

# Household Headship and Academic Skills of Indian Children: A Special Focus on Gender Disparities

## Sexe du chef de ménage et compétences scolaires des enfants indiens : une analyse des disparités entre sexe

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**Abstract** Using multivariate analyses and reading, mathematics and writing scores of children (aged 8–11 years) 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, household fixed effect analysis reveals no gender disparity in academic scores of children belonging to female headed households, a case not true for children from male headed households. We relate this finding to gender parity in educational expenditure on children in female headed households against gender disparity in the same in households headed by males. Based on our findings we also offer some policy suggestions.

**Keywords** Household headship · Academic skills · Gender disparities · Indian children

**Résumé** Les résultats de cet article, basés sur les scores obtenus en lecture, en mathématiques et en écriture par des enfants indiens (âgés de 8 à 11 ans) dans le cadre d'une enquête représentative au niveau national, et sur l'utilisation de méthodes d'analyses multivariées, montrent que les enfants appartenant à des ménages dirigés par des femmes ont des niveaux de performance soit meilleurs soit

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similaires, mais jamais inférieurs à ceux d'enfants appartenant à des ménages dirigés par des hommes. De plus, une analyse avec effets fixes ne révèle aucune différence selon le sexe dans les scores scolaires des enfants des ménages dont le chef est une femme, ce qui n'est pas le cas des enfants des ménages dont le chef est un homme. Ce résultat pourrait être la conséquence de dépenses scolaires égales pour les garçons et pour les filles dans les ménages dirigés par les femmes, ce qui ne serait pas le cas dans les ménages dirigés par les hommes. A partir de ces résultats, quelques implications en termes de politiques sont également suggérées.

**Mots-clés** Chef de ménage · Compétences scolaires · Disparités entre sexe · Inde · Enfants

## 1 Introduction

There is growing evidence which relates increase in bargaining power of adult females in a household (say in household decision making) to improved human development outcomes through better health and schooling outcomes for children. Phillips and Burton (1998) using micro-data of Canadian households, associate increase in women's share of household income to increase in expenditure on child care. Extant empirical literature on the subject has emphasized that higher level of maternal education which is often taken as an indicator of mothers' bargaining power is associated with better schooling for children in developed as well as developing countries (Behrman et al. 1999; Lam and Duryea 1999; Peter and Sahn 1999; Schultz 2002; Chudgar 2009, 2011). Among the developing countries, Chudgar (2009) associates improvement in maternal education to better schooling for Indian children (especially girls). Another study which reports similar evidence in Indian context is by Kambhampati and Pal (2001), in which the authors relate greater impact of mother's literacy to the chances of daughters being educated than sons. In other parts of the non-developed world, Glick and Sahn (2000) associate significant impact of mothers' education to the schooling of daughters for Guinean households. Further, in Ghana, Tansel (1997) relate greater effect of mothers' education on daughters' schooling than sons' (Tansel 1997). Moreover, Hoddinott and Haddad (1995) found evidence that increase in income of women was associated with increase in food expenditures in Cote d'Ivoirian households. Other studies with similar findings include Quisumbing and Maluccio (2000) and Thomas (1990, 1993).

Taking our discussion on the significance of correlation between bargaining power of women and better outcomes for children in a household further, we shift our focus to female headed households. This is primarily because though the education level of females or income share of females are often taken as indicators of bargaining power within households, household headship is clearly considered the most acceptable indicator of intra-household bargaining power (Chudgar 2011). Focusing on literature on female headed households, there are a few studies which infer that female headed households excel in imparting positive health and better schooling in their children. For example, in Jamaica, children in female headed

households were found healthier in comparison to those in male headed households (Handa 1996). Similarly, Johnson and Rogers (1993), in their study on Dominican households find that children from female headed households enjoyed better health outcomes compared to children from the male headed households. Furthermore, Seebens (2009) relate more spending on the welfare of children in female headed households compared to male headed households in Tanzania.

When it comes to schooling, there are investigations which reveal that children from female headed households are 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 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 Datta (2005) find that children in female headed households had a higher chance of attending schools where as Chudgar (2011) conclude that rural children were more likely to enjoy better schooling 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 Datta (2005), and Weir (2005) which claim that female children in female headed households complete more grades of school than their male counterparts. On the other hand there are studies, for example, Smith and Byron (2005), which could not find any concomitant association between increases in female intra-household decision making power and improved schooling outcomes for girls in South Asian households. Further, Aslam (2007) observes 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) finds 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 schooling for children belonging to female headed households in developing countries, in this article we reinvestigate this issue for India which is one of the fastest growing economies in the developing world. While doing so, our study not only complements the existing studies on the subject but also offers certain distinct advantages over the existing studies on the subject in the Indian subcontinent. The reason for the above

mentioned investigation for India primarily lies in the fact that though India has achieved unprecedented economic growth and has made noteworthy advances in the fields of science, agriculture, medicine, and information technology after the introduction of new economic policy in the 1990s (CSNSI 2008), the country still suffers from substantial gender based inequalities in schooling and health outcomes, wages and labor force participation, and access to physical and financial resources (World Bank 1991; Bhan 2001; Pande 2003; Borooah 2004; Mishra et al. 2004; Reilly and Datta 2005; Agrahari and Singh 2009).

Before elaborating on how our study complements and adds to the existing literature on female headship and outcomes for children in India, we discuss the situation and characteristics of female-headed households in India. Female headship of households is relatively low in India and as noted by the earlier studies, women become head of their households not by choice but rather due to circumstances (Visaria and Visaria 1985; Unisa and Datta 2005; Chudgar 2011). In majority of cases, females head their households by the compulsion of their single status due to death of husband, abandonment by husband, divorce or because husband migrated elsewhere for work (Unisa and Datta 2005). As per India's 2001 census, at the national level, the percentage of female-headed households is only 10.4 %, with a marginal differential of one percentage point between the rural and urban areas (Census Commissioner of India 2001). Of the 10.4 % female-headed households, the majority (6.8 %) are headed by widowed females, 2.8 % are headed by currently married females, 0.4 % are headed by single females and remaining 0.3 % are headed by divorced/separated females. The data from the National Family Health Survey (1998–1999) puts the national percentage of female-headed households at 10.3 %, a figure very close to the census estimates (Unisa and Datta 2005). Also, the percentage of female-headed households has not increased much during the period 1971–2001; it was about 10 % in 1971 (Visaria and Visaria 1985).

Coming to the economic condition of the female-headed households vis-à-vis the economic condition of the male-headed households in India, the evidence is mixed. A national level study by Meenakshi et al. (2000) concludes that female-headed households may be worse off economically but Dreze and Srinivasan (1997) which focused specifically on widow-headed households found that, on an overall, female-headed households do not appear poorer than the male-headed households. Also, on the one hand, Chudgar (2011) using data from NFHS 1998–1999 (but restricted to rural areas only) concludes that female-headed households tend to be worse off economically, on the other hand, Unisa and Datta (2005) conclude (using the same data set) that it is difficult to draw inference conclusively.

Given this context, our study investigates the association between academic skills and household headship and offers the following advantages over the existing studies which have examined the relationship between gender of household head and schooling for children in the Indian context. First, the earlier studies (Unisa and Datta 2005; Chudgar 2011) have related female headed households to improved school enrolment or years of schooling, we perhaps for the first time systematically examine the relationship between female headed households and specific schooling outcomes in terms of academic skills of children (8–11 years old). We have chosen academic skills for two main reasons: (i) academic skills (reading, mathematics and writing) are

important indicators of a child's overall cognitive development, and (ii) the academic scores (the measures of the academic skills) used in the analysis are obtained from the administration of common standardized tests (on reading, mathematics and writing) to a large sample of children belonging to households covered in a nationally representative survey. The tests were administered to all children in the specified age group who were ever enrolled in a school. Out of these, the children who were not currently enrolled but attended school in past form little less than 10 %.

Academic skills as measured above might be considered superior to a conventional measure of schooling such as school enrollment. Enrollment in a poorly equipped municipal corporation school can be very different from enrollment in a private school fully equipped with up to date facilities because they can lead to very different academic abilities. In the same way, enrollment in a school in a rural area can be very different from enrollment in a school in an urban area. Though in all the cases a child will be considered as enrolled, her/his academic abilities may vary depending on the kind of school in which s/he is enrolled. It may be noted that it is the academic abilities (outcomes) with which we are concerned with rather than the school enrollment itself which is a channel. Further, due to the rampant gender discrimination by parents in India in providence for schooling (see, Singh 2011 and the references there in), parents may selectively send a boy child to a private school whereas sending the girl child to a public school where education is relatively cheaper.<sup>1</sup> Though in such a case, both the boy and the girl child will be considered as enrolled but the enrollment in different types of schools can lead to drastically different outcomes as far as academic abilities are concerned. So, taking school enrollment as a measure for educational outcomes fails to take into account the difference in the nature of schools where children are enrolled, whereas taking academic abilities measured through common standardized tests as an indicator of educational outcome is free from this limitation. We test whether the children in two types of female headed households—headed by married females and headed by widows—are likely to perform better on academic skills than their counterparts in male headed households. Given the considerable nature of gender discrimination in schooling in India; we also pay increased attention to the intra-household gender differences in academic skills across different types of households. It is here where our study offers the second substantial advantage over the past studies.

Though the past studies, for example Chudgar (2011), have investigated intra-household gender disparity in schooling for children belonging to households headed by males and females, they have not investigated the reasons for the differential nature of gender disparity in schooling outcomes across the different types of households. We go one step further and relate the difference in intra-household gender differences in academic abilities of children belonging to male and female headed households to the difference in gender based disparity in the annual expenditures on education of children in the two types of households. We also suggest some pragmatic policy implications.

<sup>1</sup> India suffers from substantial gender based discrimination in schooling, health, nutrition, wages and labor force participation and access to physical and financial resources (World Bank 1991; Bhan 2001; Pande 2003; Borooh 2004; Mishra et al. 2004; Reilly and Datta 2005; Agrahari and Singh 2009).

The rest of the article is organized as follows: Sect. 2 discusses the data and the variables. It is followed by a section which provides the details of the methods and the empirical strategy used in the study. Main findings have been summarized in Sect. 4 and the study finally concludes with a section discussing the findings and presenting some policy suggestions.

## 2 Data, Academic Skills and Determinants of Academic Skills

### 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 2004–2005. 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 (Desai et al. 2010).

A major contribution of this survey was the administration of an education module which assesses reading, mathematics, and writing skills of children aged 8–11 years using standardized 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. In order to achieve this, IHDS worked with PRATHAM, a voluntary organization that has worked in the field of elementary education in India for many years and has developed simple assessment tools to measure the effectiveness of their training programs. These tools have been pre-tested on more than 250,000 children in India. 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, p. 79).<sup>2</sup> Interviewers were trained by PRATHAM volunteers 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 (Desai et al. 2010, p. 79).

The focus was on children aged 8–11 years because “all of these children should have acquired the basic skills” (Desai et al. 2010, p. 79)—which are the relevant outcome variables in our study. The list of variables and the descriptive statistics are presented in Table 1.

<sup>2</sup> Similar tests were also used in PRATHAM's survey, the Annual Status of Education Report (ASER), 2005. The ASER results are based on a large sample of children but do not contain detailed information about their social background and parental characteristics.

**Table 1** Descriptive statistics

Variables	Mean/proportion (%)				
	Complete sample	Male headed households	Female headed households	Married female headed households	Widow headed households
Outcome variables (mean)					
Reading skills	2.62	2.62	2.61	2.46	2.70
Mathematics skills	1.58	1.58	1.59	1.53	1.63
Writing skills	0.69	0.69	0.71	0.72	0.71
Explanatory variables (child)					
Female (%)	47	47	46	45	47
Has older male sibling (%)	9	9	9	8	9
Birth order (mean)	1.19	1.19	1.19	1.18	1.20
Age (mean; years)	9.47	9.47	9.50	9.57	9.46
Explanatory variables (household; %)					
SC/ST	29	29	27	25	28
OBC	40	40	39	44	36
Muslim	14	14	18	26	13
Other religions	7	7	8	8	8
Consumption quintiles (monthly per capita; INR)					
1	264.36	263.93	270.96	282.67	265.56
2	415.60	415.28	419.34	417.93	420.23
3	568.15	568.62	562.36	554.04	568.01
4	799.41	800.31	788.24	799.84	782.10
5	1623.74	1612.60	1754.65	1696.51	1790.62
Monthly per capita consumption expenditure (INR)	674.87	674.18	683.23	712.22	661.55
Household size	6.76	6.81	6.09	5.31	6.54

Table 1 continued

Variables	Mean/proportion (%)				
	Complete sample	Male headed households	Female headed households	Married female headed households	Widow headed households
Age of household head	44.79	44.56	47.77	38.21	53.37
Educational level of household head (%)					
No education	35	33	68	62	71
Primary or less	20	20	13	12	14
Incomplete secondary or more	45	47	19	26	15
Household type (%)					
Male headed	92.32				
Married female headed	3.00				
Widow headed	4.44				
<i>N</i>	12,198	11,300	898	332	566

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. 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. Writing score: = cannot write a simple sentence with 2 or less mistakes = 0, writes with 2 or less mistakes = 1. INR stands for Indian Rupees. Source: Authors' computations based upon IHDS (2004–2005)



## 2.2 Academic Skills: Outcome Measures

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 article. 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

### 2.3.1 Household Headship

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

It may be noted that, of the total sample, widowed females head 4.44 %, married females head 3 %, separated/divorced females head 0.23 % and never married women head about 0.01 % of households, respectively. Also, the husbands of about 86.3 % of the currently married female household heads are not staying (migrated elsewhere for work) in the household. Clearly, the above indicates that the females are heading households not by choice but because of circumstances.

For the identification and the construction of the household headship variable, we adopted the following procedure which is a standard in the literature (for example, see Chudgar 2011)—first, we identified the individual whom the survey respondent identified as the household head; second, we identified the sex of that individual; and, finally the marital status, if the identified household head was a female. As noted by Chudgar (2011), the above process of identifying the household head may raise some concerns or possible biases. There is always a possibility that a respondent might identify the "legitimate (or de jure)" head, for example, an elderly widowed mother for being the eldest, although the household decision making rests with her eldest son. As such there is no guaranteed way to ascertain that the survey respondent identified the de facto household head, however, IHDS is a reliable

survey and standard procedures were followed carefully in the administration of instruments and collection of data (Desai et al. 2009, 2010).

Moreover, we conducted some additional checks related to the relationship between the survey respondent and the identified household head. It reveals that, in the male headed households, a little more than 88 % of the respondents reported either that they themselves were the head or that they were the wife of the household head. Similarly, in the female headed households (married female headed and widowed female headed), about 89 % of the respondents identified themselves as the household head. This indicates that the chances of cases, like an adult son identifying the “legitimate (or de jure)” head, for example, his elderly mother as the household head, although the household decision making rests with him (or in simpler terms identifying himself as a son of the household head), are low.

### 2.3.2 Other Determinants

Drawing from the published literature on determinants of education for 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 a child has an older male sibling to describe the characteristics of child. To characterize the households we use caste and religion (categorical variables), household size, monthly per capita expenditure (normalized using natural log) and age as well as level of education of household head. 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.<sup>3</sup> 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

<sup>3</sup> Castes in the Indian context are related to “Jatis” (and “upajatis” or subcastes) and “Varna”. The ancient Varna system divided the Hindu society into initially four, later five, distinct “Varnas” or castes that are mutually exclusive, hereditary, endogamous, and occupation specific. These castes are the Brahmins (priests), Kshatriyas (warriors), Vaisyas (traders and merchants), and Sudras (those engaged in menial jobs) and those doing the most despicable menial jobs — the Ati-Sudras, the former untouchables. However, the operative category that determines the contemporary social code is the “Jati”. Jatis are also castes (and share the basic characteristics of the Varna), with individuals of different jatis lying at different levels of development and welfare (Deshpande, 2000, 2001, p. 131). The Government of India has categorized the different “Jatis” into four categories—Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC) and Others (OC or upper castes). There has been considerable evidence of SCs and STs having suffered severe discrimination and atrocities on the hand of upper castes of Indian society. The Constitution of India abolished the practice of untouchability and prohibits any discrimination on the basis of caste. The Government of India imbibes the principle of social equality and implements affirmative policies in terms of positive discrimination (compensatory discrimination) favoring the lower castes (SC, ST and OBC) and categorizes the different Jatis into four caste categories, namely, SC, ST, Other Backward Classes (OBC), and Other Castes (OC). The social and economic condition of SC/STs has been historically poorest in India followed by OBCs whose conditions were poorer than the OCs (other castes or upper castes).

minorities) and “Others”. Educational level of household head has been categorized into no education (taken as reference), primary education or less; and secondary (incomplete) education or more. We also include categorical variables for regions to account for heterogeneity in female-headship composition across geographical regions. The five specified 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 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).

### 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 conduct the analysis at three levels as explained below.

At the first level we conduct 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 regression. The model can be specified as below:

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

$$y_i = k \text{ if } \delta_{k-1} \leq y_i^* < \delta_k \text{ for } k = 1, \dots, J; i = 1, \dots, N, \delta_0 = -\infty; \delta_J = \infty \quad (2)$$

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 and 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 Eq. 1,  $\beta$  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).  $\alpha_{fw}$  and  $\alpha_{fm}$  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 has been taken as the reference group.  $R_i$  indicates the categorical variables for regions to account for heterogeneity in female-headship composition across geographical regions.

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 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: p. 8). Observed reading levels (as coded in the survey responses are only observed;  $y_i$ ) are tied to the latent variable  $y_i^*$  by the measurement model where the underlying events are cumulative logits:

$$y_i = 1(\text{does not read}) \quad \text{if } \delta_0 = -\infty \leq y_i^* < \delta_1 \quad (3)$$

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

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

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

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

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 second analytical level, we focus on the difference between the academic skills of boys and girls within a given household type and conduct 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.<sup>4</sup> The models at this level are same as that mentioned above; the only difference being the dropping of categorical variables indicating household types from the models.

Finally, at the third level of our exercise, we examine the intra-household differences between boys and girls and to this effect we employ household fixed effects modeling (Behrman and Deolalikar 1993; Chudgar 2011). That is, we 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 observed and unobserved heterogeneity) for each of the academic skills separately for male headed and female headed households. Since, the gender differential ( $\lambda$  in Eq. 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 household 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, respectively. Since, it is not possible to apply

<sup>4</sup> At the first analytical level (the overall sample) we have three categories of household type, that is, male headed, married female headed and widowed female headed and the household type itself has been included as a categorical variable (with the above three categories) in the analysis; but at the second level, where we perform separate analyses on sub-samples by household types, we are combining the married female headed households with widowed female headed households to get the sample of female headed households. It would have been desirable here to conduct the analysis separately for married female headed households and widowed female headed households but the resulting sub-samples are small in size resulting in inadequate variation in the other factors in the subsamples and therefore don't permit such separation.

linear probability modeling with a dependent variable having multiple outcomes, the reading and mathematics scores have been dichotomised (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:

$$Y(S_j = 1) = \lambda \text{FEMALE} + X\beta + h_i + \varepsilon_i \quad (8)$$

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 the 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 of children and mean birth order, existence of older male sibling as well as caste composition.

Female headed households (both married female headed as well as widowed female headed) seem to be smaller than the households headed by males. The difference between the mean household size of the households headed by males and the households headed by married females is greater than one. Also, the married female household heads are on an average more than 6 years younger than the male household heads, whereas the widowed female household heads are more than 8 years older than the male household heads.

We also find that the average monthly per capita consumption expenditure (MPCE) of married female headed households is higher than the average MPCE of male headed households whereas the average MPCE of widowed female headed households is lower than the average MPCE of the male headed households. However, the economic condition of the different types of households varies by the quintiles. Further, the average educational attainment of the male heads is substantially higher than that of married female heads whose average educational attainment in turn is higher than that of widowed female heads.<sup>5</sup>

Finally, the mean skills of children in the male and female headed households seem to be almost equal across the three dimensions. One important point to

<sup>5</sup> If we observe the average age of the household heads (Table 1), we find that the married female heads (38.2 years) are younger than the widowed female heads (53.4 years). Since, schooling in India has improved over time, the age difference between the married female heads and the widowed female heads might explain the higher educational level of married female heads compared to the widowed female heads.

mention here is that, though the survey measures the academic skills at quite young ages (8–11), the acquisition of these skills (reading, mathematics and writing) does not seem to be universal in the Indian society. Findings from Table 1 reveal that the mean level of reading skills in the overall sample is only 2.619 (on a scale of 0–4); the mean level of mathematics skills is only 1.578 (on a scale of 0–3); and the mean level of writing skills is only 0.692 (on a scale of 0–1). This shows the advantage of using measures of basic skills rather than enrollment rates for capturing educational outcomes, because even if enrollment rate or literacy is very high there can be substantial differences in the acquisition of basic academic skills in the children. The above point has also been highlighted by the Consortium for Research on Educational Access, Transitions and Equity (CREATE) programme at the University of Sussex (CREATE 2011).

#### 4.2 Academic Skills of Children Across the Three Household Types

The odds ratios from the logistic models are presented in Table 2. In the overall sample, female children, children from lower caste groups (SC/ST and OBCs) and Muslim households have lower chances of getting higher scores (significant at the 1 % level) in the three dimensions of academic abilities 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 their age (significant at the 1 % level), which is not surprising because the same set of tests were administered to the children of all the age groups. Furthermore, the children’s academic scores are also positively correlated with household wealth (significant at the 1 % level). 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 the 1 % level 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 the 1 % level 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.

Findings (columns (1–3) of Table 2) 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 the 5 and 10 % level, respectively. For writing skill also, the odds ratio is greater than one but insignificant.

Further, children from married female headed households have higher odds of obtaining better scores (significant at the 1 % level) in writing skills than the children from male headed households. Moreover, for reading and mathematics skills also, the odds ratios are more than one but they are not significant. It is

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

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

Table 2 continued

	Overall			Male headed households			Female headed households		
	Reading (1)	Maths (2)	Writing (3)	Reading (4)	Maths (5)	Writing (6)	Reading (7)	Maths (8)	Writing (9)
Household head's age	(0.01) 1.01***	(0.01) 1.02***	(0.01) 1.02***	(0.01) 1.02***	(0.01) 1.02***	(0.01) 1.02***	(0.03) 1.02***	(0.03) 1.01***	(0.03) 1.02***
Education level of household head	(0.00) 1.42***	(0.00) 1.23***	(0.00) 1.27***	(0.00) 1.42***	(0.00) 1.23***	(0.00) 1.27***	(0.01) 1.43**	(0.01) 1.38*	(0.01) 1.29
Primary or less	(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***
Married female head	(0.10) 1.04	(0.09) 1.11	(0.11) 1.45***	(0.10) 1.45***	(0.09) 1.45***	(0.11) 1.45***	(0.44)	(0.33)	(0.50)
Widow head	1.22**	1.16*	1.09						
Region fixed effects	(0.10) Yes	(0.09) Yes	(0.11) Yes	(0.11) Yes	(0.09) Yes	(0.11) Yes	(0.44) Yes	(0.33) Yes	(0.50) Yes
N	12,198	12,198	12,198	11,300	11,300	11,300	898	898	898

Standard errors in parenthesis are heteroskedastic robust. Source: Authors' computations based upon IHDS (2004–2005)

\* Significant at the 10 % level. \*\* Significant at the 5 % level. \*\*\* Significant at the 1 % level



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.

### 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 (4–6) that girls are at a significantly (significant at the 1 % level) 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 in female headed households when considered at the 5 % level of significance (columns (7, 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 include 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 (see Chudgar 2011 for a similar kind of treatment). Table 3 provides the descriptive statistics of the variables relevant to the household fixed-effects analysis.

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” (columns (7–9)) 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 (significant at the 5 % level) lower than those of boys.

## 5 Discussion and Conclusions

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, we perhaps for the first time have systematically

**Table 3** Descriptive statistics for household fixed-effects analysis

Variable	Mean/proportion (%)		
	Overall	Male headed households	Female headed households
Outcome Variables (mean)			
Reading skills	0.57	0.57	0.56
Mathematics skills	0.49	0.49	0.47
Writing skills	0.69	0.69	0.71
Explanatory variables			
Female (%)	51	51	51
Has older male sibling (%)	26	26	28
Birth order (mean)	1.55	1.55	1.55
Age (mean; years)	9.47	9.46	9.54
Type of household (%)			
Male headed	91.84		
Female headed	8.16		
<i>N</i>	2,205	2,025	180

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. Source: Authors' computations based upon IHDS (2004–2005)

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 uses a nationally representative data to investigate this issue. Taking reading, mathematics and writing scores as the measures for academic abilities of children and using logistic regression and household fixed effects estimation, we find that—first, children from female headed households either perform better or similar, but never worse than those from male headed households; second, there is no significant gender difference in academic scores of children belonging to female headed households, a case not true for children from male headed households; and finally, for children of every age, male headed households systematically spend more on education of boys than that of girls (details provided subsequently). However, the same is not true for female headed households. The finding that in no case children from female headed households perform worse than children in male headed households 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 schooling) 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 (significant at the 5 % level). 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 widow 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 shows no

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

Standard errors in parenthesis are heteroskedastic robust. 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 ( $\hat{y}$ ) 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. Source: Authors' computations based upon IHDS (2004–2005)

\* Significant at the 10 % level. \*\* Significant at the 5 % level. \*\*\* Significant at the 1 % level

gender difference in academic scores of children in female headed households. The same, however, is not true for male headed households.

To further explore the possible reasons for the above 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.

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 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 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 2001).

Our findings may have some potential policy implications for a few welfare schemes in India. For example, the ambitious Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) targeted at rural population in India. The MGNREGA, previously called NREGA (National Rural Employment Guarantee Act) was passed in 2005 and the implementation of the program began in 2006. Under this Act, at least 100 days of guaranteed wage employment in every financial year has to be provided to every household whose adult members volunteer to do unskilled manual work at the statutory minimum wage. If employment is not provided, an unemployment allowance has to be paid. There is an emerging consensus in the literature that the economic as well as non-economic (health and schooling) outcomes for a household are better when the control of females over the income (or say in the expenditure on various items) in a household increases. Our findings in principle also support the above observation. Given this, the Government of India might consider providing the guaranteed employment (and therefore the wages and also the unemployment allowance in case work is not provided)

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

Age (years)	Overall		Male headed households		Female headed households	
	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

Expenditure on education includes expenses on school fees, expenditure on books, uniform, transportation and other materials as well as private tuition fees. Source: Authors' computations based upon IHDS (2004–2005)

preferentially to adult females from the rural households seeking work under MGNREGA provided the adult females are willing to work under the scheme.

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