



Household Educational Expenditure in India: Quantile Regression Estimates of the Socioeconomic Determinants and Differential Effects

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Abstract: Despite substantial government expenditure on education, scholarships and financial aid to students to provide affordable education, the household education expenditure on children is sizable and varies widely on account of gross differences in the socio-economic, demographic, religious and cultural factors. This paper attempts to identify such determinants and analyse the differential effects of the determinants of household education expenditure on children in India using the 2014 NSSO 71st round survey data, applying the quantile regression method. Unlike the standard regression method, the quantile regression method allows estimation beyond the average effects, at different points of the distribution of household expenditure on education. The quantile regression estimates reveal that low-income households are more sensitive to changes in household income and government programmes than upper-income households. The proportion of household income spent on the education of children increases more in the lower quantiles than in the higher quantiles. Gender bias exists at the lower quantiles and is considerably less at the higher quantiles. The SC/ST households spend less than the non-SC/ST communities at the lower quantiles, and the difference gets reduced at higher quantiles. Compared to scholarships, the provision of educational materials has a higher impact on household education expenditure. More children from lower quantiles attend government institutions, and a substantial difference exists in household education expenditure between the students attending government and private educational institutions. Despite government policies and programmes for

affordable education, lower-income households still incur a considerable proportion of their income on the education of their children.

Keywords: Household educational expenditure, socioeconomic determinants, differential effects, gender bias, quantile regression

Introduction

The essence of human development is education, which is a significant factor in balancing the socio-economic fabric of a country. Quality education is the main foundation for furthering knowledge, discoveries, innovation and entrepreneurship that triggers the growth and prosperity of an individual as well as of a nation. Therefore, both individuals and governments invest heavily in education. Individual investment refers to the investment made by the students and/or their parents in their education and is referred to as the household investment in education or private expenditure on education. The government investment in education is mostly an institutional investment and is referred to as government or public investment in education. Both public and household investments in education are highly significant not only because of their magnitudes but also because of their nature and characteristics. While public investment provides educational facilities, only household investment enables their utilisation. Though at lower levels of education, considering its publicness, the public expenditure needs to be higher than the household expenditure, the pattern gets reversed at the higher levels of education. However, either the absence of adequate government expenditure in school education and/or the ability of the household to pay for school education necessitates the substitutability between the two sources of expenditure on education.

Recognising that a good start or foundation is essential in strengthening higher education, India has made significant progress with the goal of 'education for all' over the years through various government policies and programmes. The public expenditure on education in India for 2013-2014 stands at 4.13% of GDP. The adult literacy rate in India has increased from 61% to 69.5% during the period 2001-2011. The 71st round of the National Sample Survey Office estimated the literacy rate (age 5 and above) of 76%, 71% in rural and 86% in urban India for the year 2014. In India, as of 2014-2015, the number of recognised schools, universities, colleges and stand-alone institutions stood at 1516865, 760, 38498 and 12276, respectively. The gross enrolment ratio (GER) was 101.4, 89.3, 62.5 and 23.0, respectively, for

primary, lower secondary, higher secondary and tertiary education. Despite the various measures taken by the governments and vast improvements, the Indian educational system has not managed to increase the proportion of individuals from the higher secondary level.

In India, as of 2014, free education is offered to nearly 60% of students at the primary and upper primary levels and 40% of students at the secondary and higher secondary levels. In government institutions, 94% and 89% of students studying at the primary level, respectively in rural and urban areas, are getting free education. The average private expenditure on education in 2014 was ₹ 6788 per student for general education and ₹ 27,81 for vocational education. The private expenditure on general primary education is ₹ 4610, the upper primary is ₹5386, secondary education is ₹7459, higher secondary is ₹12619, graduate education is ₹ 13478, and postgraduate education is ₹ 15999 per student. The private expenditure on medical education is ₹ 64968, and that of engineering education is ₹42401 on average. The course fee accounts for 46% of the private expenditure on general education and 73% of the private expenditure. There are substantial variations across regions, locations, communities, institutions and gender in private education expenditure in India.

Table 1 presents the gender-wise distribution of students in various educational streams in India. It can be observed that the majority of students are males and are in science and commerce courses. In technical education, the participation of female students is significantly low relative to males; naturally, only medicine, including nursing, has a better proportion of female participation.

Table 1 Distribution of Students in Education by Gender (%)

Education stream	General education		Education stream	Technical/professional education	
	Male	Female		Male	Female
Up to class 10 th	54.2	45.8	Medicine	35.3	64.7
Humanities	49.9	50.1	Engineering	75.2	24.8
Science	59.5	40.5	Management	62.3	37.7
Commerce	56.6	43.4	Law	63.9	36.2
Others	51.1	48.9	Vocational	82.8	17.2

Source: Calculations from NSSO (2014): 71st round - Key Indicators of Social Consumption in India: Education.

Table 2 presents the distribution of students by institution and residence. It is observed that the majority of the students, predominantly up to higher secondary

levels, are in government institutions in rural areas in urban areas about 69% of students attend private (aided and unaided) institutions even at the primary level. This trend of private institutional dominance is followed at the higher secondary level also in comparison to the rural sector.

Table 2 Distribution of Students in Education by Institution (%)

<i>Institution</i>	<i>Rural</i>	<i>Urban</i>	<i>Rural & urban</i>	<i>Rural</i>	<i>Urban</i>	<i>Rural & urban</i>
	<i>Primary</i>			<i>Upper primary</i>		
Government	73.2	30.9	62.0	75.8	38.0	66.0
Private aided	5.0	17.5	8.1	7.9	20.2	11.1
Private unaided	22.5	51.4	29.7	16.2	41.5	22.8
	<i>Secondary & higher secondary</i>			<i>Graduation and above</i>		
Government	63.5	37.5	55.8	47.9	38.0	43.5
Private aided	15.5	25.6	18.5	22.5	28.0	24.9
Private unaided	20.9	36.5	25.5	29.1	33.5	31.1
	<i>Diploma and certificate</i>					
Government	35.6	28.9	32.8			
Private aided	24.7	29.6	26.8			
Private unaided	39.3	40.5	39.8			

Source: Calculations from NSSO (2014): 71st round - Key Indicators of Social Consumption in India: Education.

The lack of significant progress in Indian education is widely explained in terms of financial constraints, both public and private resources and by the opportunity cost of time of the households. Though household investment in the education of children is influenced by a wide variety of factors, households primarily invest in education with the anticipation of economic and non-economic benefits from education. The economic benefits of education are measured frequently in terms of internal rates of return to education. There are several other household characteristics such as income, religion, community, household size, parental education and occupation, place of residence, etc. There are also a host of social, cultural, demographic and other environmental factors that influence the quantum of expenditure that households make in the education of their children. The supply-side factors like the nearness of educational institutions, the type of institutions, the type of courses pursued by the pupil, the fee structure and placement facilities.

Empirical research on the determinants of household expenditure on education in India is very limited, especially research examining the differential effects of the

determinants of household expenditures on education is extremely scant. The lack of empirical studies on household expenditures on education, more specifically on determinants of household expenditures on education and their differential effects in India, warrants a deeper study in a period when public budgets for education are dwindling and household and private finances are cast as alternative avenues. This paper tries to identify the determinants of and their heterogeneous effects on household expenditure on the education of children in India. In order to estimate the differential effects of the factors on the quantum of educational expenditure at different points of the household education expenditure distribution, this paper follows the quantile regression method. The quantile regression estimation allows looking beyond the average effects and describes the whole conditional distribution of household expenditure on education in terms of the determining variables. The pattern of household expenditure on children's education is analysed by gender, type of institution, type of courses and household characteristics. The cross-section data of the 71st round (January-June 2014) of the NSSO survey is used in the empirical analysis.

Review of Literature

Generally, at the household level, the private expenditure on education is influenced by a wide variety of socioeconomic and demographic factors. It has been widely recognised that household decision-making for investment in education can be understood at least partly in terms of economic factors. However, there is not much research on the extent of household expenditure on education and determinants of household expenditure on education due to limited information on household expenditure, especially in developing countries, including India.

Rajalakshmy (2012) outlined the problems of higher education in India in the context of globalisation and the entry of the private sector in higher education in India. The study found that higher education spending had not increased commensurately with the requirements of global standards and needs in India. The study emphasised the crucial role of the public sector in the face of a resource crunch in facilitating equity and inclusive growth and the provision of research, vocational and quality education. The coordination of the private sector with the public sector is important to fill the gaps in higher education, especially excellence and high-quality education. Public-private participation should also improve the monitoring

and regulating aspects to improve the quality of education to make India a world-class educational hub.

At the macro level, Chatterji et al. (2015) analysed the determinants of per capita education expenditure of state governments in India during 2000-2010. The states of Bihar and Madhya Pradesh spend the lowest while Kerala and Himachal Pradesh were the high-performing states. Quantitative analysis showed that richer states spend more on education compared to the poorer states. A lower share of the child population and higher tax revenue and grants from the central government significantly enhance the education expenditure of the states.

Khan (2013) observed that though the public expenditure on education in Karnataka had increased at an annual growth rate of 29.8% in nominal terms, accounting for 2-4% of the net state domestic product, in real terms, public expenditure on education in Karnataka had decreased significantly over time.

Jana and Maiti (2019) analysed state-wise disparity in public expenditure on higher education in Indian states. The study notes that budgetary allocations to higher education have been squeezed in the post-economic reform era since 1991, less than 1% of the gross domestic product in India. The elasticity of higher education expenditure to gross state domestic product in many Indian states is less than unity.

At the household level, Tilak (1996), analysing the NSSO data on household expenditure on education, found that households incur large sums of money on education, even on primary education. The public provision of financial and material incentives is available only to a small fraction of pupils in India. There exist large-scale inter-state and inter-group variations in several aspects of public provision of incentives and the levels of household education expenditure.

Tilak (2002) investigated the determinants of family expenditure on education using the 1994 NCAER survey data on Human Development in rural India, supplemented by other sources. The elasticity of household expenditure on education to changes in household income on the one hand and the government expenditure on education on the other for different groups of the population was calculated. The results show that household expenditures on education are sizeable, and there is nothing like free education in India. Households from even lower socioeconomic strata, SC/ST, and low-income groups all spend considerable amounts on acquiring education. Also, households do not discriminate much against spending on girls' education. However, substantial differences exist in household expenditures between

children attending government schools, government-aided schools and private schools. Among the determinants of household expenditure on the education of children, household characteristics, particularly household income and the education level of the head of the household, are important. Further, the coefficients of elasticity show that government expenditures and household expenditures do not substitute for each other, instead, they complement each other.

Ota and Moffatt (2007), using micro-data from a field survey of children in rural Andhra Pradesh, attempted to identify the key factors that influence the decision on schooling, a binary choice. The focus was on the effects of sibling competition within the household, with a hypothesis that the child's position within the household is the key to capturing sibling rivalry. The many factors that affect the schooling decision were grouped into three sets of variables: characteristics of the child, characteristics of the household and features of the community in which the child lives. The probit estimates of the schooling decision showed that the child's characteristics, age and gender are the most important determinants of the schooling decision. The first-born child is less likely to attend school irrespective of gender, controlling for age. The presence of elder sisters increases the probability of schooling, whereas the presence of younger brothers decreases the probability of attending school. The boys compete with the same sex, while girls face double competition.

Motiram and Osberg (2012) analysed school attendance and the total time spent in acquiring human capital (time in school, plus travel time, plus in-home instructional time) using the 1998-99 India Time Use Survey and the 7th All India School Educational Survey. The estimated probit and selectivity bias correction regression estimates indicate that the inequality in human capital investment time in rural India can be explained more by the poor quality and availability of schooling to potential students than by parental education, income or barriers of SC/ST background.

Steinberg (2015) studied the impact of NREGA, one of the largest workfare programs in the world, introduced in 2008, on human capital outcomes of children aged 5-16. The paper uses the data of the NGO Pratham's survey on the educational achievement of primary school children in India for cognitive testing, the Annual Status of Education Report (ASER) for 2005-2009 and the data from the NSSO rounds 60, 61, 62, 64 and 66 collected between 2004 and 2009. The results show that children score significantly low in mathematics and reading tests, and more children

are likely to drop out and less likely to both attend and be on track in school once the NREGA enters their district, primarily caused by increases in the opportunity cost of schooling for children. These results are primarily driven by children aged 13-17, who are precisely the age group that is most likely to enter the labour market. Though the results on human capital are similar for both boys and girls, girls are more likely to substitute for their mothers in domestic work, while boys are more likely to work outside the home for pay.

Sarkar (2017) examined the determinants of household expenditure on higher education in India using the 64th round National Sample Survey unit-level data. The study finds gender bias in the household expenditure on higher education. Parental education and household income are important determinants of household educational expenditure, along with the community background. Households belonging to the backwards caste groups spend less than the general category households.

Chandrasekhar et al. (2019), using the 2013 and 2014 NSSO survey data, estimated that urban households in India spend 18.4% of their total expenditure on higher education, whereas in rural areas of India, 15.3% of total household expenditure is on higher education. The share of higher education expenditure in the mean annual household expenditure is 27% in rural and 30% in urban India. The share of higher education expenditure in household expenditure is larger in rural South Indian states, where the enrollment in technical education in private unaided institutions is higher. The average household education expenditure per student is ₹ 36,063 in rural and ₹ 49,690 in urban South India.

In another developing country context, Turkey, Bayar and Ilhan (2016) examined the determinants of education expenditure of Turkish households using 2002, 2010 and 2013 Household Budget Surveys. The paper especially estimated the effects of different income groups on education expenditure by the Tobit method. The estimated results show that higher household income levels are associated with higher educational expenditure; higher income groups spend more on education, and the poor spend less on education. Also, parents with higher human capital spend more on their children's education; families whose household heads and mothers have higher education levels are likely to invest more in education than others. The paper observes that not only intergenerational educational mobility but also intergenerational income mobility is low in Turkey.

Data and Methodology

The data used to analyse the household expenditure on education was derived from the 71st round of NSSO (January-June 2014) data. The NSSO 71st round covers a sample of 36479 households from 4577 villages in rural India and 29447 households from 3720 blocks in urban India. The stratification of the households has been on the basis of having any student (aged 5-29 years) currently attending formal education at the primary level or above. The NSSO data contains information on the participation of individuals aged 5-29 years in pursuit of education in the country during the period January-June 2014, the extent of use of educational infrastructure, facilities and incentives provided by the government and private sectors and its impact on current attendance status of the population in the educational institutions, the private expenditure incurred by households on education and the extent of educational wastage in terms of dropping-out and discontinuance and its causes. For each student in the survey household, the private expenditure on payment of course fees, including tuition fees, examination fees, purchase of books, stationery and uniforms, expenses on conveyance, private coaching, etc., is related to the current academic session of study of a student for the basic course.

Panel Quantile Regression Method

In the empirical estimation of the household expenditure on education, this paper follows the quantile regression method. The classical linear regression model estimates only the conditional mean response of the outcome variable $E(y|x)$ to each fixed value of the covariates. The conditional mean model can not be extended to non-central locations of the response variable. It restricts the effect exclusively to the specific location of the outcome variable's conditional distribution and does not capture the differential impact of the covariates at other locations across the different levels of the outcome variable. The quantile regression extends the linear regression approach, allowing effects to differ at different locations of the conditional distribution of outcome variables. The quantiles are cut points where a sample is divided into equal-sized, two or more subgroups. The 50th quantile is also the median value, one that describes the central location of a distribution.

The θ^{th} quantile denotes the value of the response below which the proportion of the population is p and above which the proportion of the population is $(1-p)$. The quantile regression estimates the conditional quantile functions. In analogy

with classical linear regression methods which are based on minimising sums of squared residuals and meant to estimate models for conditional mean functions, the quantile regression method is based on minimising asymmetrically weighted absolute residuals giving differential weights to positive and negative residuals and intends to estimate conditional median function and a full range of other conditional quantile functions. While the ordinary least squares minimises the sum of the squares of the errors, $\sum u_i^2$, the quantile regression minimises $\sum \theta |u_i| + \sum (1 - \theta) |u_i|$ a sum that gives the asymmetric penalties $\theta |u_i|$ for underprediction and $(1 - \theta) |u_i|$ for overprediction.

In the quantile regression model, introduced by Koenker and Bassett (1978) as an extension from the notion of ordinary quantile to a more general class of linear models, the conditional quantiles have a linear form. The quantile regression model is specified as:

$$y_i = \beta_\theta x_i + u_{\theta i} \quad \theta \in (0, 1) \quad (1)$$

where θ denotes the quantiles. The θ^{th} unconditional quantile is obtained by optimising:

$$\text{Min } \sum \rho_\theta (y_i - u_\theta) \quad (2)$$

where the function $\rho_\theta(\cdot)$ is the absolute value function. Given a random sample of observations, estimates of conditional quantile functions are obtained by solving:

$$\text{Min } \sum \rho_\theta [y_i - u(x, \beta)] \quad (3)$$

The resulting minimisation problem is formulated as a linear function of the parameters and is solved by linear programming methods (Koenker & Hallock, 2001).

Consider a real-valued random variable y characterised by the distribution function:

$$f(y) = P(y \leq y_0) \quad (4)$$

Then, the θ^{th} quantile of y is defined as:

$$Q_\theta = \inf [y: f(y) \geq \theta] \quad (5)$$

Given a set of regressors, x_i , the quantile regression can be specified as:

$$f_\theta = (\theta - \beta_\theta x_i | x_i) = P(y_i < \theta | x_i) \quad (6)$$

which is essentially a different form of equation (5), where the distribution of the error term $u_{\theta i}$ is unspecified and the only constraint being the quantile restriction:

$$Q_{\theta}(u_{\theta i} | x_i) = 0 \quad (7)$$

The estimate of the conditional mean function is specified as:

$$\hat{\beta} = \arg \min_{\beta} \sum_{i=1}^N (y_i - \beta x_i)^2 \quad (8)$$

The linear conditional quantile function is specified as:

$$\theta_y(\theta | x_i = x_0) = \beta_{\theta} x_i \quad (9)$$

which can be estimated by solving the equivalent of the expression:

$$\hat{\beta}_{\theta} = \arg \min_{\beta} \sum_{i=1}^N \gamma_{\theta}(y_i - \beta x_i) \quad (10)$$

where $\rho_{\theta}(u)$ is the so-called check function defined as:

$$\rho_{\theta}(u) = \begin{cases} \theta u & \text{if } u \geq 0 \\ (\theta - 1)u & \text{if } u < 0 \end{cases} \quad (11)$$

Assuming that y is linearly dependent on a vector of exogenous variables x , the conditional quantile function can be specified as:

$$Q_y(\theta | x_i) = \min[\Sigma \theta | y_i - u_{\theta} | + \Sigma(1 - \theta) | y_i - u_{\theta} |] \quad (0 < \theta < 1) \quad (12)$$

The expanded version of the quantile regression is specified as:

$$\min_{\beta} [\sum_{i: y_i \geq \beta x_i} \theta | y_i - \beta x_i | + \sum_{i: y_i < \beta x_i} (1 - \theta) | y_i - \beta x_i |] = \min \Sigma \rho_{\theta}(y_i - u_{\theta i}) \quad (13)$$

For a unit change in a regressor, the marginal effect is the coefficient for the θ^{th} quantile:

$$\frac{\partial Q_y(\theta | x_i)}{\partial x_i} = \beta_{\theta} \quad (14)$$

Thus, a quantile regression parameter β_{θ} estimates the change at the specified quantile of the response variable y produced by a unit change in the independent variable x , i.e. the marginal effect.

The empirical quantile regression equation for estimating the effects of the determinants on the private household education expenditure is specified as:

$$\begin{aligned} \ln HHEDExp = & \beta_0 + \beta_1 HHIncome + \beta_2 Age + \beta_3 Gender + \beta_4 MotherEducation + \\ & \beta_5 Residence + \beta_6 Community + \beta_7 Religion + \beta_8 Fatheroccupation + \\ & \beta_9 Coursestudying + \beta_{10} Educationinstitution + u_i \end{aligned} \quad (15)$$

Empirical Analysis

Table 3 presents the average private expenditure on education for different levels of education and different types of institutions. It is observed that with an increase in the level of current attendance, the expenditure on education increases. The rural-urban difference narrows down at higher levels of general education. At the primary level, education expenditure in urban areas is more than four times that in rural areas. At the graduation and post-graduation levels, the average expenditure on female students is more than their male counterparts in rural areas. The average expenditure for different levels of study in different types of institutions shows a substantial difference. At all levels of education, both in rural and urban areas, the household educational expenditure is invariably higher at private aided and unaided institutions than at government institutions. Even at the primary level, the average educational expenditure is about six times higher in private-aided schools and seven times higher in private unaided institutions, both in urban and rural sectors.

Table 3: Average Private Expenditure on Education (₹ per student)

Education level	Rural				Urban			
	General education		Technical/ Professional		General education		Technical/ Professional	
	Male	Female	Male	Female	Male	Female	Male	Female
Primary	3061	2512	-	-	10604	9489	-	-
Upper primary	3603	2813	-	-	11864	10940	-	-
Secondary	5568	4534	29861	14200	13781	13284	16500	18000
Higher secondary	9820	8012	7383	5446	21681	18442	24703	13521
Graduate	11306	11813	59979	62201	17480	16161	82298	77224
Post graduate	13017	16715	50067	56526	19090	16565	80391	84262
Diploma	15209	10706	61515	45621	23040	21249	70189	70990
All	4854	4042	-	-	13426	12323	-	-
		Government	Private aided	Private unaided	Govern- ment	Private aided	Private unaided	
Primary		965	6452	7907	2149	11881	14242	
Upper primary		1605	6013	9514	3356	12074	18553	
Secondary		3328	5896	11222	5540	14096	21565	
Higher secondary		6056	10803	13988	9668	20066	30810	
Graduate		8753	11730	17093	11560	16993	26380	
Post graduate		11403	14224	25372	13580	20978	29661	
Diploma		10603	14935	20976	12184	19059	46445	
Upto X		1552	6140	8807	3291	12487	16536	

Education level	Rural				Urban							
	General education		Technical/ Professional		General education		Technical/ Professional					
	Male	Female	Male	Female	Male	Female	Male	Female				
Humanities	6666		8619		11044		8725		11345		16758	
Science	9302		15594		18828		14489		24419		37158	
Commerce	7592		14814		21397		11586		15254		28573	
Medicine	57292		76383		91391		72636		99468		148510	
Engineering	40828		61516		69439		43418		74291		83448	
Management	39511		60548		69473		46050		62124		121150	
IT/Computer science	27094		36401		43453		29718		54976		59626	
ITI/Vocational	13675		30872		30598		14508		33567		39166	

Source: NSSO (2014): 71st round - Key Indicators of Social Consumption in India: Education.

Table 4 presents the average private expenditure on education for different levels of education by income class. It is to be noted that higher income classes both in rural and urban areas incur higher levels of education expenditure in both rural and urban areas and for all levels and types of education. The top income quantile classes spend more on the technical and professional education of their children.

Table 4: Average Private Expenditure on Education Per Student by Quantile Class

Education level	Rural					Urban				
	1 st quantile	2 nd quantile	3 rd quantile	4 th quantile	5 th quantile	1 st quantile	2 nd quantile	3 rd quantile	4 th quantile	5 th quantile
<i>General education</i>										
Primary	1027	1667	2462	3375	7595	3465	6213	9095	14936	28658
Upper primary	1281	1950	2793	3241	8044	3677	6436	8754	15659	30211
Secondary	2801	3573	4260	4675	9618	5417	8010	9829	15759	30815
Higher secondary	5095	6596	7681	8205	13353	7472	9869	13548	20588	38663
Graduate	6868	8539	9258	10357	15577	8672	10063	13470	16019	27761
<i>Technical/Professional education</i>										
Higher secondary	4254	3977	5991	5841	11170	8826	14456	17009	20545	30019
Graduate	26209	25156	30784	50500	73051	43110	63788	54023	66250	94299
Post graduate	48650	41204	38953	30850	61507	23553	51557	49376	55821	100798
Diploma (graduate)	45652	29021	43940	52812	63071	40379	37950	70566	49541	88249

Source: NSSO (2014): 71st round - Key Indicators of Social Consumption in India: Education.

The quantile regression estimation in this paper captures the effects of the determinants of private household education expenditure at different quantiles along with its distribution. The quantiles considered in this paper are the 10th, 25th, 50th, 75th, and 90th quantiles. Figure 1 shows the quantile regression plots of household expenditure on education. The graph shows that the distribution of the private/household expenditure on education varies at the tail of the expenditure distribution, where the expenditure is at the extremes. This is the reason to use quantile regression to study the determinants of private expenditure on education across the entire distribution for a given set of regressors.

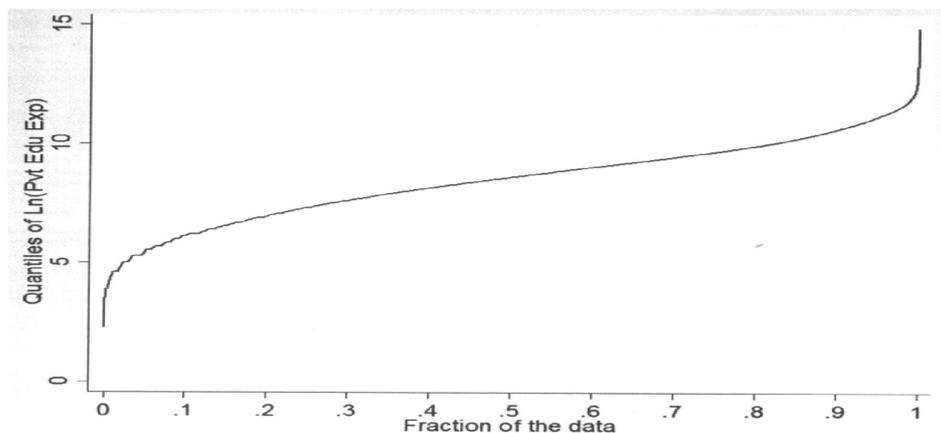


Figure 1: Quantile Plot of Household Expenditure on Education

Table 5 presents the descriptive statistics of all variables used in the study. Table 6 presents the OLS and the quantile regression estimates of household expenditure on education per student. The R-squared and Pseudo R-squared values indicate better explanatory power of the included variables in explaining the variations in private education expenditure across households in India. It is also to be noted that almost all the regression coefficients are statistically significant and in the expected direction. The empirical estimates show that household income, age of the child, male child, mother's education, father's occupation, Hindu religion, English medium education, change of institution, and professional education have positive effects whereas below 10th education level, rural background, socially backward community, government educational institutions, science, commerce and vocational subjects and scholarships and aid in the form of books and stationaries

have a negative impact on household expenditure on education. In fact, in-kind aid substantially reduces household expenditure on the education of children than financial aid and scholarships. Households spend significantly on medical and engineering education, and for English-medium institutions. Rural households and SC/ST groups spent less on the education of children.

Table 5: Descriptive Statistics of Variables

<i>Variable</i>	<i>Description</i>	<i>Mean</i>	<i>Std. dev.</i>
lnHHEDExp	Per capita private household expenditure on education (₹)	8.476	1.713
lnPCE	Per capita consumption expenditure, a proxy for household income (₹)	9.860	0.612
Age	Age (years)	13.80	5.06
MEducation	Mother's education (years)	7.09	5.08
Male	If male=1, 0 otherwise	0.56	0.49
Rural	If rural=1, 0 otherwise	0.57	0.49
FSelfEmp	If father is self-employment=1, 0 otherwise	0.53	0.49
Hindu	If Hindu=1, 0 otherwise	0.79	0.40
SC/ST	If SC/ST=1, 0 otherwise	0.30	0.46
School10	If attending up to class X=1, 0 otherwise	0.66	0.47
Commerce	If studying in commerce or humanities streams=1, 0 otherwise	0.13	0.33
Science	If studying in science streams =1, 0 otherwise	0.06	0.24
Professional	If studying in medicine or engineering streams=1, 0 otherwise	0.07	0.26
Vocational	If studying in vocational streams=1, 0 otherwise	0.03	0.18
GovtSchool	If studying in government institution=1, 0 otherwise	0.53	0.49
EngMedium	If English medium education=1, 0 otherwise	0.41	0.49
InsChange	If change of education institution=1, 0 otherwise	0.17	0.37
Scholarship	If receiving scholarship=1, 0 otherwise	0.18	0.38
Aid	If received books and stationary=1, 0 otherwise	0.03	0.18
Obs.	93,446		

Source: Author's calculation.

Table 6: Quantile Regression Estimates of Household Education Expenditure
Dependent variable: ln (HHEDExp)

<i>Variable</i>	<i>OLS</i>	<i>Q10</i>	<i>Q25</i>	<i>Q50</i>	<i>Q75</i>	<i>Q90</i>
lnPCE	0.601* (0.006)	0.625* (0.011)	0.631* (0.009)	0.612* (0.008)	0.573* (0.007)	0.550* (0.008)
Age	0.082* (0.001)	0.082* (0.002)	0.079* (0.001)	0.074* (0.001)	0.070* (0.001)	0.068* (0.001)
MEducation	0.024* (0.0006)	0.024* (0.001)	0.023* (0.0008)	0.023* (0.0008)	0.023* (0.0008)	0.068* (0.0009)
FSelfEmp	0.039* (0.006)	0.045* (0.011)	0.049* (0.011)	0.039* (0.007)	0.044* (0.007)	0.036* (0.008)
Male	0.069* (0.006)	0.083* (0.011)	0.077* (0.009)	0.067* (0.007)	0.062* (0.007)	0.056* (0.008)
Rural	-0.163* (0.007)	-0.170* (0.013)	-0.150* (0.010)	-0.150* (0.008)	-0.153* (0.008)	-0.141* (0.009)
Hindu	0.084* (0.008)	0.108* (0.014)	0.094* (0.001)	0.091* (0.009)	0.093* (0.009)	0.110* (0.010)
SC/ST	-0.135* (0.007)	-0.180* (0.013)	0.156* (0.010)	-0.128* (0.008)	-0.103* (0.008)	-0.095* (0.009)
School10	-0.591* (0.018)	-0.290* (0.033)	-0.455* (0.023)	-0.654* (0.021)	-0.772* (0.021)	-0.872* (0.024)
Commerce	-0.358* (0.016)	-0.087* (0.031)	-0.234* (0.024)	-0.409* (0.020)	-0.561* (0.019)	-0.669* (0.022)
Science	-0.259* (0.018)	-0.059 (0.034)	-0.180* (0.027)	-0.331* (0.022)	-0.412* (0.022)	-0.468* (0.025)
Professional	0.413* (0.017)	0.663* (0.033)	0.482* (0.026)	0.349* (0.021)	0.284* (0.021)	0.247* (0.024)
Vocational	0.014* (0.021)	0.230* (0.040)	0.086* (0.031)	-0.023* (0.026)	-0.080* (0.026)	-0.120* (0.029)
GovtSchool	-0.971* (0.007)	-1.291* (0.013)	-1.161* (0.010)	-0.954* (0.008)	-0.772* (0.008)	-0.678* (0.009)
EngMedium	0.679* (0.007)	0.801* (0.014)	0.741* (0.011)	0.695* (0.009)	0.648* (0.009)	0.611* (0.010)
InsChange	0.051* (0.008)	0.061* (0.015)	0.051* (0.012)	0.055* (0.010)	0.037* (0.009)	0.026* (0.011)
Scholarship	-0.190* (0.008)	-0.239* (0.015)	-0.193* (0.012)	-0.195* (0.010)	-0.178* (0.009)	-0.145* (0.011)
Aid	-0.737* (0.007)	-0.941* (0.032)	-0.922* (0.025)	-0.799* (0.021)	-0.596* (0.021)	-0.383* (0.233)

Variable	OLS	Q10	Q25	Q50	Q75	Q90
Constant	1.069* (0.068)	0.408* (0.127)	1.062* (0.101)	2.051* (0.082)	3.092* (0.081)	3.829* (0.092)
Pseudo R-square	-	0.461	0.483	0.483	0.479	0.480
R-square	0.71					
F-value	12996.91					

Note: Standard errors in parentheses. * Significant at 1 level.

In the quantile regression estimates, which describe the effects at different points of the distribution of household educational expenditure, a percentage increase in consumption expenditure monotonically decreases the education expenditure from 6.2% at the lower to 5.5% at the higher quantile. This shows that the proportion of household income spent on education is higher at the lower quantiles and decreases at the higher quantiles, a result similar to the findings in Turkey by Bayar and Ilhan (2016). The OLS regression coefficient of per capita consumption expenditure is also 0.60, showing that on average, households spend about 6% on the education of children with a 1% increase in the per capita household income.

The education of the mother has a positive and statistically significant effect on the household education expenditure, and the effect is almost a constant 2% throughout the expenditure distribution, similar to the OLS result. The self-employment of the father also has a similar positive effect on higher education distribution. Irrespective of the quantiles, self-employed parents spend about 4% more relative to other occupations on the education of their children. Though households spend about 7% more on the education of male children compared to female children, the marginal effect declines throughout the education expenditure. At the 10th and the 25th quantiles, the gender coefficients are 0.082% and 0.077% respectively and at the 75th and 90th quantiles, the gender coefficients are 0.062% and 0.056% respectively. This shows that at the higher quantiles, the gender bias in educational investments is significantly lower than at the lower quantiles. Religion has a positive effect on private education expenditure. The estimated coefficients suggest that households belonging to the Hindu religion tend to spend nearly 8-10% more on the education of their children. The rural dummy has a negative sign, and its impact is decreasing across the quantiles. The coefficients at the 10th and the 90th quantiles have a significant difference - about 3% - in spending than the

middle quantiles. This shows that households in rural areas spend about 16% less on education compared to urban households, and households in the lower quantiles in rural areas also spend considerably less on education than the rural households at the higher quantiles.

The social group dummy (SC/ST) has a negative effect but a decreasing trend across the quantiles. The Scheduled Caste/ Tribe households spend less than other communities on education. The gap between the education expenditure of the two groups is narrow, both at the higher quantiles compared to the lower quantiles, but at the middle quantiles, the gap is slightly larger. The OLS estimate of -0.135 shows that the SC/ST groups spend, on average, 13% less than the non-SC/ST communities. These results imply that households at both ends of the expenditure distribution are better able to utilise the benefits extended to the SC/ST students, both at the lower and higher levels of education, especially the scholarships and tuition fee waiver schemes, especially in government institutions. These results are also confirmed by the negative coefficients of scholarship, aid provision, and government institution dummies. In fact, the effect of studying in government institutions and getting free books and stationery is larger at all quantiles than the 1-2% effect of scholarships on reducing household educational expenditure.

Though scholarships are given to non-SC/ST communities also by many state governments, like backwards class scholarships, the number of beneficiaries and the amount of benefit are low and are restricted to the poor and within certain limits, compared to SC/ST scholarships for which all SC/ST students are eligible. The scholarship dummy shows a negative effect on private expenditure on education, indicating that the wards of households who have scholarships spend less on education expenditure. It has a decreasing effect across the quantiles, a significant difference between the 10th and 90th quantiles from 2.4% to 1.4%. Thus, the scholarship schemes of the governments have more effect on the lower quantiles than on the higher quantiles. Similarly, the in-kind aid dummy, free books and stationery provisions, have a negative effect on the private expenditure on education, showing less need for the purchase of educational materials. There is a significant difference between the coefficients of the lower quantiles and the higher quantiles, from more than 90% at the 10th to about 80% at the median quantile to 38% at the 90th quantile. Similarly, the type of institution the student attends, i.e. whether the student goes to a government or a private institution, matters.

The household expenditure is significantly higher when the student is enrolled in a private institution and lower if enrolled in a government institution. The regression coefficient of the dummy of enrollment in government institutions is negative and has a decreasing impact across the quantiles. The OLS coefficient shows a significant 97% less expenditure in government institutions relative to enrollment in private educational institutions. At the 10th and 25th quantiles, the effects are larger, the coefficients being -1.29 and -1.16, respectively, and at the 75th and 90th quantiles -0.95, -0.77 and -0.68, respectively, which are considerably less compared to the lower quantiles. Also, the increase in the proportion of education expenditure in government institutions as the level of education increases is lesser compared to the proportion of education expenditure in private institutions. Hence, the students at the lower quantiles tend to enrol in government institutions and get the incentives, and the students at the higher quantiles are likely to enrol mostly in private institutions, and the incentives may not necessarily be available in private institutions (Tilak, 2002).

Among the other education-related variables, the English medium of instruction has a significantly positive effect on private education expenditure compared to vernacular medium institutions, and its effects are decreasing across the quantiles. The percentage amount spent is higher in English medium institutions at the lower quantiles than at the higher quantiles, from 80% to 60%. Most of the English medium institutions are private educational institutions, and hence, they charge high fees, and many of the government schemes for weaker sections are not available in these private institutions. However, at higher education levels, some benefits are available even to the meritorious poor students in the form of institutional concessions, and the slightly better-off households among the poor are able to tap these avenues. School education is less costly for households as its coefficients are negative, on average 60% -and increasing - from 30% to 80% - over the private education expenditure distribution. Obviously, such an education expenditure pattern shows that the students from the lower quantiles are mostly attending the government institutions, and the students from the higher quantiles are most likely in private institutions.

In addition, the estimated coefficients of commerce, humanities and science dummies show that the proportion of household education expenses incurred for commerce or humanities courses is less than that for professional courses like

medicine or engineering. The coefficients are decreasing over the quantiles. On average, the household expenditure on these educational streams is lower by 25 to 35%. The professional education expenditure has a positive effect on private expenditure on education. The students who pursue medicine or engineering spend more than 40% of their education in these fields. The coefficients of the quantiles have a decreasing trend across the quantiles. The proportion of education expenditure spent by the lower quantile households is almost 50% greater than the higher quantile households. The vocational education dummy has a positive effect at the lower quantiles and a negative effect at the median quantile. This implies that a significant number of students from the lower quantiles pursue vocational studies than children at higher quantiles of private/household educational expenditure.

Figure 2 plots the OLS and quantile regression coefficients of the determinants of private education expenditure across the distribution. The dotted lines are the OLS coefficients, which are average and constant across the distribution of private education expenditure. The quantile regression coefficients plots show that the effect of the determinants on the educational expenditure of households is not the same across the distribution. Compared to the constant marginal effects of the OLS estimates, the plots of the marginal effects on expenditure on education show a continuous decline with an increase in income and age, and for the medium of instruction, below 10th grade, science, professional and vocational education streams of education. The plots of the effects of the social background, type of institution, scholarships and aid for books and stationaries show a continuous rise in marginal effects and the plots of the male child, mother's education, father's self-employment, rural background, and change of institution coefficients reflect differential effects at different quantiles, crossing over the OLS coefficients generally at the median values. The quantile plots also show the opposite effects at the extreme ends of the educational expenditure distribution for income, age, gender, social group, institution type, medium of instruction, change of institution, scholarships and aid, and course of the study compared to the average OLS effects throughout the distribution.

To further investigate the gender and community differences in private expenditure on education in India, the quantile regression is estimated for male and female students and SC/ST and non-SC/ST communities separately. Table 7 reports the estimates for the 10th and 90th quantiles for each of the sub-samples.

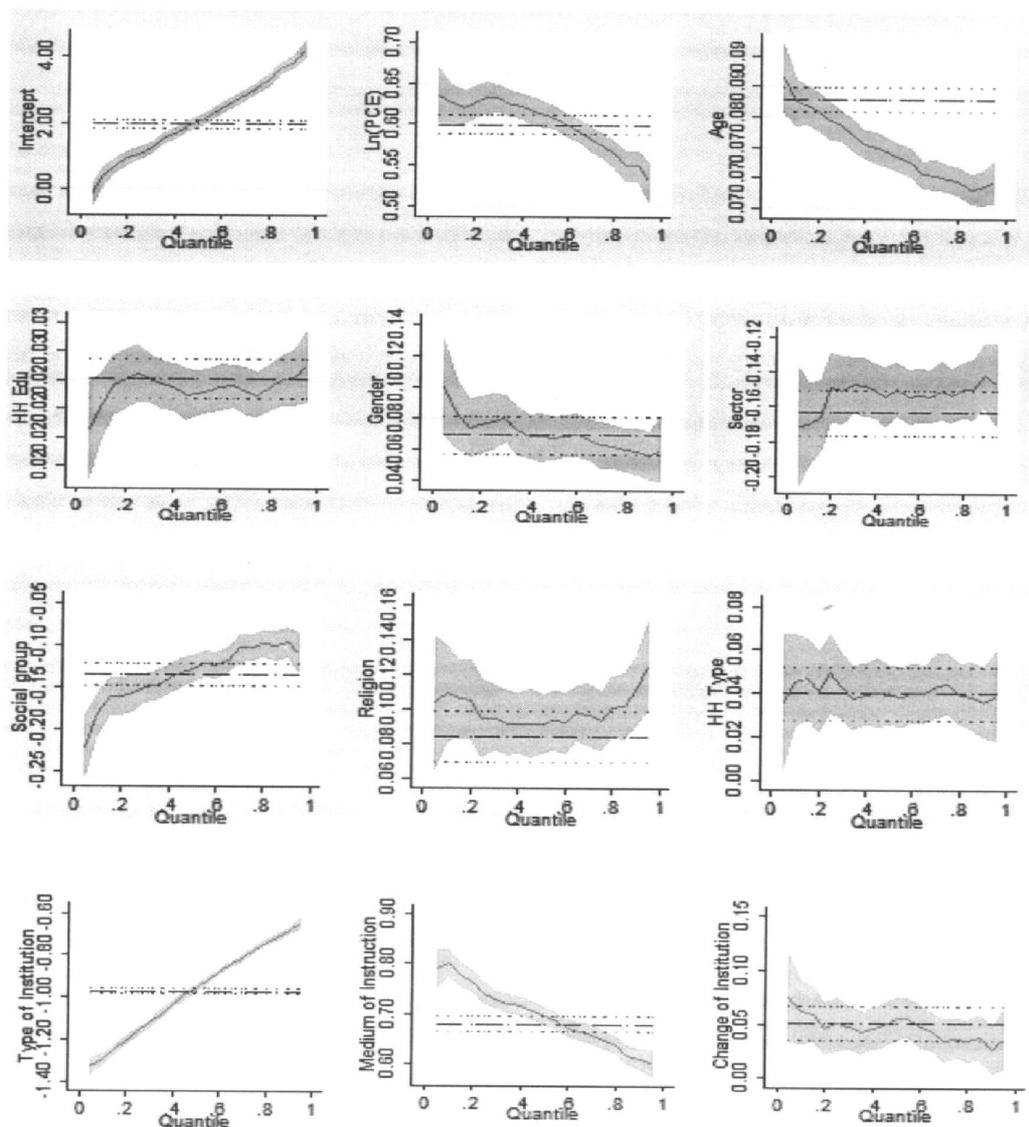


Figure 2: Quantile Regression Plots of the Determinants of Household Education Expenditure

The effect of household income on the educational expenditure of households is much higher in the lower quantiles than in higher quantiles for both males and females, as well as in SC/ST and non-SC/ST households. The self-employment of the father has a significant negative effect on non-SC/ST households, whereas its

effect on educational expenditure is positive in SC/ST households. The non-SC/ST self-employed fathers spend less, almost double the amount, on education at the 10th quantile than at the 90th quantile of the expenditure distribution. Similarly, the SC/ST households spend less on students at the lower quantile than at the higher quantile. The negative effect of school education is much stronger at the 90th quantile compared to the 10th quantile. The household expenditure on professional education at the bottom quantiles is also much higher than that at the upper quantiles. The same is the case with non-financial aid, except for male students at the 10th quantile.

Table 7: Quantile Regression Estimates of Household Education Expenditure in India by Gender and Community

Dependent variable: ln (HHEDExp)

Variable	Males		Females		SC/ST		Non-SC/ST	
	Q10	Q90	Q10	Q90	Q10	Q90	Q10	Q90
lnPCE	0.61* (0.015)	0.53* (0.011)	0.65* (0.018)	0.57* (0.012)	0.67* (0.024)	0.57* (0.017)	0.61* (0.013)	0.54* (0.010)
Age	0.08* (0.001)	0.07* (0.002)	0.08* (0.003)	0.07* (0.002)	0.10* (0.003)	0.08* (0.002)	0.076* (0.002)	0.063* (0.001)
MEducation	0.02* (0.001)	0.024** (0.001)	0.02* (0.002)	0.02* (0.001)	0.02* (0.022)	0.02* (0.001)	0.02* (0.001)	0.03* (0.001)
FSelfEmp	0.06* (0.014)	0.04* (0.012)	0.03* (0.021)	0.03* (0.012)	0.02 (0.023)	0.05* (0.016)	-1.30* (0.015)	-0.64* (0.010)
Male	-	-	-	-	0.07* (0.022)	0.04* (0.016)	0.08* (0.013)	0.06* (0.010)
Rural	-0.16* (0.016)	-0.12* (0.013)	-0.19* (0.020)	-0.17* (0.013)	-0.15* (0.026)	-0.18* (0.018)	-0.17* (0.014)	-0.12* (0.010)
Hindu	0.14* (0.018)	0.11* (0.014)	0.09* (0.022)	0.09* (0.015)	0.05* (0.033)	0.17* (0.023)	0.14* (0.016)	0.08* (0.012)
SC/ST	-0.18* (0.017)	-0.10* (0.013)	-0.17* (0.020)	-0.10* (0.013)	-	-	-	-
School10	-0.23* (0.041)	-0.10* (0.033)	-0.40* (0.054)	-0.85* (0.037)	-0.34* (0.071)	-0.88* (0.049)	-0.30* (0.038)	-0.86* (0.029)
Commerce	-0.03* (0.038)	-0.68* (0.030)	-0.20* (0.050)	-0.64* (0.033)	-0.01* (0.067)	-0.65* (0.047)	-0.13* (0.035)	-0.70* (0.029)
Science	-0.04* (0.042)	-0.44 (0.033)	-0.20* (0.056)	-0.49* (0.037)	-0.47* (0.078)	-0.44* (0.054)	0.08* (0.039)	-0.48* (0.029)
Professional	0.72* (0.034)	0.22* (0.031)	0.55* (0.059)	0.37* (0.040)	0.66* (0.077)	0.30* (0.053)	0.67* (0.037)	0.24* (0.028)
Vocational	0.36* (0.046)	-0.13* (0.036)	-0.07* (0.077)	-0.10* (0.052)	-0.24* (0.084)	-0.18* (0.058)	0.22* (0.046)	-0.09* (0.035)

Variable	Males		Females		SC/ST		Non-SC/ST	
	Q10	Q90	Q10	Q90	Q10	Q90	Q10	Q90
GovtSchool	-1.31* (0.017)	-1.19* (0.013)	-1.26* (0.021)	-0.69* (0.014)	-1.24* (0.027)	-0.72* (0.019)	-1.30* (0.015)	-0.64* (0.011)
EngMedium	0.79* (0.018)	0.72* (0.015)	0.81* (0.022)	0.60* (0.015)	0.72* (0.031)	0.59* (0.022)	0.82* (0.016)	0.62* (0.013)
InsChange	0.07* (0.018)	0.04* (0.015)	0.05* (0.024)	0.002* (0.017)	0.07** (0.034)	0.04*** (0.024)	0.05* (0.017)	0.03* (0.013)
Scholarship	-0.22* (0.020)	-0.15* (0.015)	-0.25* (0.023)	-0.15* (0.016)	-0.19* (0.025)	-0.11* (0.017)	-0.30* (0.021)	-0.21* (0.015)
Aid	-0.74* (0.007)	-0.94* (0.032)	-0.86* (0.049)	-0.31* (0.031)	-0.90* (0.052)	-0.42* (0.036)	-0.96* (0.042)	-0.33* (0.032)
Constant	0.52* (0.161)	4.06* (0.127)	0.34* (0.200)	3.57* (0.134)	0.40* (0.262)	3.33* (0.183)	0.67* (0.147)	3.99* (0.111)
Pseudo R-square	0.47	0.48	0.44	0.47	0.40	0.47	0.47	0.48
Obs.	52239		41207		27832		65614	

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

Conclusion

Households spend a substantial part of their income on the education of their children in India. This private expenditure is increasing despite the subsidised education system with substantial government spending and various financial aid programmes. Households incur expenditure on education as an investment with sizable returns for various levels of education. Apart from the private returns, human capital investments also have social returns. Hence, the overall benefits of investing in education are well recognised, and therefore, household expenditure on education is worth it. However, there exist other barriers to education such as availability, access and quality of education, and infrastructure and location of educational facilities. There are socioeconomic, demographic and regional issues in the provision and utilisation of educational services also. This paper aimed to identify the differential effects of the determinants of private household expenditure on education in India using the 2014 NSSO 71st round survey data and applying the quantile regression method. The paper focused on the socioeconomic characteristics of the students currently attending an educational institution. Quantile regression is used to capture the differential impacts across the distribution of private education expenditure.

The quantile regression estimates show consumption expenditure (a proxy for income), social group, type of institution, scholarship and in-kind incentives, and the course the student is currently attending have significant effects on the household education expenditure. The proportion of income spent on the education of children increases more in the lower quantiles than in the higher quantiles. In other words, lower-quantile households are more sensitive to changes in household income than the higher-quantile households. The general observation of gender differences in the educational expenditure by households is not borne out in this study. The gender bias does exist only at the lower quantiles, but is considerably less at the higher quantiles. From the social group perspectives, the SC/ST households spend less than the non-SC/ST groups at the lower quantiles, and the difference gets reduced at higher quantiles, probably due to access to community-specific scholarships and other incentives, especially free education and tuition fee waiver schemes.

Compared to scholarships, the provision of educational materials such as books and stationery has a higher impact on household expenditure on education. The type of institution the student goes to and the English medium of education are the important determinants of private education expenditure. The proportion of expenditure spent on the government institution is a lot less than the expenditure spent on the private institution. It holds true across the quantiles, especially for the lower quantiles, since more students from the lower quantiles attend the government institution. In addition, substantial differences exist in private expenditure on education between students attending government institutions and private institutions. Students from higher-income groups tend to attend private institutions. The results of this paper reveal that despite the government policies and programmes to provide educational facilities such as free education, scholarships and incentives to make education affordable, the lower-income groups still spend a considerable amount of their income on the education of children.

The quantile results of this paper imply that the policies, schemes and programmes towards promoting gender equality and reducing gender bias in education need to be streamlined and strengthened in consideration of their differential effects on different segments of the income classes. The policies should place more emphasis on providing educational materials than subsidising education altogether. In particular, the lower-income households require more incentives and information on the available educational incentives and financial support. Perhaps a direct money transfer

programme to the households with enrolled children, as is the case with research fellowships and the central government general welfare programmes, or a voucher scheme, generally followed in Western countries, would enable the lower-income households to cope with the financial burden of educating children. Finetuning the schemes towards girls' education would also reduce the gender gap and gender bias in household education expenditure. The government educational institutions where most lower-income households send children to study should be improved both in terms of infrastructure and qualified teachers to improve educational standards.

The paper is based on the 2014 NSSO 71st round survey data, which is a limitation of the study. The data set used is given the availability of certain data on the household-level matched samples and its amenability to the quantile regression analysis. The use of recent data from the 2018 NSSO 75th round survey should give more insights. Apart from quantile level analysis, more disaggregated analysis at the state and rural-urban level is not attempted in this paper. Econometric analysis over time using the various NSSO surveys will throw more light on the changes in the differential effects of the determinants, as well as the gender gap in the household expenditure on the education of children.

Future research on the gender gap and gender disparity in education should aim to delineate the heterogeneity of the effects of the determinants of household education expenditure by the socioeconomic and demographic status of the households. More research should also examine the differential effects of the institution and course of study and financial as well as educational material aids, on household expenditure on education. Research should also identify the effects of alternative financing methods on household expenditure on education. A comparative analysis over time should throw more light on the dynamics of the effects of policies and programmes on the household expenditure on the education of children and the changes in the gender gap and gender disparity in education in India.

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