Boy	71.2	12.3	3.5	13.0
	Girl	73.2	4.8	3.5	18.6
Maharashtra	Boy	87.6	8.2	0.6	3.6
	Girl	75.2	8.4	6.1	10.3
Gujarat	Boy	20.5	66.9	5.1	7.5
	Girl	17.7	72.9	9.0	0.4

Madhya Pradesh	Boy	36.0	42.0	11.9	10.1
	Girl	34.5	45.3	10.5	9.7
Rajasthan	Boy	54.5	37.6	3.7	4.2
	Girl	46.7	31.5	12.8	9.0
Haryana	Boy	44.8	35.2	3.7	16.3
	Girl	22.2	46.0	8.7	23.2
Punjab	Boy	45.1	46.0	3.8	5.2
	Girl	40.8	40.1	15.0	4.1
Himachal Pradesh	Boy	13.9	84.7	-	1.4
	Girl	20.8	66.7	4.2	8.3
Uttar Pradesh	Boy	38.1	49.7	5.6	7.7
	Girl	28.1	53.6	10.6	7.8
Bihar	Boy	19.8	55.7	13.2	11.3
	Girl	21.3	54.6	18.5	5.6
West Bengal	Boy	84.8	2.5	3.3	9.5
	Girl	79.7	2.8	2.8	14.7
Jharkhand	Boy	34.5	47.1	10.1	8.4
	Girl	26.1	39.5	28.6	5.9
Chhattisgarh	Boy	48.2	38.7	2.1	11.0
	Girl	44.7	36.7	10.6	8.0
Orissa	Boy	78.5	5.2	1.7	14.6
	Girl	77.1	7.3	6.2	9.5
Andhra Pradesh	Boy	84.9	3.9	0.3	11.0
	Girl	80.6	8.8	0.6	10.0
Tamil Nadu	Boy	68.3	31.0	-	0.7
	Girl	76.4	22.8	0.3	0.6

Source: Authors calculation from REDS 2006

*Note: The status of 'work' indicates that a child is involved in any kind of paid (e.g. working in other household farm) and unpaid work (e.g. helping parents in their own farm or household chores while 'no where' represents children who do not enrolls in a primary school nor participate in labor works..

Table 2 shows a considerably wide regional variation in the status of children across states. For example, merely 19% of children in Gujarat and 21% of those in Bihar participate in school only while the corresponding figures are 83% for Andhra Pradesh and 82% for Maharashtra. Although children who participate in school only are estimated to be 68% and 73% for both Tamil Nadu and Kerala respectively, the percentages of children who work only are less than one percent in these states, ranked 2nd and 3rd following Andhra Pradesh. Jharkhand and Bihar have the highest shares of children who work only, 17% and 16% respectively. Many children undertake both schooling and work. It is somewhat striking that 9 states share have nearly 10% or more children in the 'nowhere' category (i.e. those who are neither in school nor at work).

IV. Methodology

Model (a): Determinants of school enrollment– Individual level

In the study of the determinants of child schooling, two approaches would be possible. One is to examine at household level whether all children in a household are undertaking primary education in school or at least one child is out of school; the other is examined at the individual level. We take both approaches and begin our analysis from the latter. A simple and popular approach to school enrollment is a binary formulation of the probit where the choice is dichotomous (e.g. Kingdon 2002). Hence, we estimate whether a child attend school in 2006, conditioned on a vector of household and village characteristics, X_i.

$$\Pr(E_i = 1) = \Phi(X_i \beta') \quad (1)$$

Where $E_i = 1$ if the benefit exceeds the cost and $E_i = 0$ otherwise. Φ denotes the cumulative density function of the standard normal distribution and β represent a vector of parameters to be estimated.

X_i is a vector of exogenous variables reflecting household, village and school characteristics. Following literature we include the age of household head (headage), whether a household head has a spouse or not (headmarried), whether a household headed by female or not (headfemale), the years of household head education (headed_yrs), whether a household head is engaged in self-employed agricultural occupation (selfagri_d), the number of infant aged between 0-4 (noinfant), whether a household belongs to Hindu or not (hindu), whether a household belongs to other caste or not (oc), age of child who is eligible to enrol in primary school (age), the BMI measure of a child as a proxy of health status (bmi_standard), log per capita consumption expenditure (lpcex), the size of land holdings (land) and its square, the number of per capita livestock (pclivestk_n) and its square for household characteristics. The square terms of land size and number of household livestock are included to capture possible non-linear relationship between these household and parent decision to send children to school.

There are three main channels through which aggregate village effects influence on parent decision for child schooling such as price effect or collective action (Dostie and Jayaraman 2006).[3] In order to capture such village contextual effect, the following 4 variables are included: the number of primary school in a village (no_primary), the provision of public services such as road and public health facilities etc. (pubgood), a proxy for village prosperity (village_hhwealth) and a proxy for village ethnic fragmentation (elf_group). It is also important to take account of supply side factors of school enrollment (Handa 2002). For school quality, we include children-teacher ratio

[3] See Dostie and Jayaraman (2006) for details.

(r_chiteach), female teacher ratio (r_feteach), ratio of teacher with higher education (r_highteach) and number of per student blackboard (per_stuboard).

Amongst, our interest is to test the effect of a child BMI measure as a proxy variable of health status on schooling choice. Note that we cannot include the child BMI measure as a continuous variable because an increase in BMI is meaningless. Therefore, we create a dummy variable for individual child that take 1 if the BMI measure of a child lies within one standard deviation from the sample mean and take 0 otherwise, assuming that the value 1 would reflect physically healthy condition. Therefore, the present study hypothesizes that parents consider child health status as an important factor in decision making. As we have seen earlier, child labor has a significant role in household economy; we do not know the effect of child health on educational participation *ex ante*and may vary according to the gender of children. It is therefore an empirical question to be test: Parents are willing to send their healthy children to school, expecting high income in the future by human capital accumulation or would they let them work given the opportunity costs of schooling.

Model (b): The role of child health on child status – Individual level

We further extend Model (a) to analyze the status of children aged 5-14, using a multinomial logit model. The unordered categories of the status of a child i ($E_i = m$) that we consider are:

$E_i = 0$: 'no where' children who participate in neither schooling nor working (reference group).
$E_i = 1$:those who devote to schooling only without undertaking any type of works.
$E_i = 2$:those who attend school and are also engaged in labor work.
$E_i = 3$: those who participate in child labor without school attendance.

The multinomial logit model is described as[4]:

[4] For simplicity, the subscripts for household and village are dropped.

$$\Pr(E_i = m) = \frac{e^{(X_{im}\lambda_m)}}{\sum_{m=0}^{3} e^{(X_{im}\lambda_m)}}, \quad m = 0, 1, 2, 3 \tag{2}$$

where the reference group is 'no where' children ($E_i = 0$).

By setting $\lambda_0 = 0$, the above equation can be normalized (see Greene (2000)) as:

$$\Pr(E_i = m) = \frac{e^{(X_{im}\lambda_m)}}{1 + \sum_{m=1}^{3} e^{(X_{im}\lambda_m)}}, \quad m = 1, 2, 3 \tag{3}$$

$$\Pr(E_i = 0) = \frac{1}{1 + \sum_{m=1}^{3} e^{(X_{im}\lambda_m)}}, \quad m = 0 \tag{4}$$

Our interest is the log-odds ratio for category 3, relative to the reference category and is computed as:

$$\ln\left[\frac{\Pr(E_i = 3)}{\Pr(E_i = 0)}\right] = X_{im}\lambda_m \tag{5}$$

,

Eq. (5) indicates that the relative probability of the group 3 to the reference group. Thus, for example the probability that children fully participate in child labor, relative to the probability of child labor, is higher if λ_1 is positive and significant.

On the other hand, relative probabilities between group 1 and 2 can be obtained as a difference between the corresponding coefficient estimates.

$$\ln\left[\frac{\Pr(Y_i = 1)}{\Pr(Y_i = 2)}\right] = X_i(\lambda_1 - \lambda_2) \quad (6)$$

Therefore, given an increase in a component of X_i, the positive sign of the difference in the coefficient estimates suggests that a child is more likely to fully engage in primary education rather than affording their time on both education and labor.

Model (c): Determinants of school enrollment – Household level

We have investigated the determinants of child school enrollment, and the determinants of child detailed status (i.e. school participation, school participation with labor, child labor with no schooling and 'no where') at individual level. In this sub-section we extend our analysis at household level and examine how household characteristics could influence on parent decision making whether or not they send all children to school or not. This might offer important information towards achieving universal primary education in rural India. We employ probit model as in model (a) but the dependent variable here takes 1 if at least one child in household does not go to school and 0 if all children attend school.

V. Results

Model (a) – Determinants of school enrollment – Individual level

The results obtained from the probit estimation on binary enrollment choice are given in Table 3 where the dependent variable is whether a child is currently enrolled or not. Panel (A) is the result of regression on demand side of schooling using household and individual child characteristics while Panel (B) and (C) are the results obtained from the regressions with inclusion of extra covariates for village effect and school quality effect as supply side respectively. The first column in each panel shows regression result from the entire sample and the second and the third in each columns offer the results from the

separate sample of boy and girl respectively. The results in Table 3 in general confirm the finding from the previous literature (e.g. Kingdon 2002; Dostie and Jayaraman 2006 etc.).

Table3. Determinants of a child school enrollment – Probit model (Marginal effect)

	(A) Household characteristics			(B) Village group effect			(C) School quality		
VARIABLES	All	Boy	Girl	All	Boy	Girl	All	Boy	Girl
headage	0.002	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.001
	(5.55)***	(3.98)***	(3.83)***	(5.07)***	(3.54)***	(3.62)***	(4.91)***	(3.47)***	(3.36)***
headmarried	0.043	0.034	0.057	0.044	0.035	0.055	0.046	0.038	0.059
	(3.62)***	(2.46)**	(2.78)***	(3.63)***	(2.52)**	(2.68)***	(3.79)***	(2.72)***	(2.86)***
headfemale	-0.028	-0.042	0.001	-0.031	-0.043	-0.002	-0.032	-0.045	0.001
	(-1.90)*	(-2.42)**	(0.03)	(-2.10)**	(-2.45)**	(-0.06)	(-2.17)**	(-2.59)***	(0.04)
headedu_yrs	0.007	0.004	0.011	0.007	0.003	0.011	0.006	0.003	0.01
	(8.84)***	(4.07)***	(8.55)***	(8.30)***	(3.60)***	(8.30)***	(7.70)***	(3.29)***	(7.64)***
selfagri_d	0.001	-0.01	0.013	-0.003	-0.016	0.011	-0.004	-0.016	0.008
	(0.21)	(-1.10)	(1.10)	(-0.34)	(-1.77)*	(0.87)	(-0.50)	(-1.83)*	(0.62)
age	0.011	0.012	0.009	0.011	0.012	0.009	0.011	0.012	0.008
	(7.58)***	(7.05)***	(3.88)***	(7.45)***	(7.07)***	(3.71)***	(7.44)***	(7.00)***	(3.64)***
bmi_standard	0.015	-0.015	0.055	0.015	-0.015	0.055	0.015	-0.016	0.056
	(2.05)**	(-1.80)*	(4.59)***	(2.08)**	(-1.82)*	(4.60)***	(2.08)**	(-1.89)*	(4.72)***
moinfant	-0.008	-0.007	-0.007	-0.007	-0.006	-0.005	-0.006	-0.006	-0.002
	(-1.95)*	(-1.28)	(-0.98)	(-1.62)	(-1.16)	(-0.70)	(-1.34)	(-1.21)	(-0.29)
hindu	0.025	-0.009	0.064	0.024	-0.013	0.068	0.013	-0.015	0.044
	(2.12)**	(-0.62)	(3.24)***	(2.02)**	(-0.93)	(3.38)***	(1.11)	(-1.09)	(2.17)**
oc	0.003	0.009	-0.007	0.001	0.006	-0.008	-0.0002	0.007	-0.011
	(0.35)	(0.90)	(-0.48)	(0.12)	(0.64)	(-0.59)	(-0.02)	(0.67)	(-0.74)
lpcex	0.083	0.051	0.107	0.082	0.048	0.106	0.083	0.049	0.109
	(8.55)***	(4.52)***	(6.56)***	(8.39)***	(4.23)***	(6.46)***	(8.47)***	(4.36)***	(6.57)***
land	-0.002	0.003	-0.008	-0.002	0.002	-0.007	-0.001	0.003	-0.007
	(-1.06)	(1.04)	(-2.09)**	(-1.01)	(0.91)	(-2.00)**	(-0.71)	(1.13)	(-1.77)*
land2	0.00001	-0.00001	0.00003	0.000004	-0.00001	0.00003	0.000003	-0.00001	0.00003
	(0.68)	(-1.44)	(1.48)	(0.59)	(-1.31)	(1.44)	(0.45)	(-1.42)	(1.37)
pdlvestk_n	-0.01	-0.004	-0.012	-0.01	-0.003	-0.012	-0.009	-0.002	-0.011
	(-1.96)*	(-0.55)	(-1.59)	(-1.76)*	(-0.38)	(-1.51)	(-1.72)*	(-0.32)	(-1.43)

pcfivestk_r2	0.0001	0.0004	0.0001	0.0001	0.00004	0.0001	0.0001	0.00003	0.0001
	(2.49)**	(0.83)	(2.02)**	(2.27)**	(0.66)	(1.93)*	(2.24)**	(0.59)	(1.87)*
no_primary				-0.001	-0.001	0.001	-0.002	-0.004	0.001
				(-0.24)	(-0.48)	(0.34)	(-0.65)	(-1.15)	(0.21)
public goods				0.071	0.057	0.077	0.082	0.057	0.1
				(2.84)***	(2.20)**	(1.90)*	(3.23)***	(2.19)**	(2.44)**
village_wealth				0.09	0.131	0.043	0.082	0.13	0.026
				(2.82)***	(3.27)***	(0.87)	(2.59)***	(3.29)***	(0.53)
elf_group				-0.025	-0.011	-0.042	-0.027	-0.014	-0.046
				(-1.24)	(-0.44)	(-1.28)	(-1.29)	(-0.54)	(-1.34)
r_chiteach							-0.0003	-0.0001	-0.0004
							(-1.84)*	(-0.49)	(-2.00)**
r_feteach							0.06	0.035	0.089
							(4.30)***	(2.11)**	(4.32)***
r_highteach							0.009	0.038	-0.02
							(0.75)	(2.58)***	(-1.06)
per_stuboard							0.118	0.121	0.113
							(0.85)	(0.64)	(0.56)
Observations	9,428	5,196	4,232	9,324	5,123	4,201	9,324	5,123	4,201
Pseudo R2	0.101	0.106	0.129	0.103	0.11	0.13	0.106	0.114	0.137
	Wald	Wald	Wald	Wald	Wald	Wald	Wald	Wald	Wald
Joint significance	chi2(31)	chi2(31)	chi2(31)	chi2(35)	chi2(35)	chi2(35)	chi2(39)	chi2(39)	chi2(39)
	=601.57	=355.54	=342.03	=618.71	=360.88	=353.38	=636.95	=380.13	=363.60
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust z statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Source: REDS 2006

Our comments begin with panel (A). A household where a head has a spouse is likely to send child to school. A household headed by female member is less willing to send a child to school relative to its counterpart, a male headed household. However, such tendency is found to be significant for boys only. Compared to other occupations, agriculture self-employed occupation of a household head is negatively associated with boys' schooling, implying that they would employ boys as extra labor resources. As we expect, educational level of a household head have in generally positive effects on child schooling. The negative sign, though statistically at 10% level, of the coefficient estimate in the BMI measure indicates that the relatively healthy boy is more likely to participate

in child labor whilst we observe the opposite sign and strongly significant coefficient estimates from girls. This might imply that in the inter-temporal trade-off in the contribution of children to household, rural Indian households react differently depending on the gender of children: For boy's primary education, parents tend to assign more weight on current income generating activities rather than future income through human capital formation. Although the negative signs found from number of infant reflect that the more infant in a household (i.e. more siblings), the less likely a child enrolls in school, the estimates are statistically insignificant. The religion is associated with girl's education not with boy's education: girls in Hindu households are more likely to attend school than those in households with other religions. As we expected, the higher household consumption expenditure is positively associated with children education and strongly significant at 1% level.

Turning to the panel (B) and (C) in Table3, our results are robust and the inclusion of village group and school quality variables does not change the findings from panel (A)-demand side of child schooling. Child health is always negatively associated with boys' but positively associated with girls' education. In panel (B) we find that the more provision of public services tends to increase the probability of child schooling. The wealthier village, the more likely boysattend school. Village ethnic fragmentation does not have significant effect on children enrollment across sample groups. In panel (C)-supply side of child education, the higher the pupil-teacher ratio, the lower the probability that households send their girls to school. However, boys are not significantly associated with the pupil-teacher ratio. The higher female teacher ratio in school tends to increase the probability of schooling for both boys and girls.

Model (b): Determinants of school enrollment and child labor – Individual level

The regression results obtained from the multinomial logit model investigating children specific activities – 'enrolled only', 'enrolled and work', 'work only' and 'no where' (the reference category) are given in Table 4.[5]

[5] For the sake of space, Table 4 only presents the regression results given by the inclusion of all the covariates taking into account demand and supply side and village group effect.

Note that the coefficient estimates in the third columns in Table 4 show the log odds between the group 3 and the reference category (i.e. those children who 'work only' vs. those 'no where' children) whilst the difference in the coefficient estimates between the first and the second columns in each panel reflects the probability of the category 1 relative to the probability of the category 2 (i.e. children 'enrolled only' vs. children 'enrolled and work').

Table4. Determinants of school enrollment and child labor – Multinomial logit model

	(A) All			(B) Boy			(C) Girl		
VARIABLES	Enroll only	Enroll & Work	Work only	Enroll only	Enroll & Work	Work only	Enroll only	Enroll & Work	Work only
headage	0.013	0.003	-0.009	0.015	0.005	-0.007	0.009	-0.001	-0.017
	(3.65)***	(0.86)	(-1.76)*	(3.04)***	(0.86)	(-0.84)	(1.65)*	(-0.13)	(-2.27) **
headmarried	0.364	-0.212	-0.553	0.249	-0.04	-0.694	0.448	-0.43	-0.699
	(2.59)***	(-1.40)	(-2.82) ***	(1.26)	(-0.19)	(-2.47) **	(2.03)**	(-1.74)*	(-2.32) **
headfemale	-0.564	-0.79	-1.171	-0.674	-1.195	-1.267	-0.342	-0.168	-1.028
	(-3.60) ***	(-4.56) ***	(-4.42) ***	(-3.25) ***	(-5.09)***	(-3.37) ***	(-1.39)	(-0.61)	(-2.52) **
headedu_yrs	0.027	0.007	-0.102	0.021	-0.013	-0.079	0.039	0.032	-0.112
	(2.63)***	(0.58)	(-6.48) ***	(1.46)	(-0.82)	(-3.35) ***	(2.58)***	(1.94)*	(-5.02) ***
selfagri_d	0.038	-0.013	0.133	-0.182	-0.369	-0.16	0.268	0.396	0.507
	(0.39)	(-0.12)	(0.95)	(-1.35)	(-2.49)**	(-0.79)	(1.77)*	(2.33)**	(2.43)**
age	0.297	0.659	0.745	0.283	0.634	0.681	0.34	0.72	0.848
	(11.65) ***	(23.79)***	(20.24) ***	(8.50)***	(17.44) ***	(13.04) ***	(8.31)***	(16.19)***	(15.10) ***
bmi_standard	0.131	0.118	-0.094	-0.121	-0.141	0.096	0.455	0.457	-0.041
	(1.51)	(1.20)	(-0.71)	(-0.98)	(-1.02)	(0.44)	(3.50)***	(3.08)***	(-0.22)
noinfant	-0.012	0.115	0.146	-0.039	0.022	0.046	0.072	0.244	0.253
	(-0.23)	(1.98)**	(1.83)*	(-0.55)	(0.28)	(0.36)	(0.91)	(2.65)***	(2.21)**
hindu	-0.142	0.109	-0.482	-0.58	-0.379	-0.826	0.232	0.618	-0.058

The results are robust regardless of the inclusion of any set of covariates as we have seen in Table 3. The full results will be furnished upon the request.

	(-0.88)	(0.60)	**(-2.06)**	**(-2.32)**	(-1.37)	**(-2.11)**	(0.93)	**(2.30)**	(-0.18)
			**	**		**		**	
oc	0.018	0.048	0.098	0.098	0.022	0.137	-0.207	-0.053	-0.057
	(0.17)	(0.41)	(0.56)	(0.71)	(0.14)	(0.50)	(-1.34)	(-0.29)	(-0.23)
lpcex	**0.978**	**1.252**	**0.556**	**0.687**	**0.818**	**0.52**	**1.218**	**1.641**	**0.74**
	(8.51)* **	**(9.67)*** **	**(2.95)*** **	**(4.52)*** **	**(4.83)*** **	**(1.75)***	**(6.37)*** **	**(7.55)*** **	**(2.78)*** **
land	-0.025	0.054	0.006	-0.032	**0.119**	**-0.124**	-0.013	0.055	**0.182**
	(-1.10)	(1.42)	(0.09)	(-0.75)	**(2.22)**	**(-1.89)***	(-0.43)	(1.15)	**(2.55)**
land2	0.001	**-0.006**	-0.001	0.001	**-0.012**	0.004	0.001	-0.004	**-0.013**
	(1.09)	**(-2.08)**	(-0.26)	(0.51)	**(-3.29)*** **	(1.58)	(0.86)	(-1.45)	**(-2.49)**
									**
pdivestk_n	0	0.084	0.148	-0.043	0.085	-0.089	0.05	0.157	0.244
	(-0.00)	(1.00)	(1.44)	(-0.31)	(0.74)	(-0.42)	(0.36)	(1.09)	(1.60)
pdivestk_n2	-0.014	0	-0.001	-0.009	0	0.001	-0.006	-0.001	-0.001
	(-0.82)	(-0.41)	(-1.23)	(-0.30)	(-0.50)	(0.39)	(-0.52)	(-0.57)	(-1.24)
no_primary	-0.019	**0.069**	0.057	-0.061	-0.021	-0.006	0.045	**0.169**	**0.157**
	(-0.57)	**(1.88)***	(1.19)	(-1.38)	(-0.42)	(-0.08)	(0.83)	**(2.96)*** **	**(2.21)** **
pubgood	**0.692**	**0.969**	-0.243	0.765	**0.865**	-0.199	0.781	**1.12**	-0.002
	(2.14) **	**(2.65)*** **	(-0.47)	(1.62)	**(1.65)***	(-0.24)	(1.60)	**(2.01)** **	(-0.00)
village_hhwealth	**1.012**	0.705	0.107	**2.086**	**2.056**	0.917	0.124	-0.311	-0.833
	(2.46) **	(1.55)	(0.18)	**(3.41)*** **	**(3.08)*** **	(0.97)	(0.21)	(-0.46)	(-1.00)
elf_group	**-0.57**	**-0.872**	**-1.187**	-0.29	-0.461	-0.773	**-1.058**	**-1.392**	**-1.709**
	(-2.04) **	**(-2.82)*** **	**(-2.97)*** **	(-0.74)	(-1.08)	(-1.29)	**(-2.35)** **	**(-2.80)*** **	**(-2.88)*** **
ratio_chiteach	**-0.004**	**-0.005**	**-0.005**	-0.003	**-0.005**	**-0.007**	**-0.006**	-0.004	-0.003
	(-2.30) **	**(-2.65)*** **	**(-1.93)***	(-1.22)	**(-2.01)** **	**(-1.96)***	**(-2.07)** **	(-1.37)	(-0.85)
ratio_feteach	**0.799**	-0.12	**-0.605**	**0.418**	**-0.552**	**-1.237**	**1.322**	0.448	-0.096
	(4.52)* **	(-0.61)	**(-2.24)** **	**(1.63)***	**(-2.03)** **	**(-2.97)*** **	**(4.78)*** **	(1.43)	(-0.25)
ratio_highteach	**0.35**	-0.108	0.325	**0.563**	0.235	0.182	0.147	**-0.526**	0.262
	(2.26) **	(-0.61)	(1.42)	**(2.48)** **	(0.93)	(0.53)	(0.63)	**(-1.96)***	(0.82)
perstud_board	1.883	**4.481**	**4.707**	2.938	3.628	3.789	1.556	**5.898**	**5.52**
	(1.04)	**(2.29)** **	**(1.80)***	(0.89)	(1.05)	(0.77)	(0.68)	**(2.37)** **	**(1.75)***
Constant	-9.216	-14.913	-10.562	-5.308	-9.517	-8.714	-12.71	-20.483	-14.012

	(-7.25)	(-10.76)	(-5.39)	(-2.82)	(-4.75)	(-2.79)	(-6.26)	(-9.16)	(-5.08)
Observations	9,324	9,324	9,324	5,123	5,123	5,123	4,201	4,201	4,201
Pseudo R2									
Joint significance									
Prob>chi2									

Robust z statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Reference group is 'no where' children and dropped from the Table.
Source: REDS 2006

Our comments are brief and selective. The negative and significant coefficient estimates implies that in a household headed by female member, the probability of 'no where' tends to be higher than the probability of 'work only' regardless of the gender of a child. As seen in Table 3, it is also confirmed from Table 4 that female headship is negatively associated with boy's education, but not for girls. Between 'enrolled only' and 'enrolled and work' for boys, the positive sign of the difference in the coefficient estimates suggests that female headship tends to increase the likelihood of 'enrolled and work', relative to the likelihood of 'enrolled only'. The more educated household head, the higher the probability of child full participation in schooling than 'enrolled and work'.[6] An increase in the years of education of a household head would increase the relative probability of 'no where' over 'work only' for both boys and girls. The positive sign in coefficient difference, which is 0.034 for boys and 0.002 for girls, between the first and the second columns are strongly significant at 1% level, imply the higher relative probability of full participation of schooling over 'enrolled and work'. The similar pattern is observed from panel (C). On the other hand, among sample children aged between 5 and 14, the older child is less likely to take 'no where' status, i. e. neither in school nor at work. Specifically, the older child is more likely to be engaged in child labor. Besides age variable also tends to increase the relative probability of 'enrolled and work'. We find that the health status does not have statistically significant effect on boy's education, including any difference in columns. On the contrary, girl's health status seems to influence on

[6] The results on the statistical significance of the difference in the coefficient estimates will be furnished upon the request.

parents decision making with respect to child status, especially school attendance; First, compared to 'work only', the healthy girl is more likely to participate in either 'enrolled only' or 'enrolled and work' (i.e. log odds between category 1 and 3, or between category 2 and 3). Similarly, a good health of girl tends to increase probabilities of both 'enrolled only' and 'enrolled and work', relative to the probability of 'no where' status. All the coefficient differences are strongly significant at 1% level. However, it is not likely to influence on girl's status between 'work only' and 'no where'. The results observed from the effect of BMI measure might suggests that when daughters are healthy, rural Indian households tend to send them to school, weighting future expected income more than income that they could earn at present. Our finding confirms that private spending to improve children's health would make it more likely for children to enroll in primary schooling and progress to higher ones (Sánchez and Sbrana 2009). In contrast, we find no significant health effect on boys' disaggregated status.

Table 4 shows village wealth effect is positively associated with boy's school attendance but not with girl's schooling. We also find no statistically significant impact of village wealth on the log odds ratio between school participation with and without any kind of work whilst the positive sign in the coefficient difference in the first and the second columns suggests that the more prosperous village population would encourage boy's full participation in school. In contrast, the more ethnic fragmented village, the probabilities of sending girls to school or to work are both lower than 'no where' status. As Chamarbagwala and Tchernis (2006) argue, our result suggests that village characteristics reflect social norms and parental attitudes toward children's activities. The fact that parents in ethnically fragmented villages, hesitate to send girls to neither school nor work, hence let them stay idle, reflects precisely that their children are more likely to face disadvantages and possible discrimination outside their homes. We observe similar impacts of school quality as found in Table 3: The higher pupil-teacher ratio or the higher male teacher ratio is negatively associated with boy's education whilst the more availability of black board per student tends to increase the relative probabilities of both boys' and girls' schooling.

Model (c): Determinants of school enrollment – Household level

Table5 presents results on marginal effects obtained from the estimated probit model at household level (the probability of household that has at least one child out of schooling).The first column offers the results from the base regression containing household characteristics whereas the second and the third columns provide the results added with village characteristics and both village and school characteristics respectively. As Table 5 is based on household level, children's individual characteristics such as BMI measure are omitted.

Table5. Determinants of no enrollment at household level (1 if any child within a household do not attend school)

VARIABLES	Household characteristics	Village roup effect	School quality
headage	-0.001	-0.001	-0.001
	(-2.18)**	(-1.81)*	(-1.65)*
headmarried	-0.021	-0.025	-0.025
	(-0.90)	(-1.03)	(-1.02)
headfemale	-0.028	-0.026	-0.024
	(-0.93)	(-0.86)	(-0.79)
headedu_yrs	-0.01	-0.009	-0.009
	(-6.37)***	(-5.88)***	(-5.50)***
selfagri_d	0.001	0.007	0.009
	(0.07)	(0.49)	(0.57)
noinfant	0.033	0.031	0.03
	(3.83)***	(3.55)***	(3.42)***
hindu	-0.043	-0.041	-0.024
	(-1.76)*	(-1.65)*	(-0.95)
oc	-0.023	-0.018	-0.018
	(-1.42)	(-1.08)	(-1.04)
lpcex	-0.105	-0.101	-0.103
	(-5.57)***	(-5.34)***	(-5.42)***
land	0.002	0.001	0.001
	(0.48)	(0.33)	(0.21)

land2	0.0001 (0.04)	0.0002 (0.18)	0.0003 (0.23)
pclivestk_n	0.016 (1.16)	0.011 (1.25)	0.011 (1.08)
pclivestk_n2	-0.001 (-0.44)	-0.0001 (-1.34)	-0.0001 (-0.17)
no_primary		0.001 (0.26)	0.001 (0.22)
pubgood		**-0.09 (-1.77)***	**-0.107 (-2.08)****
village_hhwealth		**-0.23 (-3.65)*****	**-0.22 (-3.46)*****
elf_group		0.029 (0.68)	0.035 (0.81)
ratio_chiteach			**0.001 (1.99)****
ratio_feteach			**-0.067 (-2.38)****
ratio_highteach			0.0002 (0.01)
perstud_board			-0.129 (-0.45)
Observations	3,856	3,813	3,813
Pseudo R2	0.087	0.091	0.094
Joint significance	Wald chi2(29) =262.42	Wald chi2(33) =277.50	Wald chi2(37) =283.54
Prob> chi2	0.0000	0.0000	0.0000

Robust z statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%
Source: REDS 2006

The pattern of the regression results is in general similar and robust across specifications. Note that the negative sign of the coefficient estimates reflects the positive impact of the corresponding variable on child schooling because the regression in Table5

is to estimate the probability of non-attendance in schools. Thus, the negative signs of the household head's education suggest that, although the magnitudes are not large, the higher the educational level of a household head, the higher the probability of all children to receive primary education. The coefficient estimates are strongly significant at 1% level in all the regressions**.** In contrast, the positive sign of the number of children aged between 0 and 4 implies that the more infants, the higher the probability of at least one child aged between 5-14 years to be out of school, implying that he/she may be responsible for caring of his/her younger brother or sister. The signs of the coefficient estimate of household consumption expenditure (lpcex) are negative and strongly significant, suggesting that the probability of any child to be out of school declines as household's living standard improves.

VI. Conclusion

Drawing upon the most recent household survey collected from rural India, the present study analyzes the determinants of child primary school enrollment at individual and household levels. In particular, with a hypothesis that child health is an important factor influencing on parent decision making for children education, we assess the effect of child health on school participation, which has been often neglected in the previous literature. However, under the cost-benefit framework, parent will send children to school if net benefit is expected to be positive; benefit side of schooling includes high expected earnings through high productivity stemming from improved cognitive skills and other capacity etc. while cost side includes forgone income from child labor instead of school participation as well as cash expenditure for child schooling. Because the status of child health are likely to influence on both child capacity to learn in school and child labor productivity, it should be taken account of in modeling school participation decision.

The analyses in this paper reveal that parents' decision-making on child's status is associated with child's health, together with a number of socio-economic, demographic, and cultural factors, both at household level and at the village level. The information on

the association presented here may in several ways help policy makers who want to identify and solve the problem of low school participation.

The child health proxied by BMI measure is shown to have gender differentiated effects: Parent is likely to send healthy sons to work whilst they tend to send healthy daughters to school. This suggests that child preschool nutrition program and mid-day school meals may be effective in inducing greater schooling for girls, which in turn could contribute toward reducing gender gaps in schooling. In contrast, government needs to address the reasons why Indian parents send healthy boys to work (e.g. economic returns) and to implement strong campaigns informing that primary education is a worthwhile and cost effective investment. Household religion of Hindu and number of per capita livestock are positively associated with girls' school participation whilst pupil-teacher ratio and ethnic fragmentation is negatively associated. Low-fee-paying (LFP) religious private schools for girls might be the solution for those parents who fears sending girls to public schools in ethnically and religiously diversified villages. Regulation on quality control for these schools in terms of pupil-teacher ratio and female teacher ratio might further ensure girls to be enrolled for longer.

Factors such as female headship, agriculture self-employed occupation of a household head are negatively associated while village prosperity is positively associated with boys' schooling. It might be the case that providing female household heads and agriculture self-employed families with greater productive credit, can help households to send their boys to school. The government and micro credit organizations can provide credit conditional on boy's schooling. For those boys who cannot ignore the opportunities for work for their households, flexible learning opportunities need to be provisioned at low cost. It is needless to mention that government needs to set a long-term goal for gender bias in labor markets to be corrected in order for female householders to be less uncertain in their income earning activities.

Finally, similar to other empirical studies with respect to India's primary school enrollment, the present study could not analyze how and where children who are involved in neither schooling nor working (i.e. 'no where' children) spend their time due to data

constraint. In order to precisely understand child education and labor in India, future study on is suggested to take account of both quantitative and qualitative aspects.

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〈국문요약〉

인도 농촌지역에서의 아동건강과 노동 및 초등교육 진학의 관계

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본 연구에서는 인도아동의 건강상태가 노동시장진입과 초등학교 진학에 미치는 영향에 대해 분석하고 있다. 2001 년 인도정부의 "보편적 초등교육의 실현" 정책목표와 재정투입에도 불구하고 여전히 7 백만명이상의 초등교육학령 아동인구는 교육의 기회를 갖지 못하고 있어 국제원조기관, 학계 등에서는 인도아동의 노동시장진입에 관한 다양한 학술·정책 연구를 수행하여 왔다.그러나 데이터의 제약으로 인해 많은 선행연구에서는 중요한 변인인 아동 건강상태에 대한 통제가 간과되어 왔다. 본 연구의 다양한 회귀분석결과에 따르면 인도 가계에서는 대체로 건강한 여아는 학교에 보내는 한편 건강한 남아의 경우 노동시장에 보내는 경향이 일관적으로 관찰되었다. 초등학교진학률 제고를 위해서는 남아의 소득창출이 가계의 주요 수입원으로 작용하는 현실적인 제약을 고려하여 초등교육투자의 저비용·고효율성을 알리는 지속적인 캠페인과 함께 취학조건부 현금이전 또는 소액금융을 통해 아동 취학을 유도할 필요가 있다. 또한 여타의 정책에도 불구하고 취학이 불가능한 아동들을 위해서는 야학 등의 다양하고 유연한 교육기회가 제공되어야 할 것으로 보인다.

주제어: 성차, 아동노동, 건강, 초등학교 취학, 인도

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