HOUSEHOLD HEADSHIP AND ACADEMIC SKILLS OF CHILDREN: NEW EVIDENCE FROM INDIA

Upasak Das[*]

Ashish Singh[†]

Sarthak Gaurav[‡]

Abstract: This study examines the academic skills of Indian children aged 8-11 years belonging to households headed by males, married females and widows respectively. Using logistic regressions analysis of test scores of children across the dimensions of reading, mathematics and writing skills from a nationally representative sample, we find that children from female headed households either perform better or similar, but never worse than those from male headed households. Also, a household fixed effect analysis reveals no gender difference in academic scores of children belonging to female headed households which is not the case with children from male headed households.

Keywords: academic skills; female headed households; children; India

[*] Indira Gandhi Institute of Development Research; Email:Upasak.das@gmail.com
[†] Indira Gandhi Institute of Development Research; Email:aashish.igidr@gmail.com
[‡] Indira Gandhi Institute of Development Research; Email:sanugaur@gmail.com

1 INTRODUCTION

There is growing evidence that increase in educational levels and bargaining power of adult females in the household results in improved human development outcomes through better health and schooling outcomes for children. Phillips and Burton (1998) using micro-data of Canadian households, found that expenditure on child care increases with increase in womens' share of household income. Extant empirical literature on the subject has emphasized that higher level of maternal education is associated with better schooling outcomes for children in developed as well as developing countries (Behrman *et al*., 1999; Lam and Duryea, 1999; Peter and Sahn, 2000; Schultz, 2002; Chudgar, 2009, 2011). For India, which is among the fastest growing developing countries in the world, Chudgar (2009) found association between improvement in maternal education and better schooling outcomes for children (especially girls). Another study which reports similar evidence in Indian context is by Kambhampati and Pal (2001), in which the authors found greater impact of mother's literacy on the chances of daughters being educated than sons. In other parts of the world, Glick and Sahn (2000) reported significant impact of mothers' education on the schooling of daughters for Guinea households. Further, in Ghana the effect of a mother's education on her daughter's schooling was much greater than on her son's schooling (Tansel, 1997). Also, Hoddinott and Haddad (1995) found evidence that increase in income of women was associated with increase in food expenditures in Cote d'Ivoirian households.[1]

Having recognized the significance of the correlation between bargaining power (and education) of women and better outcomes for the children in a household, we shift our focus to female headed households, as household headship is considered as an acceptable indicator of intra-household bargaining power (Chudgar, 2011). There are studies which infer that female headed households excel in imparting positive health and educational outcomes in their children. For example, in Jamaica, children in female headed households were healthier in comparison with those in male headed households, (Handa, 1996). Similarly, Johnson and Rogers (1993), in their study on Dominican households found that children from female headed households enjoyed better health outcomes compared to children from the male headed households. Furthermore, in Tanzania, female headed households spent more on the welfare of children compared to the male headed households (Seebens, 2009).

When it comes to educational outcomes, there are investigations which reveal that children from female headed households fare better than those from male headed households. Living in a female headed household was advantageous for schooling of children as compared to living in male headed households

[1] Other studies with similar findings include Quisumbing and Maluccio, 2000; Thomas 1990 and Thomas 1993.

with similar resource levels in African countries like Kenya, Namibia and Zambia (Llyod and Blanc, 1996). Similarly, children in households headed by currently married women or widows were more likely to be enrolled in school compared to children in households headed by men in Pakistan (Aslam, 2007). However, the benefits associated with living in a widow-headed household were slightly lower. On similar lines, Joshi (2006) found that children in households headed by married women had "stronger schooling attainments" in Bangladesh. In the Indian context two studies that have used a nationally representative sample stand out; Unisa and Dutta (2005) found that children in female headed households had a higher chance of attending schools where as Chudgar (2011) concluded that children were more likely to enjoy better schooling outcomes in terms of school enrolment and number of years of schooling in households headed by married females compared to children living in male headed households.

Another pertinent issue which forms a central theme in the literature on differential outcomes for male headed households vis-a-vis female headed households is along the dimension of gender based differentials in schooling (and other) outcomes for children within the households. The evidence on the extent of gender based differentials in outcomes for children in male headed households compared to female headed households is rather mixed. At one hand there are studies like Lloyd and Blanc (1996), Unisa and Dutta (2005), and Weir (2005) which claim that female children in female headed households complete more grades of school than their male counterparts. Smith and Byron (2005), on the other hand could not find a concomitant association between increases in female intra-household decision making power and improved schooling outcomes for girls in South Asian households. Also, Aslam (2007) observed that while female headed households in general were as likely as others to discriminate against girls when making enrollment decisions, widow headed households were less biased against girls. Interestingly, Chudgar (2011) found that boys and girls from widow headed households were equally likely to enroll in school and to attain a given amount of education.

Though there are a few studies that focus on improved educational outcomes of children belonging to female headed households in terms of their school enrolment and years of schooling, we could not come across any study which has systematically examined the relationship between female headed households and specific schooling outcomes in terms of academic skills of children. Since academic skills (reading, mathematics and writing) are important indicators of a child's overall cognitive development, we investigate how academic skills of children vary across households headed by males and females. Our analysis focuses on two basic issues. First, we test if children in two types of female headed households (headed by married females and headed by widows) are likely to perform better than their counterparts in male headed households. Second, we also test how intra-household gender differences in

these academic skills vary across different households. Given this context, section 2 discusses the data, and the variables which is followed by a section on methods and empirical strategy used in the analysis. Main findings have been presented in section 4 and the study finally concludes with a section discussing the findings.

2 DATA, ACADEMIC SKILLS AND ITS DETERMINANTS

2.1 Data

We use the publicly available data from the Indian Human Development Survey (IHDS), conducted by National Council of Applied Economic Research, New Delhi, India in collaboration with the University of Maryland, in 2004-05. The survey is a micro unit recorded, nationally representative survey based on a stratified multistage sampling procedure. The survey was spread over 33 states and union territories of India and covers 26,734 households (143,374 individuals) in rural areas and 14,820 households (72,380 individuals) in urban areas. This survey is unique in the sense that it was designed to measure different dimensions of human development with modules on education, health, employment, income, and gender empowerment.

A major contribution of this survey was the administration of an education module which assesses reading, mathematics and writing skills of children aged 8 to11 years. A major focus was to measure basic skills using standardised tests that can be administered relatively easily and with low anxiety levels on the part of children. Also, it was administered at the children's homes in order not to miss those who were absent from school. The tests were simple, intuitive and were translated into 13 languages in addition to English and the children were asked to take the test in whichever language they were most comfortable in (Desai *et al*., 2010: 79). Interviewers were trained using specifically developed films so that they could differentiate between a child's shyness and inability to read. They were also trained in inter-personal skills to develop rapport with children.

The focus was on children aged 8 to11 years because "all of these children should have acquired the basic skills" (Desai *et al*., 2010: 79) - which are the relevant outcome variables in our study.

2.2 Academic Skills

The scores of children in tests administered for measuring reading, mathematics and writing skills form the three outcome variables for the analysis presented in this paper. The first outcome variable relates to children's reading skills and is divided into five categories: (i) child cannot read at all; (ii) child can read letters but not form words; (iii) child can put letters together to read words but not read whole sentences;

(iv) child can read a short paragraph of 2-3 sentences but not fluent enough to read a whole page; and (v) child can read a one page short story.

The variable pertaining to mathematics skills is the second outcome variable and is divided into four categories: (i) child cannot read numbers above 10; (ii) child can read numbers between 10 and 99 but not able to do more complex number manipulation; (iii) child can subtract a two digit number from another; (iv) child can divide a number between 100 and 999 by another number between 1 and 9.

Finally, the third outcome variable captures the writing skills of children and is dichotomous in nature, that is, whether the child is able to write a simple sentence, such as, "My mother's name is Madhuben", with two or fewer mistakes (Desai *et al*., 2010).

2.3 Determinants of Academic Skills

The primary explanatory variables of interest are the dummy variables related to the type of household headship. These dummy variables are coded into three categories: male household head, married female household head and widow household head. This categorisation is similar to Chudgar (2011) and helps in capturing the nature of difference in outcomes for children's academic skills among different household types based on headship.

Drawing from the published literature on determinants of educational outcomes among children in Indian context (Dreze and Kingdon, 2001; UIS, 2005; Govinda and Bandyopadhyay, 2008; Chudgar, 2011), we include a number of controls. These can be broadly classified into two categories; first one pertaining to individual child specific characteristics and the second one related to the child's household characteristics. Following Chudgar (2011), we use child's sex, birth order, age and whether or not the child has an older male sibling to describe the characteristics of child. To characterise the households we use dummies for caste and religion, household size, monthly per capita expenditure (normalised using natural log) and age of household head along with his/her level of education. The categorical variable for caste is coded into the categories of "Scheduled" groups ("Scheduled Caste" (SC) and "Scheduled Tribes" (ST)), "Other Backward Classes" (OBC) and "Other Castes" (OC; taken as reference) which are meaningful representations of the Indian social fabric along caste lines. Religion has been divided into three categories, namely "Hindu" (the majority religious group in the Indian population; taken as reference), "Muslim" (largest group among religious minorities) and "Others". Educational level of household head has been categorised into no education (taken as reference), primary education or less; and secondary (incomplete) education or more. The list of variables and the descriptive statistics are presented in Table 1. [Table 1 here]

3 METHODS AND EMPIRICAL ANALYSIS

We use ordinal logistic or ordered logit models for reading and mathematics skills (since these dependent variables have multiple levels) and binary logit model for writing skills (since it is a dichotomous variable). For every outcome variable, we have conducted the analysis at three levels as explained below.

At the first level we conducted the regression analysis on the full sample (that is sample including both male and female headed households). The details of this level are as follows: since for each dimension of skills of the *N* children, we have *J* achievement levels naturally ordered in a meaningful way (ranked) for the ordinal dependent variable, we model them using ordinal logistic or ordered logit regression (Maddala, 1983). The model can be specified as below:

$$y_i^* = \alpha_{fm} FMHH + \alpha_{fw} FWHH + \lambda FEMALE + X\beta + R_i + \varepsilon_i \quad (1)$$

$$y_i = k \text{ if } \delta_{k-1} \le y_i^* < \delta_k \text{ for } k = 1, \ldots, J \; ; i = 1, \ldots, N; \; \delta_o = -\infty; \delta_k = \infty \quad (2)$$

where, the ordered outcomes (dependent variables) are modeled to arise sequentially as a latent variable, y^*, with lower y^* indicating lower level of achievement (Cameron & Trivedi, 2005; Desai et al., 2008). In our case, y^* is an unobserved measure of a child's academic achievement as indicated by scores in tests designed to measure reading skills, mathematics skills and writing skills. In the equation 1, β is the vector of coefficients associated with child and household specific characteristics and X is the matrix of corresponding household and child level control variables as listed in Table 1. α_{fw} and α_{fm} are the coefficients of interest which would help us in gauging how the skills of children in widow headed (FWHH dummy) and married female headed households (FMHH dummy) differ from the male headed households which have been taken as the reference group. R_i indicates the region dummies to account for heterogeneity in female-headship composition across geographical regions.[2]

Though, the tests were administered by trained interviewers to specifically distinguish among children at varying levels of reading, mathematics and writing ability, the same child may well be

[2] The five geographic regions are: North (states of Jammu and Kashmir, Punjab, Haryana, Delhi, Himachal Pradesh, Uttaranchal and Rajasthan), East (states of Bihar, Jharkhand, West Bengal, Orissa and the seven states of North East), Central (states of Uttar Pradesh, Madhya Pradesh and Chattisgarh), West (states of Gujarat, Maharashtra and Goa) and South (Karnataka, Andhra Pradesh, Tamil Nadu, Kerala and Pondicherry).

classified, for example, by one interviewer as being able to read letters and not words and by another interviewer as being able to put the letters together in words. So the outcome variable in this case is better interpreted as a *propensity to read* rather than a specific skill level (Desai *et al*., 2008). Observed reading levels (as coded in the survey responses are only observed; y_i) are tied to the latent variable y_i^* (which is unobserved) by the measurement model where the underlying events are cumulative logits:

$y_i = 1$ (does not read) if $\delta_o = -\infty \leq y_i^* < \delta_1$ (3)

$y_i = 2$ (letter) if $\delta_1 \leq y_i^* < \delta_2$ (4)

$y_i = 3$ (word) if $\delta_2 \leq y_i^* < \delta_3$ (5)

$y_i = 4$ (paragraph) if $\delta_3 \leq y_i^* < \delta_4$ (6)

$y_i = 5$ (story) if $\delta_4 \leq y_i^* < \delta_5 = \infty$ (7)

Accordingly, for mathematics ability the observed levels are: y_i =1 (does not recognize written numbers), $y_i = 2$ (read numbers), y_i = 3 (subtract) and y_i = 4 (divide).

Since, the outcome variable for writing ability is dichotomous, the model becomes a simple logistic regression (logit) model with y_i = 1 (cannot write a simple sentence with two or less mistakes) and $y_i = 2$ (can write a simple sentence with two or less mistakes).

At the next analytical level, to focus on the difference between the academic skills of boys and girls within a given household type, we have conducted the above analysis separately for male and female headed households. Households headed by married females and those headed by widows have been combined to create the sample of female headed households.[3] The models at this level are same as that mentioned above; the only difference being the dropping of dummy variables indicating household types from the models.

Finally, at the third level of our econometric exercise, we tried to examine the intra-household differences between boys and girls and to this effect we employ household fixed effects modeling

[3] It would have been desirable to conduct the analysis separately for married female headed households and widow households but the resulting samples which are small in size don't permit this separation.

(Behrman and Deolalikar, 1993; Subramaniam, 1996). That is, we try to test the existence of gender bias and estimate the gender difference or *gender effects* (by controlling for the household level fixed effects, which takes into account all the household specific unobserved heterogeneity) for each of the academic skills separately for male headed and female headed households. Since, the gender differential (λ in equation 1) might differ by household type not because of the sex of the child, but due to some unobserved characteristics of the household, we need to control for all observable and unobserved characteristics. To achieve this, we estimate a linear probability model (LPM) with household fixed-effects for each academic skill for male headed and female headed household sub-samples. Since, it is not possible to apply linear probability modeling with a dependent variable having multiple outcomes, the reading and mathematics scores have been dichotomized (see Singh, 2011 for the methodological application in a similar context); i.e. reading score = 1 if a child can read a paragraph or a short story and 0 otherwise. Similarly, mathematics score = 1 if a child can perform mathematical operation of subtraction or division and 0 otherwise. Formally, the model can be written as:

$$Y(S_j = 1) = \lambda FEMALE + X\beta + h_i + \varepsilon_i \qquad (8)$$

where, h_i represents household fixed effects; S is the variable representing outcome variable for specific skill subscripted by j = 1,2,3 representing reading, mathematics and writing abilities respectively.

4 RESULTS

4.1 Descriptive Statistics

Some stylised observations can be noted from Table 1 which in addition to elucidating the variables used in our models, also presents the descriptive statistics for the overall sample as well as samples by household types. It can be seen that the samples of male and female headed households (married and widow combined) are comparable in terms of demographic factors like percentage of female children in an average household, mean age and mean birth order, existence of older male sibling as well as caste composition. They are also comparable in terms of average household size and average age of household head. However, the educational attainment of household heads in male headed households is substantially more than the educational attainment of household heads in the female headed sample. When it comes to academic skills, the mean skills of children in the two households are almost equal across the three dimensions.

4.2 Academic Skills of Children across the Three Household Types

The odds ratios from the logistic models are presented in Table 2. An odds ratio greater than 1 indicates a positive relationship (implying a greater chance of achieving a higher outcome level than the reference group given a base level of outcome) and that less than 1 indicates negative relationship (a lower chance of achieving a higher outcome level than the reference group given a base level of outcome). [Table 2 here]

In overall sample, female children, children from lower caste groups (SC/ ST and OBCs) and Muslim households have lower chances of getting higher scores (significant $p \leq 0.01$) in the three dimensions compared to male children, children belonging to other castes ("higher castes") and Hindu households respectively. The same is true for male headed households also. In households headed by females, the trend is similar but the significance level is lower (in some cases the odds ratios are not significant at all). The gender differences have been discussed in greater detail subsequently. Further, in all cases children's academic scores are positively correlated with household wealth (significant $p \leq 0.01$). The academic scores of children are also found to be positively correlated with educational attainment of household heads. In the overall and the sample of households headed by males the correlation is significant at $p \leq 0.01$ whereas the significance level varies across skills in the sample of female headed households. It is important to note that in male headed households, children with older male siblings are less likely to achieve any higher level of score in any skill dimension compared to children with no older male siblings (significant at $p \leq 0.01$ only in the case of reading skills). This pattern is contrary to that observed in female headed households, where having an older male sibling seems advantageous to a child. However, the advantage is not significant.

We now lay emphasis on a core objective of this paper, namely, how children's academic skills compare across different household types. Column (1), (2) and (3) of Table 2 which present the results for reading, mathematics and writing skills for the overall sample give away the answer. Findings suggest that children from widow headed households are more likely to obtain higher scores in reading and mathematics skills than the children from male headed households; the estimates being significant at 5% ($p \leq 0.05$) and 10% ($p \leq 0.10$) respectively. For writing skill also, the odds ratio is greater than one though insignificant.

Further, children from married female headed households have higher odds of obtaining better scores (significant at $p \leq 0.01$) in writing skills than the children from male headed households. Moreover, for reading and mathatics skills also, the odds ratios are more than one but they are not

significant. It is important to note that, the odds ratios for married female headed households and widow headed households are always greater than one indicating the relative advantage of children belonging to these households over male headed households in attaining higher academic skills under consideration.

4.3 Gender Differences

Our second objective is to examine gender differential in academic scores of children in specified types of households. It may be observed (odds ratios for the variable "Female") from columns (4), (5) and (6) that girls are at a significantly ($p \leq 0.01$) disadvantaged position in all the three academic skills compared to boys in male headed households. In complete contrast to male headed households, there is no significant difference between male and female children in reading and writing skills when considered at 5% level of significance (columns (7) and (9)). To explore this finding further, we have conducted a household fixed effects analysis to get more insight into gender effects in female headed households vis-à-vis gender effects in male headed households.

This analysis has edge over other analysis as in household fixed effects all the unobserved as well as observed household level variables, for example caste, religion, wealth, household head's education etc. that are invariant across children within a household would drop out. Hence, it would enable us to capture purely the effects of factors which vary across the children within households. Since this analysis can only be carried out using households with at least a pair of male-female children; we included only those households which met this criterion. This has been done separately for samples of both male headed households as well as female headed households. On account of the above specification, the sample sizes for the household fixed effects analysis are smaller than those used in the earlier models. Table 3 provides the descriptive statistics of the variables relevant to the household fixed-effects analysis. [Table 3 here]

It can be seen from Table 3 that, whether we consider percentage of female children in the household, age of children, birth order or existence of older male sibling, the samples of male headed households and female headed households are comparable. Table 4 presents the findings of the household fixed-effects analysis. Clearly, the coefficients associated with the variable "Female" (column (7), (8) and (9)) are not significant for female headed households. That is, there is no significant difference in any of the academic skills of girls and boys in female headed households. Interestingly, the same cannot be said for male headed households, where the academic scores of girls in reading and mathematics skills are significantly ($p \leq 0.05$) lower than those of boys. [Table 4 here]

5 DISCUSSIONS AND CONCLUSION

Though there have been studies contrasting male headed households with female headed households with regards to school outcomes (enrollment and years of completed education) of children, to the best of our knowledge, there is no study which has systematically enquired into the association between gender of household head and academic abilities of children in developing countries in general and India in particular. Our study, using a nationally representative data investigates this issue. Taking reading, mathematics and writing scores as the measures for academic ability of children and using logistic regression and household fixed effects estimation, we find that children in widow headed households perform better in reading and mathematics and children in married female headed households perform better in writing compared to children in male headed households. Of note is the finding that in no case children from female headed households perform worse than children in male headed households. This is in a way consistent with findings of Chudgar (2011) for India, Aslam (2007) for Pakistan and Joshi (2006) for Bangladesh, as they have found benefits (in terms of educational outcomes for children) associated with belonging to household with a female head.

Another striking finding is that in female headed households, girls are equally likely as boys to achieve any level of reading and writing skills (at $p \leq 0.05$). This is not the case in male headed households. This is also somewhat in line with the evidence in Chudgar (2011) and Aslam (2007) who found for India and Pakistan respectively that, in window headed households girls and boys are equally likely to enroll in school and to attain a given level of education. Our finding in this context is also supported by the household fixed effects analysis which showed no gender difference in academic scores of children in female headed households. The same, however, was not true for male headed households.

To further corroborate findings, we examine the annual expenses incurred by male and female headed households on the education of their children. Table 5 reports the mean annual expenditure by households on the educational needs of their children including school fees, expenditure on books, uniform, other materials and transportation as well as private tuition fees. [Table 5 here]

It can be observed from the table that for children of every age, male headed households systematically spend more on education of boys than that of girls. However, the same is not true for the female headed households. With the exception of children of age 10 years, the mean annual expenditure on education of girls is more than that of boys in the female headed households which probably explains why there is no significant difference between the academic skills/scores of girls and boys in female headed households. This is in line with the existing literature on decreased gender differences among children in households with increased bargaining power of women (Kambhampati and Pal, 2000). Based on our findings, we argue for increased attention on female headed households as there is evidence that at

one hand the educational outcomes for children are better in these households and on another the gender based differences among children in these households are lower.

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Table 1. Descriptive statistics

Variables	Mean/frequency				
	Complete Sample	Male Headed Households	Female Headed Households	Married Female Headed Households	Widow Headed Households
Outcome variables					
Reading skills	2.619	2.620	2.608	2.458	2.697
Mathematics skills	1.578	1.578	1.590	1.530	1.625
Writing skills	0.692	0.690	0.709	0.717	0.705
Explanatory variables (child)					
Female	0.471	0.472	0.463	0.449	0.472
Has older male sibling	0.091	0.091	0.086	0.075	0.092
Birth order	1.188	1.187	1.193	1.178	1.201
Age	9.468	9.466	9.500	9.566	9.461
Explanatory variables (household)					
SC/ST	0.292	0.294	0.267	0.247	0.279
OBC	0.401	0.401	0.390	0.443	0.360
Muslim	0.138	0.135	0.178	0.256	0.129
Other religions	0.071	0.070	0.081	0.081	0.081
Consumption quintiles (monthly per capita)					
1	264.363	263.927	270.960	282.667	265.558
2	415.599	415.283	419.337	417.932	420.233
3	568.149	568.616	562.361	554.041	568.009

4	799.406	800.310	788.242	799.841	782.101
5	1623.744	1612.602	1754.649	1696.507	1790.619
Household size	6.758	6.811	6.085	5.310	6.539
Household age	44.792	44.555	47.767	38.211	53.373
Educational level of household head					
No education	0.351	0.326	0.677	0.624	0.709
Primary or less	0.199	0.204	0.134	0.121	0.141
Incomplete secondary or more	0.450	0.470	0.189	0.256	0.150
Household type					
Male headed	92.64				
Married female headed	2.72				
Widow headed	4.64				
N	12,198	11,300		332	566

Notes: (1). First row: mean; second row: standard deviation; third row: number of observations.

(2). Reading scores: 0 = cannot read at all; 1 = can read letters but not form words; 2 = can put letters together to read words but not read whole sentences; 3 = can read a short paragraph for 2-3 sentences but not fluent enough to read a whole page; and 4 = can read a one page short story.

(3). Mathematics scores: 0 = cannot read numbers above 10; 1 = can read numbers between 10 and 99 but not able to do more complex number manipulation; 2 = can subtract a two digit number from another; 3 = can divide a number between 100 and 999 by another number between 1 and 9.

(4) Writing score: = Cannot write a simple sentence with 2 or less mistakes = 0, writes with 2 or less mistakes = 1.

Table 2. Odds ratios from logistic models for reading, mathematics and writing skills

	Overall			Male Headed Households			Female Headed Households		
	Reading	Maths	Writing	Reading	Maths	Writing	Reading	Maths	Writing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Female	0.87***	0.77***	0.86***	0.88***	0.77***	0.87***	0.81*	0.77**	0.74*
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.10)	(0.10)	(0.12)
Age	3.76***	3.40***	5.46***	3.88***	3.39***	5.21***	1.63	2.29	12.39*
	(1.23)	(1.11)	(2.24)	(1.32)	(1.15)	(2.23)	(1.95)	(2.78)	(18.81)
Age squared	0.95***	0.96**	0.93***	0.95***	0.96**	0.93***	(0.99)	0.98	0.89
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.06)	(0.06)	(0.07)
Has older male sibling	0.83**	0.93	0.87	0.81***	0.92	0.86	1.20	1.14	1.14
	(0.06)	(0.07)	(0.08)	(0.06)	(0.07)	(0.08)	(0.34)	(0.34)	(0.41)
Birth order	0.94	0.85***	0.94	0.96	0.85***	0.93	0.75	0.82	1.02
	(0.06)	(0.05)	(0.07)	(0.06)	(0.05)	(0.07)	(0.18)	(0.20)	(0.25)
SC/ST	0.64***	0.57***	0.67***	0.65***	0.57***	0.67***	0.54***	0.49***	0.67*
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.10)	(0.09)	(0.16)
OBC	0.81***	0.74***	0.75***	0.81***	0.74***	0.76***	0.86	0.71**	0.72
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)	(0.13)	(0.11)	(0.14)
Muslims	0.55***	0.56***	0.65***	0.54***	0.55***	0.64***	0.69**	0.68**	0.93
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)	(0.12)	(0.13)	(0.21)
Other Religions	1.07	1.09	1.12	1.08	1.05	1.06	1.00	1.64**	2.16**
	(0.07)	(0.07)	(0.10)	(0.07)	(0.07)	(0.10)	(0.24)	(0.36)	(0.82)
Urban	1.31***	1.43***	1.26***	1.32***	1.44***	1.29***	1.19	1.30*	0.94
	(0.05)	(0.06)	(0.07)	(0.05)	(0.06)	(0.07)	(0.17)	(0.20)	(0.18)
Wealth status	1.64***	1.93***	1.88***	1.67***	1.92***	1.90***	1.39***	2.01***	1.75***
	(0.05)	(0.06)	(0.08)	(0.06)	(0.07)	(0.09)	(0.15)	(0.24)	(0.28)
Household size	0.98**	0.99	0.99	0.99**	0.99	1.00	(0.96)	1.00	0.96
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
Household	1.01***	1.02***	1.02***	1.02***	1.02***	1.02***	1.02***	1.01***	1.02***

head's age									
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Education level of household's head									
Primary or less	1.42***	1.23***	1.27***	1.42***	1.23***	1.27***	1.43**	1.38*	1.29
	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)	(0.07)	(0.25)	(0.24)	(0.32)
Incomplete secondary or more	2.23***	2.07***	2.07***	2.22***	2.09***	2.07***	2.42***	1.74***	1.96***
	(0.10)	(0.09)	(0.11)	(0.10)	(0.09)	(0.11)	(0.44)	(0.33)	(0.50)
Married female head	1.04	1.11	1.45***						
	(0.10)	(0.11)	(0.20)						
Widow head	1.22**	1.16*	1.09						
	(0.10)	(0.09)	(0.11)						
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	12,198	12,198	12,198	11,300	11,300	11,300	898	898	898

Notes: (1) Figures in parenthesis are robust standard errors.

(2) *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

Table 3. Descriptive statistics for household fixed-effects analysis

Variable	Mean/Frequency		
	Complete Sample	Male Headed Households	Female Headed Households
Outcome Variables			
Reading skills	0.566	0.566	0.556
Mathematics skills	0.492	0.494	0.472
Writing skills	0.695	0.693	0.711
Explanatory variables			
Female	0.505	0.505	0.506
Has older male sibling	0.264	0.262	0.283
Birth order	1.552	1.553	1.550
Age	9.466	9.460	9.539
Type of Household			
Male headed	91.84		
Female headed	8.16		
N	2,205	2,025	180

Notes: For household fixed effects analysis, reading and mathematics scores have been dichotomized. Reading Score =1 if a child can read a paragraph or a short story and 0 otherwise. Similarly, mathematics score = 1 if a child can perform mathematical operation of subtraction or division and 0 otherwise.

Table 4. Linear probability estimates for reading, mathematics and writing skills with household fixed effects

	Overall			Male Headed Households			Female Headed Households		
	Reading	Maths	Writing	Reading	Maths	Writing	Reading	Maths	Writing
Female	-0.04**	-0.04***	-0.02	-0.03**	-0.04**	-0.02	-0.07	-0.05	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.06)	(0.06)	(0.06)
Age	0.65***	0.57***	0.48***	0.59***	0.56***	0.45**	1.16*	0.55	0.57
	(0.18)	(0.18)	(0.17)	(0.19)	(0.19)	(0.18)	(0.63)	(0.64)	(0.64)
Age squared	-0.03***	-0.03***	-0.02**	-0.03**	-0.03**	-0.02**	-0.05	-0.02	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)
Has older male sibling	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.03	-0.01	-0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.11)	(0.12)	(0.11)
Birth order	-0.05	-0.06	0.01	-0.07	-0.07	-0.02	0.10	0.08	0.31**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.18)	(0.17)	(0.15)
N	2205	2205	2205	2025	2025	2025	180	180	180

Note: (1) Figures in parenthesis are robust standard errors.

(2) *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

(3) It may be noted that there are two problems associated with LPM; first, by construction it produces heteroskedasticity in the residual variance and second, in many cases the predicted probability of dependent variable (=1) turns out to be either below 0 or above 1 which indicates that the probabilities cannot be linearly related to the independent variables for all their possible values. The first problem is taken care by using the option “robust” in STATA (package used for regression analysis), whereas the second problem doesn’t arise in our estimation as the predicted probability of reading scores (and mathematics as well as writing) = 1 lies in the interval 0-1.

Table 5. Mean annual expenditure (in Indian Rupees) by households on education of children: by gender and age

	Overall		Male Headed Households		Female Headed Households	
Age (years)	Male	Female	Male	Female	Male	Female
8	1325.03	1140.65	1319.71	1118.46	1397.19	1425..99
9	1582.66	1390.64	1593.33	1381.16	1446.29	1489.65
10	1435.52	1225.06	1440.95	1217.91	1365.94	1330.39
11	1713.56	1421.80	1739.04	1411.36	1451.68	1555.96

Note: Expenditure on education includes expenses on school fees, expenditure on books, uniform, transportation and other materials as well as private tuition fees