GENDER DISPARITIES IN PRIMARY EDUCATION ACROSS SIBLINGS

IS INTRA HOUSEHOLD DISPARITY HIGHER IN REGIONS WITH LOW CHILD SEX RATIOS?

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Abstract

Strong son preference in developing countries often motivates parents to undertake sex selection at birth, infanticide, and subsequent neglect of daughters, leading to low child sex ratios in these countries. An interesting question is whether such attitudes also lead to gender discrimination in primary education. While there is a vast literature on inter-household gender discrimination in education, studies of discrimination between siblings is comparatively rare. This paper asks the question: Do parents tend to educate sons more than daughters? Using unit level National Sample Survey Organization data for the 61st Round (2004-2005), we analyze disparity in primary educational attainments between siblings and examine whether such intra-household disparity is higher in areas where child sex ratios are low. Findings indicate that parental attitude towards education and practices may be more complicated and less uniformly negative at lower levels of education than commonly portrayed.

Key words: Gender Discrimination, Education, Intra-household disparity, Sibling, India.

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INTRODUCTION

The strong son preference observed in South Asian countries has led to practices like sex selective abortion and infanticide (either directly, or through neglect). This has led to a decline in child sex ratio. In India, for instance, the number of females per 1000 males (in the age group 0-6 years) has fallen to from 927 (2001 Census) to 914 girls per 1000 boys (2011 Census). This has been referred to as the phenomenon of "missing girls" (Sen, 1992, 2003). The term "missing girls" is defined as the difference between number of women there would be without female disadvantage in survival and actual number of women. Economists have argued that this deficit was mainly caused by sex selective abortion and neglect of the girl child during her early years (Qian and Lin, 2002; Sahni et al., 2008). Sen (1992) estimated that as many as 23 million women were "missing" in India.[1] Recent studies have also provided evidence of the role of sex-selective abortion and infanticide in sex imbalances (Sahni et al., 2008), particularly among urban educated households (Nanda and Véron, 2005).

An interesting question that emerges in this context is whether such attitudes persist, leading to discrimination in spheres like primary education. This is important in view of the empowering effects of education and the wide gender disparity in primary educational

[1] Oster (2005), however, argues that the high incidence of Hepatitis B among parents, coupled with the skewed male-female birth (1.5:1) given by carriers, explains this phenomenon. She argued that this explanation accounted for 45 per cent of the missing women in the world, and about a fifth in India (Oster, 2005). Oster's theory was criticized by Dasgupta (2006); it was also pointed out by Lin and Luoh (2008) that Hepatitis B could account for only 1-2 per cent of missing women in China.

attainments observed in many countries. In West and Central Africa, for instance, primary completion rates (PCRs)[2] boys are 15 percentage points above that of girls (UIS, 2005). The 2001 Census revealed that the PCR in India was 51 per cent, with a gender gap of 21 percentage points. Although the gender gap is particularly high in rural areas (25 percentage points), urban disparity levels, too, are quite high (16 percentage points). The Annual Survey Education Reports brought out by PRATHAM[3] also reveal that gender disparities at the primary education remains a major issue for policy making in India.

Given that education has a significant spillover effects not only on the present generation but also in the future, with mothers playing an important role in the education of children (Hadden and London, 1996), the wide gender gap observed in developing countries and in India has serious implications for economic growth and human development. Therefore, the Millennium Development Goals (MDG) has also acknowledged the need to promote gender equality in primary and secondary schooling and women empowerment (Goal 3).

Attaining such a goal will not be easy, particularly in view of the fiscal squeeze on the education budget in developing countries, gender insensitive nature of existing policies (Lockheed, 2010) and disincentives to educating girls (Hannum et al., 2008; PROBE,

[2] The primary completion rate is the ratio of the total number of students successfully completing (or graduating from) the last year of primary school in a given year to the total number of children of official graduation age in the population. (United Nation Development Group, 2003).

[3] Since 2005, PRATHAM, an Indian NGO, has bringing out annual reports on the access to education and its quality. These reports are available at http://www.asercentre.org/ngo-education-india.php?p=Download+ASER+reports.

1999; Sathar and Lloyd, 1994). In order to introduce an effective strategy to ensure gender equality it is necessary to identify the forces that influence gender disparities in education. Further, given that such disparities essentially occur as a result of household decision-making, such an analysis must occur at the household level. The literature on gender disparities in education has focused on the individual level. Such studies, relying mainly on econometric methods, have established that gender disparities exist (for the mean household). In comparison, the literature on intra-household disparity between siblings of opposite gender is rare, particularly in the context of the Indian economy.

This study attempts to remedy this lacuna by directly comparing educational outcomes of siblings from the *same* family. Focusing on households with both sons and daughters, we have developed two simple measures of gender disparity in education within such households. We will then examine how these intra-household disparity measures vary across household characteristics, to enable us to identify the determinants of gender disparity at the primary education level. Specifically, we will test the hypothesis that households in regions with low child sex ratio will educate sons more than daughters.

The structure of this paper is as follows: In the next section we review the existing methodologies to measure gender disparity and identify its limitations with respect to our research question. This is followed by a description of our methodology – how we adapted the National Sample Survey (NSS) data set to facilitate comparisons between siblings - and the measures of disparity employed in the study. The next two sections present the findings of our analysis, while a concluding section sums up the main findings and uses them to draw policy conclusions.

METHODOLOGY

Limitations of existing methodology

While researchers often theorize that differential treatments by parents, based on the gender of their children, play a role in the considerable differences in educational outcomes observed in developing countries, attempts to directly examine whether educational outcomes of siblings from the same family vary are rare (Gregory, 2010). The majority of researchers estimate regression models using individual level data, to identify factors like family income or wealth, parental education, empowerment and education of mother, credit constraints, age and gender of the child, family size or presence of siblings, caste affiliations, religious identity, place of residence and educational infrastructure as determinants of educational outcomes (Boissiere, 2004; Brown and Park, 2002; Connelly and Zheng, 2003; Deolalikar, 1993; Desai and Kulkarni, 2005; Dreze and Kingdon, 2001). The common method of testing for the presence of gender disparity is to estimate the regression equation:

$$Y = \alpha + \beta \text{ MALE} + \delta \text{ Control Variables} \qquad [1]$$

when:

Y = Probability of attaining a specific educational stage (like enrolment, primary education, etc.)

MALE = 1 if respondent is male = 0 if respondent is female

> Control variables include income (or expenditure), household size, age of respondent, place of residence, geographical region, occupation of parents, etc.

A statistically significant and positive coefficient of the gender dummy (MALE) indicates that male children enjoy a relative advantage over female children.

This method enables us to test for the presence and direction of gender disparity by measuring the magnitude of disparity in a representative household (characterized by mean values of control variables). However, an important question that researchers and policy makers face is how the level of disparity varies across different groups. This can be examined in two ways – either by re-estimating the equation for sub-groups of the original sample (as for instance in Irving and Kingdon, 2008), or by introducing interaction dummies (Sen et al., 2007). However, both methods have their limitations.

The former method is to re-estimate [1] for groups of the original sample, and see how the coefficient of the gender dummy is changing across sub-samples. For instance, [1] may be estimated for rural residents and urban residents separately to see whether gender disparity is greater in rural areas. However, this method is cumbersome and does not offer any direct test of significant variation in regression coefficients across the sub-samples. The use of interaction dummies, on the other hand, is more effective, particularly if we want to examine the variation in gender disparity over one or two dimensions.

Interaction dummies involve adding an additional variable to see whether disparity varies across a particular control variable or not. For instance, we can add MALE*URBAN (=1 if respondent is male and resides in urban areas) to [1]. The t-statistic and sign of this variable indicates whether boys are indeed better off than girls *to a greater extent* in urban areas. The problem with introducing interaction dummies is that it is not viable to incorporate too many interaction dummies. It is difficult to interpret the estimated regression coefficients; in addition the issue of collinearity may result in the dropping of some of the dummies.

Another approach to measuring discrimination is based on the Oaxaca decomposition method (Oaxaca, 1973). This method argues that if we have a function:

$$Y = \alpha + \beta X$$

the difference in outcomes between two groups (labeled for convenience as Superior and Inferior) may be attributed in part to the differences in X (that is, difference in X_S and X_I) and in part to the differences in slope coefficients (that is, difference in β_S and β_I). Thus:

$$\begin{aligned} Y_S - Y_I &= \beta_I(X_S - X_I) + X_S(\beta_S - \beta_I) \\ &= \beta_S(X_S - X_I) + X_I(\beta_S - \beta_I) \qquad [2] \end{aligned}$$

The two decompositions are similar conceptually, but vary with respect to the reference category being used. The second component in both formulations is the residual component, taken to represent an estimation of the extent of discrimination. Although this decomposition was initially formulated for continuous outcomes, it has been subsequently adapted for non-linear models also (Fairlie, 2005; Mathew et al. 2008).

The method was initially used to measure discrimination in labour market outcomes, but has also been applied in research on health and education. Kingdon (2001), for instance, has used this method to estimate the gender gap in education. Based on data collected from a household-level survey in urban Uttar Pradesh, carried out in 1995, Kingdon found that parental motivation to educate girls was significantly lower, relative to the motivation to educate boys – indicated by the presence of a large unexplained component in the gender gap in schooling attainment. The Oaxaca-Blinder decomposition method is useful if we propose to estimate the extent of discrimination. However, it has two limitations. Firstly, the magnitude of the residual will depend upon the explanatory variables being used in the model. Thus, omission of an important determinant of educational attainment will result in an increase in residual component. The second limitation of this method is that it only provides an estimate of the magnitude of discrimination; it fails to identify the factors determining the level of discrimination.

In contrast to such studies, studies of disparities in educational outcomes across siblings are not only allows us to concentrate directly on gender disparity and identify its determinants, but is also justifiable on conceptual grounds. As pointed out by Sen and Batliawala (2000) disparity occurs at the household/family level, so that it would be more appropriate to study intra-household disparity between siblings in each household – rather than between children across households (when using individual level data). This approach is also consistent with both the new family economics (Agarwal, 1994; Sen, 1990) that argues us to look at intra-household distribution of resources (for education) and with the conceptualization of schooling demand as a household level analysis (Dreze and Kingdon, 2001).

Unfortunately, such studies are rare. Possibly the first study of disparity in educational outcome was by Behrman et al. (1995), in the context of the US economy. A recent study by Eirich (2010) employs a fixed effects regression model to show that parents in US do prefer sons. Further, while marked levels of disparity may be observed among families from affluent socio-economic status, households with low socio-economic status do not seem to discriminate between siblings. A study based on Ethopian Rural Household Survey (1994-2004), too, found evidence of discrimination against daughters (Delelegn, 2007). Another interesting study by Chen et al. (2009) tests whether son preference leads to gender disparities in educational outcomes between siblings in Taiwan. Interestingly, they observe positive spillovers from having a brother (in the form of increased parenting time by mothers and increased supply of working hours by fathers) positively affecting educational outcome of girls. A study of rural Chinese families also found that parents, despite expecting to rely on sons for old-age support and agreeing that sending girls to school was useless since they would get married and leave home, did not discriminate significantly between sons and daughters (Hannum et al., 2008). However, there does not seem to be any major study of intra-household discrimination against girls in India, a country where the issue of missing women is a major problem. The present study is an attempt to address this deficiency.

Database and how it is adapted

The paper is based on unit level data pertaining to Schedule 10.1 from the 61st round of the National Survey Organization (NSSO) survey on “Employment and unemployment situation in India” undertaken between July 2004 and June 2005. Data was collected from 124,680 randomly selected households (79,306 in rural areas and 45,374 in urban areas) containing 602,833 individuals (398,025 in rural areas and 204,808 in urban areas). A multi stage sampling design was adopted for the survey.

While the dataset contains information pertaining to both households and individuals surveyed, we extracted the individual-level information relating to age, sex and educational attainments (provided in Block 4 of the questionnaire). We then recoded information on educational levels of respondents as follows:

- Illiterates were given a score of 1,
- Literates without formal education were scored as 2,
- Drop-outs before completing primary education were scored as 3, and
- All respondents completing at least primary education were allotted a score of 4.

It may be argued that this system of assigning values to educational levels is arbitrary, particularly as the values are ordinal in nature. While admitting the merit of this criticism we would like to point out that the available database does not permit us to assign cardinal values to educational levels. This would be possible if, for instance, we had information on years of schooling of respondents. Despite the crudity of our measure, however, we feel that it does raise some interesting issues, which can be explored using more accurate measures of educational attainment.

Using the collapse command in STATA, we next calculated the number of girls and boys aged 12-18 years for each household and the average educational score for such boys and girls in each household. This information – relating to each household – was stored in a household level file, which was then merged with other files containing the relevant household level information on socio-economic characteristics of each family (from Blocks 1 and 3).

Finally, the gap between the average educational attainments of boys and girls was used to obtain a distance-based measure of gender inequality in educational attainments. In addition, we also estimated the gap between maximum educational score attained by any boy and any girl in the household. Thus, we have two measures of gender deprivation:

$$D_{1i} = AES_{bi} - AES_{gi} \qquad [2]$$

$$D_{2i} = MES_{bi} - MES_{gi} \qquad [3]$$

when,

AES_{bi}: Average educational score for boys in household i

AES_{gi}: Average educational score for girls in household i

MES_{bi}: Maximum educational score attained by a boy in household i

MES_{gi}: Maximum educational score attained by a girl in household i

Three points need to be clarified here.

1. Households may be classified into four groups, based on the gender composition of their children – households may have only sons, only daughters, both sons and daughters and no children. The gender gap, or distance, is calculated only for

households having siblings of both gender. There are 18,851 such households in the dataset.

2. The age limits of 12 and 18 have to be justified. The lower age limit is taken to ensure that children are allowed the opportunity of completing five years of schooling. The upper age limit was imposed to ensure that children remain in their parental household (and does not leave it either due to marriage, or to set up a new household after getting employment), so that the information that we obtain about the socio-economic characteristics of the respondent's household (particularly, gender, education and occupation of the head of family, and monthly expenditure level) relates to their parental family. This prevents misspecification of the data set.
3. The focus on primary education may be justified because of two reasons. Firstly, primary education is an important stage in education and has important consequences for growth and development. It provides the foundation, which can be used by individuals to access information at latter stages; it is also important in for functional purposes. Secondly, focusing on higher levels of education would have required raising lower age limits, resulting in the inclusion of a group of respondents who have left their parental families.

Sample profile

Before proceeding to the main analysis, it is necessary to understand the characteristics of the households whom we will be analyzing. In addition, we also want to check whether we have sufficient observations in the categories formed by the control variables to be used in our analysis. Analysis of the sample profile (Appendix Table A.1) indicates the following facts:

1. About 67 per cent of households reside in rural areas.
2. About a third of the households are from Central Indian states. Representation from the remaining zones varies from 10 to 15 per cent of total sample.
3. About 30 per cent of the households in India belong to Hindu-Other Cakward Castes (HOBC) community. Hindu Scheduled Castes (HSCs) comprise 15 per cent, Hindu Upper Castes (HUCs) 20 per cent and Hindu Scheduled Tribes (HSTs) 6 per cent of the sample households. About 16 per cent of the households belong to the Muslim community.
4. About 22 per cent lie below the poverty line, while 53 per cent of households lie above the poverty line but below double the poverty line.
5. The majority of households have male heads (91 per cent).
6. Around 32 per cent of the household heads are illiterate; 25 per cent of household heads have completed primary level (4-5 years of schooling), while 25 per cent have studied up to the secondary level (10 years of schooling). Only 9 per cent completed higher secondary level (12 years of schooling).
7. Analysis of the occupational pattern of the household head reveals that majority of the household heads are self-employed in agricultural sector (27 per cent). The next largest occupational groups are self employed in non-agricultural sector (16 per cent) and self employed in urban sector (15%). Wage and salary earners comprise 12 per cent of the sample households.

EDUCATIONAL DISPARITY AND CHILD SEX RATIO

Let us first start by analyzing the frequency distribution of households according to their discrimination pattern. Although three possibilities may occur – households discriminate against girls, households treat both genders equally, and households discriminate against boys – we would expect a priori that the second and, particularly, the third category will not have a high frequency. Our analysis yields the surprising result that as many as 70 per cent of sample households educate both sons and daughters equally. Moreover, only about a fifth of the households discriminate against girls while one of every ten households actually educate daughters more than sons. In urban areas, the corresponding figures are 77, 13 and 11 per cent, respectively, indicating that gender disparity in educational attainments are lower in urban areas. If we consider differences in maximum educational score, we find an even lower level of disparity (households who do not discriminate comprise 75 and 83 per cent of households in rural and urban areas, respectively), while in only 17 and 9 percent of households discriminate against daughters.[4]

Child sex ratio and discrimination in education

To examine the validity of our hypothesis that discrimination patterns is related with child sex ratio we first estimate mean child sex ratio for the three categories of households – those favouring sons, those behaving equitably and those favouring daughters. If our hypothesis is true, then we would expect the mean child sex ratio be

[4] Now one possibility is that the educational levels of boys are very low, so that there is not much scope to practice discrimination. To check this, we analyzed the educational level of children in households where boys and girls are treated equally. We find that children in nine out of every ten of such households have completed at least five years of schooling. On the other hand, only 0.04 per cent of such households have not enrolled their children in schools.

lowest in the first category of households and lowest in the third group. Our estimates indicate otherwise (Table 1).

Table 1: Mean child sex ratio by discrimination pattern

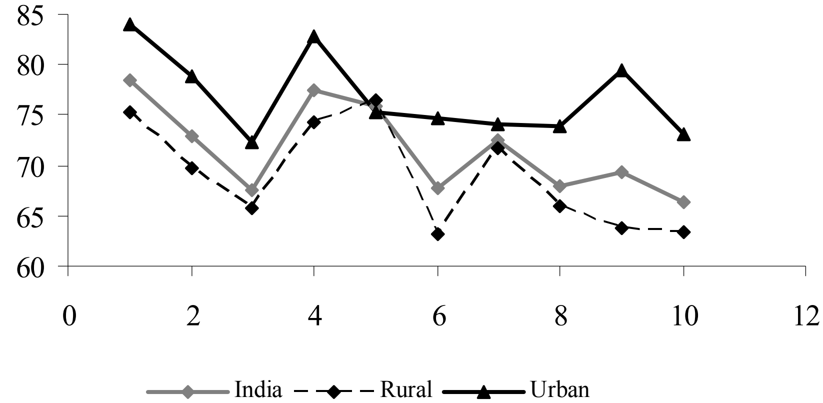
Measure	India	Favouring boys	Equitable treatment	Favouring girls
Mean Score (D_1)	Rural + Urban	931.11	919.1	925.06
	Rural	933.19	921.52	924.97
	Urban	924.05	914.79	925.25
Maximum Score (D_2)	Rural + Urban	930.41	919.98	926.65
	Rural	931.7	922.5	927.05
	Urban	925.65	915.36	925.82

What we do observe is a U-shape relation, with the worst child sex ratio being observed in households treating both sons and daughters equitably. On the other hand, mean of child sex ratio is lowest for households favouring girls – in the Rural+Urban and Rural samples! This may be observed for both mean and maximum score (D_1 and D_2). This is surprising and calls for a closer look. Let us examine the data graphically.

Disparity in mean educational attainments

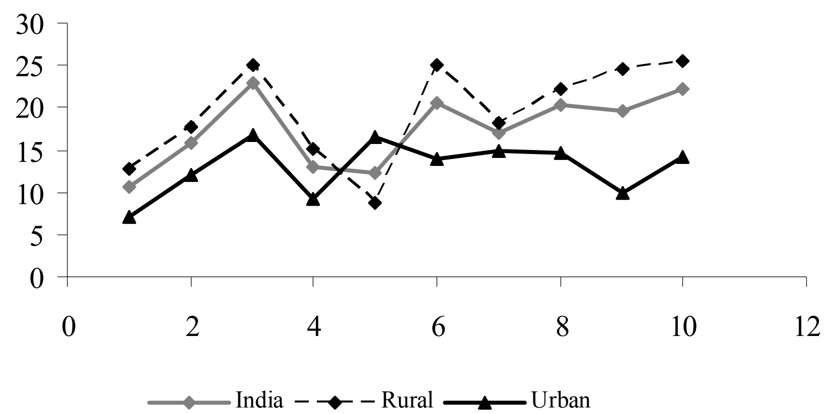
Using the unit level data from the 61st Round, we had calculated child sex ratio for each of the NSS regions. These are then clubbed into deciles, and the percentage of families who treat their children equitably (D_1=0) and the percentage of families who favour sons (D_1>0) are calculated for each of these deciles. These percentages are then plotted against each decile (Fig. 1 and Fig. 2).

Fig. 1: Percentage of families treating children equitably, against decile of child sex ratio - Mean score



In Fig. 1 we have plotted the distribution of families who treat both sons and daughters equitably. While, *a priori*, we would expect that this proportion is low in the initial deciles, and rises in higher deciles (a positive slope), the opposite trend is observed. This holds for both Rural and Urban areas, as well as the combined sample.

Fig. 2: Percentage of families favouring boys, against decile of child sex ratio - Mean score

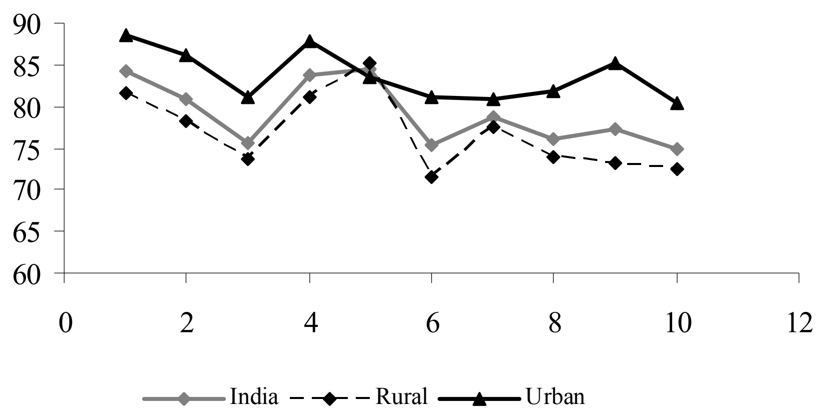


In Fig. 2, where we have plotted the distribution of households who invest more on sons, a positive slope is observed, indicating that it is in regions where sex ratio is high that a greater proportion of families discriminate against daughters.

Disparity in maximum educational attainments

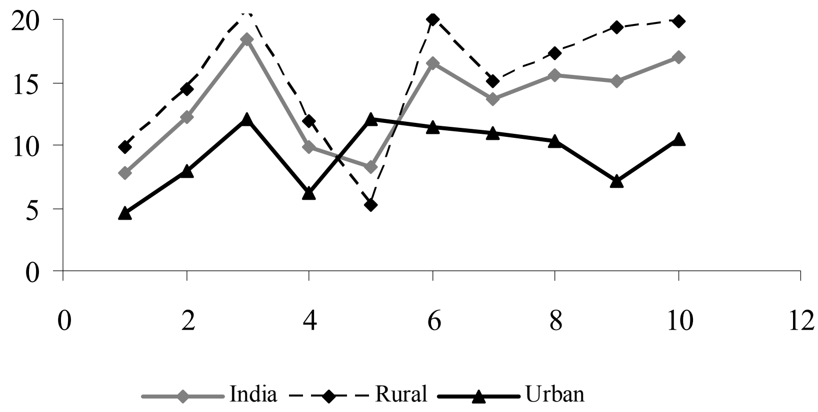
The analysis is repeated using D_2 (disparity in maximum score). The trend is less clear this time for the distribution of families who educate children equally (Fig. 3), but the expected positive slope is clearly not visible.

Fig. 3: Percentage of families treating children equitably, against decile of child sex ratio - Maximum score



In Fig. 4, where distribution of families discriminating against girls is plotted, a positive trend is discernible.

Fig. 4: Percentage of families favouring boys, against decile of child sex ratio - Maximum score



MULTIVARIATE ANALYSIS

The above analysis is based on descriptive statistics, and neither tests whether the variation across deciles is statistically significant nor controls for household and regional characteristics. This section attempts to redress this deficiency by estimating a regression model. The econometric model regresses D_1 and D_2 on child sex ratio of the region in which the household is located. In addition it includes three broad groups of control variables:

- *Household characteristics*: Per capita monthly expenditure, Socio-religious identity, Gender of family head, Education of family head, Occupation of family head, Number of children aged 12-18 years, Geographical zone, Rural/Urban;
- *Gender-related regional indicators*: Female Workforce Participation Rates, Percentage of females who have completed primary education, Ratio of female and male daily wage rate;[5] and,

[5] These variables were calculated for NSS-regions from the NSS data set from Blocks 4 and 5.3.

- *Supply of educational facilities*: No. of schools per '000 population, Percentage of schools without girls toilet, Percentage of schools with female teachers.[6]

Choice of econometric model

The dependent variables are D_1 and D_2 (household level disparity levels). Although both variables are continuous, the OLS method is not appropriate as there is a censoring problem within the measures of disparities adopted. Consider a household where the boy is educated up to primary level (score of 4) while the girl is not educated at all (score is 0). In this case, $D_1 = 4 – 0 = 4$. Compare this with another household, where the boy is educated up to (say) secondary level. Although disparity level is higher, D_1 (and also D_2) is same for both households. Thus, disparity levels higher than 4 (-4) are censored and observed as 4 (-4). While the Tobit model appears to be the relevant econometric model in this case, there is a problem with using this method also. The frequency distribution of D_1 and D_2 indicates presence of an unusually high spike (with over 70 per cent of observations) for $D_1 = D_2 = 0$. The resultant lack of matching between variation in the independent variables and the largely constant dependent variable may reduce the explanatory power of the estimated model. So the Tobit model, too, may not be appropriate for our dataset.

We have, therefore, categorized the dependent variables into three categories as follows:

Households discriminating in favour of girls ($D_1= D_2<0$)

Households who do not discriminate ($D_1= D_2=0$)

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[6] These were calculated for the district level from District Information System for Education (DISE) data pertaining to 2005, retrieved on 23 December 2010 from http://www.dise.in/drc.htm.

Households discriminating in favour of boys ($D_1 = D_2 > 0$)

The response variable generates three precise categories. Further, as the variable has a natural (ordinal) ranking/ordering – higher the values of the dependent variable mean that household favour sons more – an *ordered logit* (McCullagh 1980) appears to be the appropriate model.[7] Now the ordered logit model has three variants, depending upon its underlying variant:

a) *Proportional odds model*: The ordered logit models fit a parallel slope model where the regression lines are parallel to each other – only the intercepts differ, corresponding to the outcomes.

   Now the assumption of constant gradient across the independent variables is a strong assumption. To test whether the slope coefficients may be assumed to be constant across the outcome categories Brant (1990) suggests a χ^2 based test. If the null hypothesis of constant slope is rejected then the assumption of constant slopes has to be relaxed. In this situation, two alternative models may be chosen based upon a likelihood ratio test of nested models (Williams, 2006).

b) *Variable parameter model*: This model goes to the other extreme of the proportional odds model by assuming that slopes of *all* variables vary with outcomes.

c) *Partial proportional odds model*: Lying between these two extremes is the partial proportional odds model, where slopes of only selected models are allowed to vary, keeping slopes of other variables constant. The variables for which the proportional odds assumption is relaxed are chosen on the basis of the Brant test.

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[7] An ordered logit model is used in cases where the dependent variable (y) is continuous but unobserved. This latent variable is measured using an observed discrete variable (y*) which clubs together all values of y falling within certain ranges. This latent variable has another characteristic – it is ordinally ordered.

4.1 Disparity in Mean Score (D_1)

The results of the Brant test (χ^2= 2174.79, p=0.00) indicate that the proportional odds model is not valid; the value of the likelihood ratio statistic for testing nestedness of the partial odds model within the variable parameter model (χ^2=11.71, p=0.4695) indicates that the former model is the most parsimonious form of the model. The results of this model are given in Table 2.

Table 2: Results of Partial Proportional Odds Model – Mean score

Disparity in Mean Educational Score (D_1)	Pro-Girls vs Equal Treatment			Pro Girls, Equal Treatment vs Pro Boys		
	Odds Ratio	z	P>z	Odds Ratio	z	P>z
Child Sex Ratio (0-6 years)	1.00	-2.22	0.03	1.00	3.51	0.00
Per capita income	1.00	6.09	0.00	0.99	-2.54	0.01
No. of children (11-18 years)	0.82	-9.07	0.00	1.19	8.51	0.00
Urban (RC)	1.00			1.00		
Rural	1.27	4.29	0.00			
Muslim (RC)	1.00			1.00		
HUC	1.28	3.00	0.00	0.60	-6.73	0.00
HST	1.23	2.63	0.01			
HSC	1.11	1.75	0.08			
HOBC	1.21	2.85	0.00	0.91	-1.60	0.11
All Others	1.03	0.32	0.75	0.91	-0.91	0.36
Female headed households (RC)	1.00			1.00		
Male headed households	1.07	0.79	0.43	0.29	0.40	0.00
Central (RC)	1.00			1.00		
North	0.81	-2.87	0.00	0.81	-2.87	0.00
South	1.66	5.05	0.00	0.48	-8.52	0.00
East	1.04	0.40	0.69	0.83	-2.58	0.01
West	1.69	4.10	0.00	0.68	-3.60	0.00
North-east	0.71	-3.02	0.00	1.10	0.89	0.37
Primary (RC)	1.00			1.00		

Disparity in Mean Educational Score (D_1)	Pro-Girls vs Equal Treatment			Pro Girls, Equal Treatment vs Pro Boys		
	Odds Ratio	z	P>z	Odds Ratio	z	P>z
Illiterate	0.88	-2.02	0.04	1.31	5.34	0.00
Literate	0.74	-2.53	0.01	1.32	2.84	0.01
Secondary	1.26	3.11	0.00	0.59	-8.45	0.00
HS & above	1.55	4.18	0.00	0.43	-9.19	0.00
SE in agriculture (RC)	1.00			1.00		
SE in non-agriculture	1.03	0.63	0.53			
Ag labour	1.03	0.26	0.80	1.19	2.37	0.02
Rural NF Labour	0.90	-1.02	0.31	1.14	1.63	0.10
Other Rural Labour	0.88	-1.78	0.08			
Urban SE (RC)	1.00			1.00		
Wage & Salary Earner	0.98	-0.30	0.77			
Casual Urban Labour	0.93	-0.73	0.46			
Urban Labour	0.96	-0.29	0.77			
No. of schools / 000 persons	1.00	-1.47	0.14			
Percent of schools with girls toilet	1.00	-3.74	0.00	1.00	-0.87	0.39
Percent of schools with female teachers	1.00	-3.00	0.00	1.00	-3.00	0.00
Ratio of female-male wage	1.10	0.50	0.61	1.69	3.19	0.00
Female Work Participation Rate	1.00	0.93	0.35			
Percent of females completing primary education	1.01	1.90	0.06	0.97	-11.67	0.00
Intercept	2.64	6.33	0.00	-1.57	-4.53	0
Model Statistics						
Observation	17866					
Wald Chi2 (52)	7008.3		0.00			
Pseudo R2	0.0938					

The partial proportional odds model is estimated using log likelihood estimates with 17866 no. of observations. The Wald χ^2 is 7008.3 (p=0.00), indicating that the model as a whole fits significantly better than an empty model (model with $\beta_1 = \beta_2 = \beta_3 = \ldots = \beta_n = 0$). As the conventional measure of goodness of fit cannot be estimated, we use McFadden's Pseudo R^2 (= 0.09). The low value of Pseudo R^2 reflects the substantial heterogeneity within our sample.

The odd ratio of Child Sex Ratio is statistically significant at 5 percent levels in both models. However, their signs vary – in case of the first model (Favour girls versus Equal treatment & favour boys), the coefficient is negative, while in the second model (Favour girls & equal treatment versus Favour boys), it is positive. This implies that families residing in areas where child sex ratio is low tend to be equitable, while those residing in areas with high child sex ratio tend to discriminate. What is important is that, although families discriminate, such discrimination may be not only in favour of sons, but also daughters.

Other important results of the model are as follows:

1. Households with low per capita income or with large number of children are more likely to discriminate, though this discrimination can be in either direction.
2. Analysis of the coefficients of socio-religious groups yields interesting results. HUC and HOBC families tend to be more equitable than Muslims. Comparison of Muslim parents with HSC and HST parents, however, reveals that the latter are

more likely to discriminate against daughters. Behavior of All Others does not significantly differ from Muslims.

3. Households residing in rural areas are more likely to favour sons than households residing in urban areas.
4. Male headed households are more likely to favour sons than female headed households.
5. Analysis of the behavioural differences across geographical zones is also interesting. Households residing in North and East India are less likely to favour sons than those residing in Central India. While South and West Indian families tend to treat children equitably, households in North-east Indian states[8] are more likely to favour daughters than Central Indian families.
6. While family heads without education or below primary education tend to educate sons more than daughters, those with secondary or higher levels of education tend to behave in a more equitable manner.
7. Most of the occupational categories have coefficients statistically insignificant at 10 per cent level. However agricultural labourers and rural non-farm labourers tend to discriminate in favour of sons more than those self-employed in agriculture. On the other hand, 'Other rural labourers', tend to favour daughters compared to those who are self-employed in agriculture.
8. Coefficient of schools per '000 persons is insignificant at 10 per cent level. Parents residing in areas having schools with separate girls' toilet and with female teachers are more likely to favour daughters.

[8] The matriarchal system prevailing in North-eastern states is an important factor underlying this result.

9. Kingdon and Theopold (2008) point out that economic return to education may have an ambigious impact on demand for schooling. Table 2 reveals that ratio of female to male daily wages motivates parents to discriminate in favour of sons. High female work force participation rate, on the other hand, does not lead to discrimination.
10. Households residing in areas having high proportion of women with at least primary education tend to treat children equitably.

4.2 Disparity in Maximum Score (D_2)

We next present the results of the ordered logit based on D_2 (gap in maximum score). The results of the Brant test (χ^2= 1448.76, p=0.00) and the likelihood test (χ^2=10.05, p=0.5258) indicates that the partial odds model is the most appropriate model. Although the pseudo R^2 is again very low (=0.09), the Wald χ^2 is satisfactory (=1804.71; p=0.00). The results of this model are given in Table 3.

Table 3: Results of Partial Proportional Odds Model – Maximum Score

Disparity in Maximum Educational Score (D_2)	Pro-Girls vs Equal Treatment			Pro Girls, Equal Treatment vs Pro Boys		
	Odds Ratio	z	P>z	Odds Ratio	z	P>z
Child Sex Ratio (0-6 years)	1.00	-1.66	0.10	1.00	1.47	0.14
Per capita income	1.0006	5.66	0.00	0.99	-7.32	0.00
No. of children (11-18 years)	1.20	4.76	0.00	0.82	-6.64	0.00
Urban (RC)	1.00			1.00		
Rural	1.33	4.55	0.00			
Muslim (RC)	1.00			1.00		
HUC	1.45	3.72	0.00	0.57	-6.49	0.00

Disparity in Maximum Educational Score (D_2)	Pro-Girls vs Equal Treatment			Pro Girls, Equal Treatment vs Pro Boys		
	Odds Ratio	z	P>z	Odds Ratio	z	P>z
HST	1.47	2.91	0.00	1.06	0.59	0.56
HSC	1.36	3.19	0.00	0.92	-1.06	0.29
HOBC	1.33	3.39	0.00	0.87	-2.17	0.03
All Others	1.12	0.89	0.38	0.89	-1.03	0.30
Female headed households (RC)	1.00			1.00		
Male headed households	1.23	3.07	0.00			
Central (RC)	1.00			1.00		
North	0.87	-1.73	0.08			
South	1.63	4.38	0.00	0.53	-6.89	0.00
East	0.90	-1.58	0.12			
West	1.60	3.20	0.00	0.69	-3.06	0.00
North-east	0.63	-3.61	0.00	1.11	0.90	0.37
Primary (RC)	1.00			1.00		
Illiterate	0.79	-3.25	0.00	1.41	6.08	0.00
Literate	0.73	-2.22	0.03	1.40	3.17	0.00
Secondary	1.25	2.52	0.01	0.58	-7.42	0.00
HS & above	1.54	3.39	0.00	0.42	-7.83	0.00
Self-Employed in agriculture (RC)	1.00			1.00		
Self-Employed in non-agriculture	0.98	-0.27	0.79			
Ag labour	1.10	1.34	0.18			
Rural NF Labour	0.84	-1.53	0.13	1.14	1.57	0.12
Other Rural Labour	0.91	-1.19	0.24			
Urban SE (RC)	1.00			1.00		
Wage & Salary Earner	0.96	-0.51	0.61			
Casual Urban Labour	0.97	-0.26	0.79			
Urban Labour	1.22	0.78	0.43	0.67	-1.50	0.13
No. of schools / 000 persons	1.00	-2.25	0.03	1.00	0.04	0.97
Percent of schools with girls toilet	1.00	-3.66	0.00	1.00	-0.27	0.79

Disparity in Maximum Educational Score (D_2)	Pro-Girls vs Equal Treatment			Pro Girls, Equal Treatment vs Pro Boys		
	Odds Ratio	**z**	**P>z**	**Odds Ratio**	**z**	**P>z**
Percent of schools with female teachers	1.00	-2.18	0.03			
Ratio of female-male wage	0.93	-0.34	0.73	1.84	3.34	0.00
Female Work Participation Rate	1.00	0.75	0.45			
Percent of females completing primary education	1.01	2.93	0.00	0.96	-12.23	0.00
Intercept	1.72	3.52	0.00	0.03	0.07	0.94
Model Statistics						
Observation	17866					
Wald Chi2 (52)	1804.71		0.00			
Pseudo R2	0.0928					

The coefficient of Child Sex Ratio is weakly significant (at 10 per cent level) only for the first model, having a negative coefficient. In the second model, it is insignificant. This would imply that families in regions having a high child sex ratio may tend to favour daughters.

On the other hand, families with higher per capita income levels tend to invest equally on sons and daughters. A similar tendency is also observed among families with large number of children. Rural households families, however, tend to invest more on sons than daughters, compared to urban households. Households residing in northern and north-eastern states educate daughters more than sons compared to central Indian households. In southern and western part of the country children are treated equally, relative to central Indian states. The behaviour of the eastern families is not significantly different from the behaviour of central Indian families.

HUC and HOBC families treat sons and daughters equally compared to Muslims. HSC and HST parents, on the other hand, are less likely to discriminate against daughters than Muslims parents. The behaviour of the residual group (All Others) is not significantly different from the Muslims.

Male headed households are more likely to favour sons over daughters compared to female headed households. Families headed by persons with less than primary education tend to discriminate against daughters, while those with education levels higher than primary level treat children equitably. Results show that discrimination levels do not vary across occupation of household head.

If the educational infrastructure is better (number of school per '000 persons) or is more sensitive to girls (per cent of schools with girls toilet and per cent of schools with female teacher) families tend to invest relatively more on daughters.

A high female-male wage ratio motivates parents to withdraw daughters from school, possibly due to higher opportunity cost of educating them. Regions where a high proportion of females have completed primary education tend to treat sons and daughters equitably.

CONCLUSION

This paper examines gender disparity in educational attainments at primary level and its variations across households, focusing on households containing both sons and daughters. The study is based on two measures of gender discrimination – gap in mean educational score of siblings (D_1) and difference in maximum educational score of siblings (D_2). Contrary to the literature indicating the presence of a pro-son bias in case of parental investment on children, this study found a low incidence of gender bias in primary education. More than 70 per cent of the households in India educate sons and daughters equally. In the majority of households, there is no difference in maximum educational levels attained by children of either sex. Further, in about 10 per cent of households we found that parents educated daughters more than sons.

Analysis of the association between child sex ratio prevailing in the region and gender discrimination in education also reveals a surprising result. In regions having a low child sex ratio – where we may infer sex selective abortion, infanticide and neglect of daughters in infancy is practiced – we find that discrimination is relatively lower than in regions where child sex ratio is high. This is observed in both rural and urban areas, and whether we consider gender gaps in mean score or maximum score. Controlling for social, economic and demographic factors the linear relation between child sex ratio and gender gap in mean score is replaced by a non-linear relationship. Regions with a low child sex ratio tend to treat sons and daughters equitably; regions with high child sex ratio are found to discriminate – but this may be either in favour of sons or in favour of daughters. In the case of gender gap in maximum educational score we find a tendency to favour daughters in regions with low child sex ratio.

In other words, parents may adopt practices and behavioural patterns aimed to reduce the number of daughters. But once they pass early childhood, surviving girls are subject to lower levels of discrimination, at least in the education sphere:

> "women in Punjab are not treated very badly compared with the rest of India. Punjab has the highest female age at marriage next to Kerala. … Parents also make the sacrifices required to educate their daughters: levels of female literacy in Punjab are well above the India average and are increasing rapidly." (Dasgupta, 1987: 93).

Alam and Kingdon (2008) also reports that although girls are less likely to be enrolled in schools, expenditure on their education is at par with that of their siblings. The absence of disparity in educational outcomes also parallel studies of gender disparities in household expenditure on siblings using the Rothbart framework in South Asia (for review see Deaton, 1997). This implies that parental attitude towards education and practices may be more complicated and less uniformly negative at lower levels of education than commonly portrayed.[9]

The findings may also be explained in terms of the demand and supply side measures to increase educational attainments and reduce gender gaps introduced by the Government. Schemes like the Mid Day Meal Scheme, Sarva Shiksha Abhiyan (literally 'Campaign for Universal Education'), District Primary Education Program and National

[9] Some studies have suggested that families with sons may increase labour supply (Lundberg and Rose, 2002: Knight, 2010). This increases household resources, so that educational outcomes of girls with brothers are better than outcomes of girls with sisters (Chen et al., 2007). However, this does not explain why a greater part of the additional resources are not diverted to the son, but seem to be shared equally at the primary level.

Programme for Education of Girls at Elementary Level Gender are designed to provide need-based incentives like residential schools for girls (Kasturba Gandhi Balika Vidyalaya), escorts, stationery, textbooks, uniforms, bicycles, in addition to creation of new infrastructure and improvement of existing facilities. This has reduced the gender gap in enrolment figures has reduced in recent years.[10] A recent evaluation of supply side intervention in rural Rajasthan estimated that such measures increased enrollment ratios of girls by about 6-7 percentage points though the reduction in gender gap was lower (3-5 percentage points, since some benefits were also shared by boys) (Meller, 2010). This study, too, provides evidence of the success of government policies in reducing gender disparities.

But, while the march towards universalizing enrolment and primary education is reducing gender disparity, other forms of disparities (across socio-religious communities) are persisting. Secondly, we also have to ensure that the reduction in gender disparity at the primary level does not taper off at higher levels of education. Our estimates from the NSS survey shows that if school education is considered, about a third of households treat sons and daughters equitably, while 45 per cent of families discriminate against girls. In rural areas, the latter figure increases to 49 per cent. This indicates the need to shift our focus to other forms of disparity and gender disparity at higher levels.

REFERENCES

[10] Mehta (2010) estimates that 69.46 million boys and 66.68 million girls were enrolled in Class I to V in 2007-08; the Gender Parity Index was 0.93.

AGARWAL, B. (1994) *A Field of One's Own: Gender and land rights in South Asia*, Cambridge University Press, Cambridge.

ALAM, M. & KINGDON, G. G. (2008) 'Gender and household educational expenditure in Pakisthan', *Applied Economics*, vol. 40 no. 20, pp. 2573-2591.

ALKIRE, S. (2010) *Human Development: Definitions, Critiques, and Related Concepts*, Human Development Research Paper 2010/01, UNDP.

BEHRMAN, J. R., POLLACK, R. A. & TAUBMAN, P. (2007) *From parent to child: Intra-household allocations and inter-generational relations in the US*, University of Chicago, Chicago, Illinois.

CHEN, S. H., CHEN, Y-C & LIU, J-T. (2007) *Separate effects of sibling gender and family size on educational achievements – Methods and first evidence from population registry*, Discussion Papers in Economics No. 09/03, Department of Economics, Royal Holloway University of London.

BOISSIERE, M. (2004) *Determinants of Primary Education Outcomes in Developing Countries*. Background paper for evaluation of the World's Bank support to primary education, The World Bank, Washington.

BRANT, R. (1990) 'Assessing Proportionality in the Proportional Odds Model for Ordered Logit Regression', *Biometrics*, vol. 46 no. 4, pp. 1171-1178.

BROWN, P. H. & PARK, A. (2002) 'Education and Poverty in Rural China', *Economics of Education Review*, vol. 21 no. 6, pp. 532-41.

CONNELLY, R. & ZHENG, Z. (2003) 'Determinants of School Enrolment and Completion of 10-18 Year Olds in China', *Economics of Education Review* 22(4), pp. 379 88.

DASGUPTA, M. (1987) 'Selective discrimination against female children in India', *Population and Development Review*, vol. 13 no. 1, pp. 77-100.

DASGUPTA, M. (2006) 'Cultural versus biological factors in explaining Asia's missing women: Response to Oster', *Population and Development Review*, vol. 31 no. 3, pp. 529-535.

DEATON. A. (1997) *The analysis of household surveys: A microeconometric approach to development*, John Hopkins University Press, Baltimore.

DELELEGN, A. (2007) 'Intra-household gender bias in child educational spending in rural Ethopia', Ethopian Journal of Economics, vol. 16 no. 2, viewed 4 April 2011 <http://www.ajol.info/index.php/eje/cart/view/46186/32587>

DEOLALIKAR, A.B. (1993) 'Gender Differences in the Returns to Schooling and in School Enrollment Rates in Indonesia', *The Journal of Human Resources*, vol. XXVIII no. 4, pp. 899-932.

DESAI, S. & KULKARNI, V. (2008) 'Changing Educational Inequalities in India in the Context of Affirmative Action', *Demography*, vol. 45 no. 2, 245-270.

DRÉZE, J. & KINGDON, G.G. (2001) 'School Participation in Rural India', *Review of Development Economics*, vol. 5 no. 1, pp. 1-24.

FAIRLIE, W.R. (2005) 'An Extension of the Blinder-Oaxaca Decomposition Technique to Logit and Probit Models', *Journal of Economic and Social Measurement*, vol. 30, pp. 305-316.

HADDEN, K. & LONDON, B. (1996) 'Educating Girls in the Third World: The Demographic, Basic Needs, and Economic Benefits', *International Journal of Comparative Sociology*, vol. 37, pp.1-2.

HANNUM, E. C., KONG, P.A. & ZHANG, Y. (2008) *Family sources of educational gender inequality in rural China: A critical assessment*, China Human Capital Projects, Gansu Survey of Children and Families, University of Pennyslvania.

IRVING, M. & KINGDON, G.G. (2008) *Gender patterns in household health expenditure allocation: A study of South Africa*, CSAE Working Paper Series 2008-32, Centre for the Study of African Economies, University of Oxford.

KNIGHT, J. (2010) 'Son preference and household income in rural China', *Journal of Development Studies*, vol. 46 no. 10, pp. 1786-1805.

LIN, M-J. & LUOH, M-C. (2008) 'Can Hepatitis B mothers account for the number of missing women? Evidence from new million newborns in Taiwan', *American Economic Review*, vol. 98 no. 5, pp. 2259-2273.

LIN, M-J., LIU, J-T. & QIAN, N. (2010) *More Missing Women, Fewer Girls Dying: The Impact of Abortion on Sex Ratios at Birth and Excess Female Mortality in Taiwan*, Mimeograph. Yale University, viewed 4 April 2011

<http://www.econ.yale.edu/~nq3/NANCYS_Yale_Website/Research_files/LinLiuQian_201002.pdf>

LUNDBERG, S. J. & ROSE, E. (2002) 'The effect of sons and daughters on men's labour supply and wages', *Review of Economics and Statistics*, vol. 84 no. 2, pp. 251-268.

LOCKHEED, M. (2010) *Gender and social exclusion*, Education Policy Series, No. 12, International Academy of Education & International Institute for Education Planning, UNESCO.

KINGDOM, G.G. (2001) 'The Gender Gap in Educational Attainment in India: How Much Can Be Explained?', *Journal of Development Studies*, vol. 39 no. 2, pp. 25-53.

KINGDON, G.G. & THEOPOLD, N. (2008) 'Do returns to education matter to schooling participation? Evidence from India', *Educational Economics*, vol. 16 no. 4, pp. 329-350.

MCCULLAGH, P. (1980) 'Regression models for ordinal data', *Journal of Royal Statistical Society, Series B*, vol. 42, pp. 109-142.

MEHTA, A. (2010) *Elementary Education in India: Progress towards UEF, 2007-08, Analytical Tables*, National University of Educational Planning and Administration, and Department of School Education and Literacy, Ministry of Human Resource Development, New Delhi.

MELLOR, M. (2010) *Narrowing the gender gap in education: Evidence from a girl focused supply side intervention in rural India*, Mimeograph. Department of Economics, Universitat Pompeu Fabra, viewed 23 April, 2011 <http://www.econ.upf.edu/eng/graduates/gpem/jm/pdf/paper/meller.pdf>

NANDA, A. & VÉRON, J. (2005) Child sex ratio imbalances, fertility behaviour and development in India: Recent evidence from Haryana and Punjab, in Attańe, I. & Véron, J. (eds.) *Gender discrimination among young children in Asia*, French Institute of Pondicherry, Pondicherry , pp. 91-131.

OAXACA, R.L. (1973) 'Male-female wage differences in urban labour markets', *International Economic Review*, vol. 14, 693-709.

OSTER, E. (2005) 'Hepatitis B and the case of missing women', *Journal of Political Economy*, vol. 113 no. 6, pp. 1163-1216.

PROBE (1999) *Public Report on Basic Education in India*, Oxford University Press, New Delhi.

SAHNI, M., VERMA, N., NARULA, D., VARGHESE, R.M., SEENIVAS, V. & PULIYEL, J.M. (2008) 'Missing girls in India: Infanticide, foeticide and made-to-order pregnancies? Insights from Hospital-based sex ratio-at-birth over the last century', *PloS One*, vol. 3 no. 5, 21 May.

SATHAR, Z.A. & LLOYD, C.B. (1994) 'Who gets primary schooling in Pakistan: Inequalities among and within families', *The Pakistan Development Review*, vol. 33 no. 2, 103–134.

SEN, A.K. (1990) Gender and Co-operative Conflicts, in Tinker, I. (ed) *Persistent Inequalities: Women and World Development*, Oxford University Press, New York, pp. 123-149.

SEN, A.K. (1992) 'Missing women', *British Medical Journal*, vol. 304 (7 March), pp. 587-588.

SEN, A.K. (2003) 'Missing women – revisited', *British Medical Journal*, vol. 327 (6 December), pp. 1297-1298.

SEN, G. & BATLIAWALA, S. (2000) Empowering women for reproductive rights, in Presser, H. & Sen, G. (ed.) *Women's empowerment and demographic processes*, Oxford University Press, Oxford, pp. 3-14.

SEN, G., IYER, A. & MUKHERJEE, C. (2009) 'A Methodology to Analyse the Intersections of Social Inequalities in Health', *International Journal of Human Development and Capabilities*, vol. 10 no. 3, pp. 397 – 415

UNITED NATIONS DEVELOPMENT GROUP (2003) *Indicators for monitoring the Millennium Development Goals: Definitions, rationale, concepts and sources*. United Nations, New York.

UNESCO INSTITUTE FOR STATISTICS (UIS) (2005) *Global Education Digest (2005)*, UIS, Montreal.

WILLIAMS, R. (2006) 'Generalized Ordered Logit/ Partial Proportional Odds Models for Ordinal Dependent Variables', *The Stata Journal*, vol. 6 no. 1, pp.58-82.

Appendix Table A1: Socio-economic profile of sample households

GEOGRAPHICAL		HOUSEHOLD		HEAD OF FAMILY	
Place of residence		**Socio Religious Community**		**Gender of Decision-maker**	
Rural	66.9	H-UC	19.71	Male	90.99
Urban	33.1	H-ST	6.26	Female	9.01
Geographical Zones		H-SC	14.81	**Education of Decision-maker**	
North	12.7	H-OBC	30.27	Illiterate	32.09
South	15.79	Muslims	16.15	Literate	3.58
East	12.83	All Others	12.8	Up to Primary	25.25
West	10.93	**Expenditure Groups**		Up to Secondary	25.49
North-East	12.19	BPL HHs	22.94	HS & above	13.59
Central	35.56	DBPL HHs	52.95	**Occupation**	
		Affluent HHs	24.11	SE in non-agriculture	15.51
				Ag Labour	8
				Other Rural Labour	6.53
				SE in Ag	26.99
				Urban SE	15.39
				Wage/Salary Earner	11.86
				Casual Urban Labour	4.18
				Urban Others	1.66
				Rural Others	9.89