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Educational Performance of Primary School Children: Ordered Logit Estimation of Reading Ability and Mathematical Skills

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Abstract: The prevalence of poor educational performance and wide inequality in the academic achievement of children in primary education between social and economic groups in India challenges the objective of a leaned Indian society. This paper analyses the academic achievement gap in the reading ability and mathematical skills of children in primary education using the IHDS-II data applying the ordered logit method of estimation. The results show substantial differences in reading and arithmetic skills among children from different socioeconomic, demographic and religious backgrounds. The backward community children are not much disadvantaged relative to the upper community children. The scheduled caste, scheduled tribe and Muslim children are the most disadvantaged groups in achieving academic ability. Children studying in public schools and non-English medium instruction schools have less chance of being in the higher categories of educational performance. Children from urban residences and with higher educated adults tend to perform better than the child from rural areas with lower educated adults in the household. The asset holding of the household has a positive impact on the educational performance of a child. Much of the disadvantages of the learning ability and skill acquisition of children in primary education stems from the poor socio-economic background of the family and lower parental education.

Keywords: Primary education, academic achievement, reading ability, mathematical skills, ordered logit

Introduction

Schooling and knowledge are desirable not only for individuals but also for society and the economy. The progress of a nation largely depends on the quantity and quality of education received by its people. Primary education is the foundation of the entire superstructure of a nation and the quality of primary education determines the quality of life that develops the social and economic institutions. Primary education is a strong pillar of democracy not only because all citizens will have equal opportunities for a harmonious development of their personalities, but because they will become creative, efficient and productive members of a democratic society. Education is now widely valued not only for

its intrinsic value in enriching the lives of individuals but also for its financial value in the development of the human capital of a nation (Sengupta and Pal, 2010).

Realising the importance of primary education, the framers of the Indian constitution included in the Directive Principles of State policy provisions for free and compulsory education for all children up to the age of 14 years. India has demonstrated considerable progress in improving primary school access, infrastructure, pupil-teacher ratio, teacher salary and student enrollment. India has also launched universal primary education. Nevertheless, the access, quality and student learning levels are disturbingly low and the Indian primary schooling system is not doing an adequate job in preparing the generation of children that represents India's 'demographic dividend' with even the basic skills that will enable them to participate in the process of higher economic growth and world leader. The important barriers to universal primary education are poverty, child labour, physical distance to schools, lack of infrastructure in schools, social distance, gender gap, and lack of trained and motivated teachers. Though India has made considerable progress on access to schooling and enrollment rates in primary education, dropout rates and low levels of learning remain challenging.

There can be little doubt that economic status is positively related to educational success (Peraita and Pastor, 2000). The socioeconomic status and demographic structure of the family significantly determines not only the quantity and quality of education a child receives but also the probability of dropping out of the education system. The importance of parents' education, in particular the mother's education, is one of the major factors not only in school enrolment but also in the academic achievement and performance of a child. The dropouts are more likely to come from families with low socioeconomic status, uneducated parents, rural households and poor local youth labour market conditions. Despite a vibrant emerging economy and a string of excellent colleges that produce high calibre professionals, India has not made the grade yet on primary education. The objective of universal primary education has not been materialised. The significant barriers to universal primary education in India are physical distance to schools, social distance, gender gap, lack of infrastructural facilities in schools, poverty, child labour, and poorly trained and motivated teachers.

An important and negative feature of the Indian primary education system is the large disparity in access to educational institutions and the prevalence

of wide inequality in educational performance. The factors contributing to inequality in educational performance are inequalities in parent's education, child health, social background of the family, and some school characteristics. Inequality in mother's education and income differentials are the most important contributors to inequality in educational performance (Pal, 2013). According to Pratham's Annual Status of Education Report (2013), close to 78 percent of children in class III and about 50 percent in class V can not read the textbook of class II. Only 26 percent of students in class V can do a division problem. Such poor status of children are generally attributed to poor socioeconomic background of the family, lack of parental education and awareness, lack of infrastructural facilities in schools, poorly motivated and less qualified teachers, and poor and slow learning process of students in the schools.

The literacy rate is the key characteristic that indicates the socioeconomic progress of the country. The figures presented in Table 1 indicates that the gap in literacy rates across rural-urban and male-female has reduced over years from 2007-08 to 2014. The literacy rates in rural India is much lower in comparison to their urban counterparts for all-age groups, though female literacy rates, especially in rural areas, has increased markedly for all ages. In terms of physical access to primary schools, Table 2 and Figure 1 shows that there is no significant difference between rural and urban India as most schools are within less than l km distance, but for upper primary and secondary schools, the gap between rural and urban areas are quite prominent. More than 12 percent of rural households in India do not have a secondary school within 5 km whereas in urban areas such cases are insignificant (less than 1 per cent). As Table 3 shows a majority of children have studied in public educational institutions. Only at the higher educational level, a significant proportion of children attended private institutions.

Table 1: Literacy Rates in India (percent)

Age group	*2007-08 (NSSO 68 round)*						*2014 (NSSO 71 round)*					
	Rural			*Urban*			*Rural*			*Urban*		
	Male	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*
0+	68.4	51.1	60.0	82.2	71.6	77.1	72.3	56.8	64.7	83.7	74.8	79.5
5+	76.8	57.3	67.3	89.7	78.1	84.2	80.3	62.4	71.4	91.0	80.9	86.1
7+	77.0	56.7	67.0	89.9	78.1	84.3	79.8	61.3	70.8	91.1	80.8	85.9
15+	71.8	47.5	59.7	88.7	74.6	82.0	75.0	53.1	64.1	89.7	77.9	84.0

Table 2 Distance to School from House (per 1000 household)

Distance to school from house	*Rural*			*Urban*		
	Primary	*Upper primary*	*Secondary*	*Primary*	*Upper primary*	*Secondary*
< 1 km	941	665	367	925	829	727
1-2 km	49	190	236	65	131	187
2-5 km	9	121	275	8	37	80
> 5 km	1	24	122	1	2	7

Table 3 Type of Institution Attended (percent)

Education level	*Rural*			*Urban*		
	Government	*Aided*	*Unaided*	*Government*	*Aided*	*Unaided*
Primary	72.3	5.0	22.5	30.9	17.5	51.4
Upper primary	75.8	7.90	16.2	38.0	20.2	41.5
Secondary and higher secondary	63.5	15.5	20.9	37.5	25.6	36.5
Graduation and above	47.9	22.5	29.1	38.0	28.0	33.5
Diploma/certificate	35.6	24.7	39.3	28.9	29.6	40.5

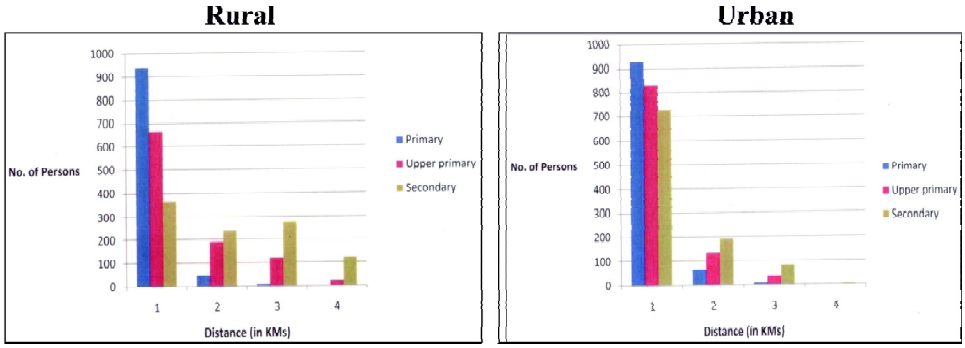

Figure 1: Distance to School from House (per 1000 household)

Given the noble objective of universal primary education and the disturbing scenario of wide inequality in learning outcomes in primary education in India, this study attempts to identify the determinants of the educational outcome in primary education in India. The study focuses on the educational outcomes in terms of an assessment of reading, writing and arithmetic skills of children aged 8-11 years in India. The study uses the second round (2011-2012) of the India Human Development survey (IHIDS-II) data and applies the ordered logit estimation method in the empirical analysis.

Review of Literature

Sathar and Lloyd (1994) study the status of primary education in Pakistan using the 1991 Pakistan Integrated Household Survey. The study finds wide inequality not only in primary schooling across households but also among children, importantly between boys and girls, within the same household. The basic decisions relating to children's entry to school and completion of the primary school levels are largely determined by parents' education, particularly that of mothers, and household income. With only a small percentage of school-age children in Pakistan having parents with sufficient income, the cycle of poverty and unequal opportunity is perpetuated. The accessibility of 'appropriate' single-sex schools and the availability of quality schools are important additional factors in children's schooling outcomes, especially for girls in rural areas.

Rumberger (1995) investigates the dropping out of middle school in the US from both individual and institutional perspectives, using the data from the National Educational Longitudinal survey of 1988 applying the Hierarchical Linear Model (HLM). At the individual level, a number of family and school experience factors influence the decision to leave the school, with grade retention being the single most powerful predictor. Parental education and income are also powerful predictors of school achievements and dropout behaviour. The study highlights the significance of demographic factors in the propensity to drop out of school and in the level of educational achievements. In particular, dropout rates are significantly higher and educational achievements are lower for blacks, Hispanics, immigrants, minority, single parent and step-families, and native Americans because they tended to come from more poor and disadvantaged families. At the institutional level, the mean dropout rate varies widely between schools and most of the variation is explained by the difference in the background characteristics of the student. High absenteeism, misbehaviour, poor academic performance, and school policies and practices are the important predictors of a student dropping out behaviour.

Peraita and Pastor (2000) study the primary school drop out in Spain using 1985 Living and Working Conditions Survey and applying the logistic regression method. The study notes that though there has been an overall improvement in enrollment at all education levels, the primary school dropout rate is relatively high, and worse is that being a dropout is permanent. The estimated results show that the socioeconomic status of the family and the youth labour market conditions are the significant determinants of the probability of primary school dropout behaviour.

Qian and Smyth (2005) investigate regional inequalities of education in China using the 1990 and 2000 China National Census data. The study uses the Gini decomposition method to measure the contribution of within and between groups to overall education inequality in China. Further, the Polarisation Index method is used to measure the ratio of educational inequality between coastal and inland provinces, and the ratio of inequality within each group. The study finds that the contribution of inequality in the coastal provinces to total inequality decreased from 16.5 percent to 14.7 percent, while that of inland provinces increased by 4.8 percent. The Polarisation index shows that the ratio of between groups inequality to within-group inequality rose slightly from 1.12 to 1.14. The study reports a decline of 11.2 percent within rural areas and 3.9 percent within urban areas in the differences across the 29 provinces per cent. While the rural-urban gap in educational inequality widened slightly, the coastal inland gap narrowed marginally. The study observes that the differences between the coastal and inland provinces in educational attainment are not as sharp as income disparities using the same group. The study concludes that disparities in access to education between rural and urban areas rather than between coastal and inland provinces are major causes of educational inequalities in China.

In India, Tilak (1996) studies how far free primary education is free, using the 1987-1988 NSSO data on household educational expenditure. The study notes that as many as 73 million children of the age group 6-13 are not currently enrolled in schools. About 65 percent of children in the age group 6-l4, 42 percent in rural areas and 17.7 percent in urban areas, are never enrolled in schools. The study finds that households spend a large amount of money on acquiring primary education. Importantly, the student pays tuition fees, examination fees and other fees even in government primary schools. Only a small fraction of students get the financial and material incentives provided by the government.

Govinda and Bandyopadhyay (2008) examine the progress in the participation of elementary education in India during the two decades from the mid-1980s to 2004-2005 using three rounds of NSSO household data in India. The study reports an increase from 4.5 years in the mid-1980s to 6.5 years in 2004-05 of the average number of years of school education and a decline in the literacy gaps in terms of gender, social groups (SC, ST and general group) and location. The study finds that there has been a decline in school dropout in the age group of 6-13 years of not attending school. The progress and pace of reduction in the number and share of children not attending school

has been faster during 1995-96-2004-05, but particularly more so during the five years since 2000. As a share of the population, children not attending school in rural areas has reduced from 47 percent in mid-l980 to 14 percent in 2004-05. In urban areas, the corresponding decline has been from 23 percent to 8 percent. While the share of girls in total out of school children is more than proportionate to their population share and during the period 1995-96 to 1999-2000, the pace of decline has been faster among girls compared to boys. Overall, in the age group of 6-13 years, there has been a sharp reduction in the number of children not attending school as well as their share in the total child population, and correspondingly the number and share of children attending school have been on the rise. Also, the increase in the number and share of children attending school among girls and socially and economically marginalised groups have been quite impressive.

Sengupta and Pal (2010) analyse the delivery and outcome of primary education in India in 2005-2006 using the district-level data from the District Information System for Education applying the Data Envelopment Analysis (DEA) method as well as the OLS method. The DEA is a nonparametric method that identifies the technical efficiency of the units (schools) given the efficiency in the input use. The estimated DEA efficiency scores show that the mean efficiency score of the eastern districts is the highest and lowest for the western districts. The eastern districts have a significantly high mean efficiency both under DEA and standard efficiency indicators. The technical efficiency of southern districts is much better than the north-eastern districts. The efficiency scores of north-eastern districts are significantly low relative to the western districts under the alternative measures, and in the case of northern and western districts, the efficiency level is more or less the same. The study identifies that the inadequacy in the infrastructure network and less serious teacher as the most serious bottlenecks in the educational system in India.

Pal (2013) examines the effect of income inequality on the educational performance of India in 2004-2005 using the India Human Development Survey data applying regression and ordered probit methods. The study uses the concentration index (CI) to measure the degree of income-related inequality in educational performance and the decomposition method to examine the percentage contribution of inequalities in economic status, parental education and child health on the educational performance of children. The ordered probit model analyses the determinants of test scores. The study results show that the education of the mother, year of schooling, and economic status are the major

contributors to educational performance. Other factors contributing to inequalities in educational performance are inequalities in the father's education, child health, social background of the family and some school characteristics. The regression-based decomposition of inequality in education performance shows that the mother's education contributes to a much higher proportion in urban areas as opposed to the rural areas for both mathematics and reading scores. In urban areas, the percentage contribution of mother's education is 25.7 percent for mathematics and 38.4 percent for reading scores. In the rural sector, the percentage contributions are much lower at 16.2 and 20.7 percent for mathematics and reading scores respectively. The study also shows that economic background, represented by the wealth index, is one of the major contributing factors to inequality in educational performance. The inequality in child health contributes positively to inequality in test scores. Thus, the study finds a strong interrelationship among inequalities in education, income and health.

Jayaraman and Simroth (2015) examine the impact of school lunch on primary school enrollment in India using data from the Districts Information System for Education and India Human Development Survey applying the OLS method. The study results show a positive direct effect of school lunch on primary school enrollment as improved nutrition and more learning have commensurately higher returns to education. The study provides evidence that India's midday meal scheme has led to large increases in primary school enrollment. Triple difference estimates indicate that primary school enrollment increases by 6.6 percent with the largest and most robust increase coming from grades l and 2 where enrollment has increased by l8 percent and 9 percent respectively. Enrollment in grades 4 and 5 are, by contrast, considerably less responsive to the meal scheme. This suggests that midday meals, although effective at encouraging early school enrollment, may be less effective at retaining students or encouraging enrollment in upper primary school.

Mukhopadhyay and Sahoo (2016) analyse the effect of distance from school and the presence of secondary school nearby on primary school participation among the age group of 6-10 years using a household level longitudinal survey covering 43 villages in a poor Bihar and applying the two-stage least squares regression (2SLS) method. The study finds that better access to secondary education increases enrolment and attendance among children in the primary school-going age group. A one km decrease in the distance to the nearest secondary school increases the proportion of children in a household who are

enrolled in primary school by 6.5 percentage points. The impact of secondary school is greater when there is a complimentary bus stop close to the village and smaller the village. The effect of the presence of secondary school nearby is larger for enrolment of children aged 6-7 years and attendance for children aged 8-10 years, and also the effect is larger for boys than girls. The study also shows that a primary school of the highest quality (relatively speaking) in a village increases the share of enrolment by 0.25 but has no impact on attendance, a unit increase in the percentage of adult members in off-farm employment raises both enrolment and attendance by 0.004 percent. Better roads increase the probability of both enrolment and attendance and this increase is highest for paved roads. The marginal effect of a decrease in the distance to secondary school is positive for both small and large villages, the impact of closer secondary schools is more prominent in small villages than on large ones. A unit drop in the distance to secondary schools raises the share of enrolment rate by 0.154 and the share of attendance by 0.156. But the marginal effects in large villages are much smaller: 0.054 and 0.053 for enrolment and attendance respectively. If the primary school is between l and 5 km away, the proportion of children enrolled falls by 1.6 percentage points than when primary schools are at less than 1 km distance. This proportion falls by 17 percentage points if primary schools are more than 5 km away and the effect on attendance is even more with a 19.2 percent fall as compared to the access category.

Data and Methodology

This study uses the second (2011-2012) India Human Development Survey (IHDS-II) data to analyse inequality in primary education in India. The IHDS - II survey covers 42,152 households across 1503 villages and 971 urban neighbourhoods of India. Considering missing values and omission of relevant information, this study uses 11,678 samples in the empirical analysis. The IHDS-II data contains information on health, education, employment, income, gender and empowerment. A major innovation of this survey is the data on short assessments of reading, writing and arithmetic skills of children aged 8-11. Educational assessment of children is difficult as the ability of children varies tremendously, the instruments of assessment must capture children at both ends of the distribution, assessment test must be translated in many different languages with similar difficulty levels, and the instrument must be simple and intuitive so that it can be administered easily and not frighten children who are not used to standardised tests. A simple assessment tool to measure the effectiveness of training programmes developed by a voluntary organisation

Pratham, working in the field of elementary education for many years is used in assessing the reading, writing and arithmetic skills of children.

Empirically, this study uses the ordered logit method in estimating the relationship between educational outcome and child characteristics (gender), schooling characteristics (distance from school, government school, English medium, enrolment, gender of teacher), family characteristics (education of father, caste, asset), and regional characteristics (urban, rural). Children are classified according to their ability to read one of the five categories: can not read at all (0), can read letters but not form words (1), can put letters together to read words but not read whole sentences (2), can read a short paragraph for 2-3 sentences but not fluent enough to read a whole page (3), can read a one-page short story (4). Children's mathematical skills are classified into four categories: can not read numbers above 10 (0), can read numbers between 10 and 99 but not able to do more complex number manipulation (1), can subtract a two-digit number from another (2), can divide a number between 100 and 999 by another number between 1 and 9 (3). Note that the Pratham assessment instrument focuses on 2 digit numbers to avoid calculations on fingertips and to get a better estimate of true understanding of subtraction and division. Also, given the Indian system of expecting children to memorise multiplication tables from 1 to 20, the assessment tool tests children on division rather than multiplication skills.

Ordered Logit Model

The educational outcomes of children aged 8-11 years as measured by the reading ability and mathematical skills are ordered categorical variables. Therefore, the empirical estimation is by the ordered logit model. When the dependent variable y is quantitative, the objective is to estimate its expected or mean value given the value of regressors. If y is qualitative, the objective is to find the probability of y falling into a particular category in the ordered categories. Let y be an ordered response taking the values $\{y_i = j, j = 0, 1, 2, \ldots, J\}$, for some unknown integer J. Since the actual value of y for an observation is not known, an unobserved latent variable y^*, conditional on a set of observed explanatory variables x, can be specified as:

$$y_i^* = \beta x_i + \varepsilon_i \quad (1)$$

Let λ ($\lambda_0 < \lambda_1 < \ldots < \lambda_m$) be a threshold parameter or unknown cut points that differentiates the adjacent level of the response variable. Then, the observed outcome of the reading level and maths scores can be specified as:

$$y_i = 0, 1, 2,\ldots, J \text{ if } \lambda_{j-1} \le y_i^* < \lambda_j \text{ for } j = 0, 1, 2,\ldots, J \tag{2}$$

where y takes the values 0, l, 2, 3, and 4 (reading level and maths scores). Then, there are four cut points in the model:

$$\begin{aligned} y_i &= 0 \ \textit{if} \ \lambda_0 = -\infty \le y_i^* < \lambda_1 \\ y_i &= 1 \ \textit{if} \ \lambda_1 = \lambda_1 \le y_i^* < \lambda_2 \\ y_i &= 2 \ \textit{if} \ \lambda_2 = \lambda_2 \le y_i^* < \lambda_3 \\ y_i &= 3 \ \textit{if} \ \lambda_3 = \lambda_3 \le y_i^* < \lambda_4 \\ y_i &= 4 \ \textit{if} \ \lambda_4 = \lambda_4 \le y_i^* < \infty \end{aligned} \tag{3}$$

Given the standard normal assumption for the error, the conditional distribution of y given x, the probability of each outcome is computed as:

$$\begin{aligned} &P(y_i = 0 \mid x) = P(y_i^* \le \lambda_1 \mid x) = P(\beta x_i + \varepsilon_i \le \lambda_1 \mid x) = \Phi(\lambda_1 - \beta x_i) \\ &P(y_i = 1 \mid x) = P(\lambda_1 < y_i^* \le \lambda_2 \mid x) = \Phi(\lambda_2 - \beta x_i) - \Phi(\lambda_1 - \beta x_i) \\ &\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ &P(y_i = j-1 \mid x) = P(\lambda_{j-1} < y_i^* \le \lambda_j \mid x) = \Phi(\lambda_j - \beta x_i) - \Phi(\lambda_{j-1} - \beta x_i) \\ &P(y_i = J \mid x) = P(y_i^* > \lambda_J \mid x) = 1 - \Phi(\lambda_J - \beta x_i) \end{aligned} \tag{4}$$

The probabilities sum to unity and as $-\lambda_0$ is the intercept inside Φ, there is no intercept term in this formulation of the ordered logit model. The parameters β and λ are to be estimated by the maximum likelihood method for each i. The maximising log-likelihood function can be specified as:

$$\begin{aligned} L_i(\beta, \lambda) = 1(y_i = 0)\ln[\Phi(\lambda_1 - \beta x_i)] + 1(y_i = 1)\ln[\Phi(\lambda_2 - \beta x_i) - \Phi(\lambda_1 - \\ \beta x_i)] + \ldots + 1(y_i = J)\ln[1 - \Phi(\lambda_J - \beta x_i)] \end{aligned} \tag{5}$$

The odds ratio can then be specified as:

$$\left[\frac{\Pr(y_i \le j \mid x)}{\Pr(y_i > j \mid x)}\right] = e^{(\lambda_j - \beta x_i)} \tag{6}$$

The log of odds that an outcome is less than or equal to *j* versus greater than *j* given *x* is given by:

$$\ln\left[\frac{\Pr(y_i \le j \mid x)}{\Pr(y_i > j \mid x)}\right] = \lambda_j - \beta x_i \tag{7}$$

which can be estimated by the maximum likelihood estimation method. The marginal change in the probability is computed as:

$$\frac{\partial \Pr(y_i = j \mid x)}{\partial x_k} = \frac{\partial \Phi(\lambda_j - \beta x_i)}{\partial x_k} - \frac{\partial \Phi(\lambda_{j-1} - \beta x_i)}{\partial x_k} \tag{8}$$

which is the slope of the curve relating x_k to $P(y_i = j \mid x)$, holding all other variables constant. The marginal effect is the change in the probability of selecting alternative *j* when there is a unit change in an explanatory variable, expressed as a percentage change. The marginal effects of each variable on the different alternatives sum up to zero. The ordered logit model is in fact a multiple equations model related to each non-reference level of the response. The parameter estimates or the slopes for each level of the equation are identical with only a difference in the constant terms. Therefore, only one set of parameter estimates are displayed together with the cut points which are the multiple-equation constants.

Empirical Analysis

Table 4 presents the distribution of reading and arithmetic skills of urban and rural children. The results show that huge differences in the reading and arithmetic abilities of children between rural and urban areas and educational standards. Though the reading and mathematical abilities increase with age and education in both areas, rural children lag much behind urban children in terms of reading ability among children. While the proportion of children who can not read anything is lower in urban areas compared to rural areas, the percentage of children who can read a story is far higher in urban areas than in rural areas. In rural areas, 14.31 percent of children can not read at all, while in urban areas 6.26 percent of children can not read. While of children 41.95 percent of children in urban areas can read a story, only 30.51 percent in rural areas can read a one-page story. The mathematical skills are higher for urban than for rural children. In rural areas, 20.84 percent of children can not read numbers, it is 8.21 percent in urban areas. While only 11.97 percent of children can do division in rural areas, 23.96 percent of children in urban areas have this mathematical skill.

Table 4: Reading and Arithmetic Ability of Children Aged 8-11 years (percent)

Standard	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*
Reading ability	*Can not read*		*Read letter*		*Read word*		*Read paragraph*		*Read story*	
First	19.18	8.85	20.21	15.93	21.92	16.81	13.36	20.35	25.34	38.05
Second	19.43	9.66	17.36	11.03	25.65	23.45	12.18	20.01	25.39	35.86
Third	12.88	6.10	18.03	9.39	24.25	21.13	14.59	22.07	30.26	41.33
Fourth	10.86	3.67	16.80	5.50	22.13	20.64	17.62	23.85	32.58	46.33
Fifth	12.08	5.37	12.08	7.80	18.22	15.12	21.61	27.32	36.02	44.39
Average	14.31	6.26	16.59	9.17	22.34	19.46	16.25	23.15	30.51	41.95
Arithmetic ability	*Can not read number*		*Can read number*		*Can do subtraction*		*Can do division*			
First	27.15	19.96	44.33	37.50	21.63	26.79	6.87	18.75		
Second	23.39	9.79	40.16	35.66	24.61	35.66	9.84	18.88		
Third	17.46	3.14	42.46	37.85	30.39	37.85	9.70	19.16		
Fourth	19.18	6.51	35.46	28.84	32.58	37.07	12.78	32.20		
Fifth	18.26	7.32	34.82	23.41	28.66	37.07	18.26	32.21		
Average	20.84	8.21	38.96	31.95	28.23	35.88	11.97	23.96		

Table 5 presents the reading and arithmetic abilities of children by community background. The results indicate that higher community children have better reading and mathematical abilities than children from the scheduled caste and scheduled tribe communities. While about 13 percent of higher community children can not read, more than 15 and 20 percent of scheduled caste and scheduled tribe children can not read. Similarly, the arithmetic abilities of upper community children are higher than the socially disadvantaged community children. While 26.72 percent of Brahmin children have the higher mathematical ability to do division, only 8.43 percent of children among the scheduled tribe can do division. Thus, moving downwards in the community hierarchy from Brahmin at the top to ST at the bottom, the children's reading and arithmetic abilities are reducing, showing a huge difference in the academic ability of children among social groups.

Table 6 presents the description and descriptive statistics of the variables used in the empirical analysis of inequality in primary education in India. The mean score of reading ability of children is 2.41 on a 5 point scale and the mean score in mathematics skills is 1.41 on a 4 point scale. The mean age of children is 9.24 years. The mean years of education of an adult in the household

Table 5: Reading and Arithmetic Ability of Children by Social Background (percent)

Community	*Can not read*	*Read letter*	*Read word*	*Read paragraph*	*Read story*
Brahmin	4.31	11.21	11.21	15,52	57.76
Forward	8.52	11.58	21.81	21.29	36.80
Backward	10.75	13.83	22.41	18.35	34.66
Scheduled caste	15.61	17.97	20.32	16.49	29.60
Scheduled tribe	20.15	16.73	22.05	17.49	23.57
Others	-	-	38.10	14.29	47.62
Average	11.92	14.39	21.46	18.29	33.95
Arithmetic ability	*Can not read number*	*Can read number*	*Can do subtraction*	*Can do division*	
Brahmin	9.48	27.59	36.21	26.72	
Forward	12.29	34.30	32.94	20.48	
Backward	17.10	37.07	31.24	14.60	
Scheduled caste	19.62	39.53	26.99	13.86	
Scheduled tribe	26.05	39.46	26.05	8.43	
Others	-	33.33	47.62	19.05	
Average	17.09	36.90	30.46	15.55	

is 7.5 years. A child has completed on average 3.5 years of education and 98 percent of children are currently enrolled. The mean distance to school from the house is 1.87 km. Only 6 percent of children attend public schools the remaining 94 percent attend private schools. About 19 percent of children attend schools with English as the medium of instruction while the remaining 81 percent attend schools with other mediums of education. About 46 percent of children are females. Nearly 42 percent of children belong to a backward community, while 21 percent are scheduled caste and 8 percent are scheduled tribe households. While a majority of children are from the Hindu religion, 17 percent are Muslims, 2 percent are Christians, 1 percent is Sikh, and less than 1 percent of children belong to other non-Hindu households. Children from rural areas constitute 81 percent of children, while 29 are from urban residence. A significant 46 percent of teachers in schools are females.

The estimated ordered logit regression coefficients of reading ability and mathematical skills of children aged 8-11 in India are presented in Table 7. The odds of the reading ability of children increases with age. Children's reading

Table 6: Descriptive Statistics of Variables

Variable	*Description*	*Mean*	*Std. dev.*
Reading ability	Can not read=0, can read letters=1, can read words=2, can read paragraph=3, can read one-page story=4	2.41	1.38
Mathematical skills	Can not read numbers=0, can read numbers=1, can subtract a two-digit number from another (2), can do subtraction=2, can do division=3	1.41	0.93
Age	Age od child (yrs)	9.24	1.02
Child education	Child standard of education	3.51	1.27
Enrolled	Currently child is enrolled=1, 0 otherwise	0.98	0.10
Adult education	Highest level of education of an adult in the household	7.45	4.96
Distance to school	Distance to school from home (km)	1.87	3.08
Female child	If female child=1, 0 otherwise	0.46	0.49
General community	If the household belongs to general community =1, 0 otherwise	0.17	0.37
Backward class	If the household belongs to backward community = 1, 0 otherwise	0.42	0.49
Scheduled caste	If the household belongs to scheduled caste= 1, 0 otherwise	0.21	0.41
Scheduled tribe	If the household belongs to scheduled tribe= 1, 0 otherwise	0.08	0.42
Other community	If the household belongs to the other community =1, 0 otherwise	0.22	0.41
Muslim	If Muslim religion=1, 0 otherwise	0.17	0.38
Christian	If Christian religion=1, 0 otherwise	0.02	0.14
Sikh	If Sikh religion=1, 0 otherwise	0.01	0.13
Buddhism	If Buddhist religion=1, 0 otherwise	0.004	0.06
Jain	If Jain religion=1, 0 otherwise	0.001	0.04
Tribal	If tribal religion=1, 0 otherwise	0.003	0.06
Residence	If urban residence=1, 0 otherwise	0.29	0.45
School type	If public school=1, 0 otherwise	0.06	0.02
Instruction medium	If medium of instruction is English=1, 0 otherwise	0.19	0.39
Teacher female	If female teacher=1, 0 otherwise	0.46	0.49
Observations		11,678	

ability improves by 1.16 times as they get older. The odds of higher reading ability is less by 0.55 with an increase in the distance to school from the home. The impact of social class on the reading ability of children is substantial. The

backward class children are 0.55 times less likely to be in higher reading ability than the general or higher community like brahmin children. The scheduled caste and scheduled tribe children are 0.54 and 0.46 times less likely to attain reading ability as higher community children. Children belonging to Muslim and Christian religions are likely to have reading ability equally with the Hindu children, while children of Sikh and Buddhist religion are 0.75, and 0.87 times less likely to have a reading ability like the Hindu children. The family economic status, measured by the household ownership of consumer durables and housing assets, The household assets variable, dampen the effects of the social group and increases the reading achievement of children substantially, the odds are higher by 1.34 times.

The differences among children in their reading achievement may be mediated through school enrollment and grade promotion. The public school children are 0.52 times less likely to have a higher reading ability. The English medium of study increases the reading ability of children higher by 0.89 times. As the education standard completed by the child increases by one year, the child is 1.57 times more likely to have a higher reading ability. Children currently enrolled are 1.46 times more likely to attain a higher reading ability than a child who is not currently in school. Having a female teacher in the school increases the reading ability of children by 1.13 times. The presence of an educated adult in the household is likely to contribute to the reading ability of children in the household. Children from the urban sector are 1.22 times more likely to attain a higher reading ability than a child in the rural sector. When the household moves from lower to higher assets quintile, the odds of reading ability of children increases by 1.35 times.

As regards mathematical skills, the estimated ordered logit regression results show that the odds of higher arithmetic skills increases with the age of children. The mathematical skills of children improve by l.17 times as they get older. The children have lower odds of academic achievement in mathematical skills by 0.55 as the distance to school from homes increases. The backward class children have lower odds of attaining mathematical skills by 0.56 times than the Brahmin or higher community children, the scheduled caste and scheduled tribe children are 0.6 and 0.42 times less likely to have mathematical skills as compared to higher community children. Children belonging to the Muslim religion are 0.92 odds less likely to have lower mathematical skills than children of the Hindu religion. However, Christian, Sikh and Buddhist children are more likely to have higher mathematical skills than Hindu children as their odds are higher by 1.22, 1.64 and 1.22 times respectively.

Table 7: Odds Ratio of Ordered Logit Regression Estimates of Academic Achievement of Children

Variable	*Reading ability*	*Mathematical skills*
Age	1.159* (0.056)	1.172* (0.057)
Female child	0.519* (0.039)	0.709* (0.014)
Child education	1.568* (0.071)	1.550* (0.072)
Enrolled	1.465** (1.028)	1.621** (0.523)
Adult education	1.063* (0.011)	1.062* (0.012)
Distance to school	0.552* (0.141)	0.550* (0.135)
Backward class	0.555* (0.140)	0.563** (0.134)
Scheduled caste	0.536* (0.141)	0.607** (0.151)
Scheduled tribe	0.465* (0.134)	0.421* (0.118)
Other community	0.849 (0.521)	1.414 (0.857)
Muslim	1.020 (0.137)	0.921 (0.126)
Christian	1.028 (0.346)	1.224 (0.416)
Sikh	0.752 (0.321)	1.643 (0.660)
Buddhism	0.867 (0.561)	1.220 (1.020)
Urban residence	1.222*** (0.139)	1.353* (0.156)
School type	0.518* (0.058)	0.519* (0.060)
Instruction medium	1.889* (0.325)	1.304*** (0.187)
Teacher female	1.127 (0.105)	1.045 (0.099)
Economic status	1.345* (0.087)	1.347* (0.089)
Log-likelihood	-2472.01	-2024.66
LR chi square	460.80	544.41
Prob.>chi square	0.000	0.000
Pseudo R square	0.185	0.118

Note: Standard errors in parentheses. *,**,*** significant at 1, 5, 10 percent levels.

The odds of achieving higher mathematical skills is lower by 0.52 for public school educated children than a child studied in a private school. The English medium of instruction enables the child to attain higher arithmetic skills as the odds ratio is higher by 1.3. As the standard completed by the child increases by one year, the child is 1.55 times more likely to have higher mathematical skills. A child who is currently enrolled in school is 1.62 times more likely to attain higher mathematical skills. A female teacher in the school increases the odds of higher arithmetic skills by 1.05 times than a male teacher. If an adult in the household is more educated, a child has 1.06 higher odds of higher mathematical skills. Children from urban residence are 1.35 times more likely to have higher

mathematical skills than children from rural areas. Household assets increase the odds by 1.35 times the arithmetic ability of children.

The significant prob>chi2, the probability of the LR test statistic, rejects the null hypothesis that all of the regression coefficients in both the model are equal to zero. The p-value <0.0000l of the LR test shows that at least one of the regression coefficients in the model is not equal to zero.

Wald Test: In the ordered logistic regression estimation, the variables are entered as a set of variables viz. social, school and household variables. Only the final estimation results are reported in this study. The Wald test, likelihood ratio test, and Lagrange multiplier test (score test) are commonly used to evaluate the difference between nested models. One model is considered nested in another if the first model can be generated by imposing restrictions on the parameters of the second. Most often, the restriction is that the parameters are equal to zero. In a regression model restricting parameters to zero is accomplished by removing the predictor variables from the model. In the Wald test, the null hypothesis is that the coefficients of the set of model variables are simultaneously equal to zero. Table 8 presents the Wald test results. Based on the p-values, the null hypotheses of all the models are rejected indicating that the coefficients of social, school and household variables are not simultaneously equal to zero. Further, the addition of the sets of variables improves statistical significance as well as the fit of the model. Therefore, the sets of variables used in the empirical analysis have a statistically significant impact on the reading and arithmetic skills of children and give a better fit of the models.

Table 8: Wald Test of Reading Ability and Arithmetic Skills

Model	*Reading ability*		*Arithmetic skills*	
	Chi2	*Prob>chi2*	*Chi2*	*Prob>chi2*
Social variables	101.46	0.00	104.91	0.00
School variables	36.61	0.00	38.27	0.00
Household variables	70.31	0.00	86.21	0.00

Conclusion

The prevalence of wide inequality in the education performance of children in primary education is a cause of worry and concern for policy. Such discrepancy is commonly attributed to the social and economic differentials among

households and regions and the infrastructural facilities at the schools in India. This study estimates the gaps in the academic achievement of children aged 8-11 years using the reading ability and mathematical skills score from the India Human Development Survey-II (2011-12) data employing the ordered logit method of estimation. The results show the presence of substantial differences in reading and arithmetic skills among children from different socioeconomic, demographic and religious backgrounds in India. The differences persist even after controlling for current school enrolment, grade completion, and parental socioeconomic status. The backward community children are not much disadvantaged and they are not statistically significantly different in the acquisition of reading and mathematical skills than the upper community children. The scheduled caste, scheduled tribe and Muslim children appear to be the most disadvantaged groups in achieving academic ability. Children studying in public schools and non-English medium of instruction schools have less chance of being in the higher categories of educational performance. Children from urban residence and the presence of adults with high education in the household tend to perform better than the child from rural areas with lower educated adults in the household. The asset holding of the household has a positive impact on the educational performance of a child.

The findings imply that the differences in the educational attainment of children from different social strata are not simply due to differences in enrolment rates nor are they solely due to parental lack of education and resources. Even when children from disadvantaged groups attend school, they fail to learn as much as their peers. Much of the disadvantage of other backward communities seems to be associated with lower income and lower parental education. The children from the marginalised groups have low educational expectations and the teachers typically have very low expectations from these children. Parental inability to negotiate the school system may be another mechanism through which social differences operate. The higher community households have substantially greater social networks than the socially disadvantaged communities, and with increased social contacts within formal systems, they are increasingly more likely to be able to negotiate the educational systems and become their children's advocates when children experience learning difficulties in the school. The results of this study point to a need to better understand the diversity across different marginalised groups as the social background is still important in developing reading and arithmetic abilities.

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