Intrahousehold Bargaining, Birth Order and the Gender Gap in Schooling in India

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Abstract

This paper utilizes an extensive household level data from India to examine the impact of intra household bargaining in resource allocation on the bias against schooling of girls. I use qualitative data on the response of married women to questions on decision making authority and social status, within the household, to develop an indicator of female autonomy. If relative autonomy and level of education reflect the bargaining power of husband and wife within the household, gender differences in allocation of resources may indicate difference in preferences which can influence the relative schooling outcomes of boys and girls. I find that mother's autonomy has a significant impact on reducing the bias against the education of girls in India. While both, more educated mothers and fathers show a preference for investing in daughter's education, the differential impact of mother's education on girls is significantly larger. I go beyond analyzing gender differences in resource allocation to examine whether gender bias in education differs by order of birth of the child. The results show that first born boys and girls have higher educational attainment than last borns. However, this birth order gap is narrower for daughters, with the marginal attainment of last born girls being higher than that of first born girls. These conclusions persist even when I control for unobservable family heterogeneity and regional differences in returns to female education. From a policy perspective, the results suggest that empowerment of women can have a significant effect on raising the level of schooling of the girl child in India.

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1 Introduction

Becker's (1981) unitary model has been used extensively to analyze the economic behavior of households. It assumes that all members of a household have similar preferences or that a benevolent dictator maximizes a household utility function subject to its total budget constraint. The household is, therefore, treated as a monolithic entity represented by a single production or welfare function. Although the unitary view of the household is useful in explaining several aspects of its behavior, it does not specify the mechanism that determines the allocation of resources or how individual preferences could influence this process. Manser and Brown (1980) and McElroy and Horney (1981) proposed alternative models for analyzing household behavior, explicitly accounting for divergence in the preferences of its members.[1] In these models, allocation of resources among household members is the outcome of a cooperative or non-cooperative Nash-bargained equilibrium. Most empirical studies have rejected the theoretical models which suggest that intra household distribution of resources is consistent with the unitary view.

This study tests a household bargaining model through the analysis of the impact of the mother's bargaining power on gender differences in the allocation of resources in India. I specifically focus on child quality, measured by schooling of female and male children, as an outcome of the household's resource distribution process. Education of children is characterized as a public good within marriage. However, husband and wife may value differently the education of boys and girls. King and Lillard (1987) find that among the Chinese in Malaysia mother' education has a positive effect on boys and girls schooling but father's education affects only sons' attainment. In Peru, King and Bellwe's (1989) analysis shows that maternal education has a bigger effect on the probability of the daughter attending school while the same is true for the effect of father's education on son's schooling[2].

Due to empirical and theoretical tractability, the literature, thus far, has focused primarily on the quantitative determinants of individual bargaining strength such as education, exogenous income, and 'extra household environmental parameters'[3] and their influence on the allocation of expenditure on the health and education of children. However, in developing countries, there are many qualitative and social aspects of bargaining power that go beyond these narrow specifications. Sociological and anthropological studies have found that qualitative determinants of a woman's bargaining strength

[1] Several other models of intra-household dynamics have been developed since, Chiappori (1988a, 1992), McElroy (1990), Lundberg and Pollak (1993).

[2] Most studies have analyzed the effect of intra household bargaining on child's health. Thomas (1994) finds that the education of the mother has a larger impact on daughter's height while paternal education has a greater effect on son's, for United States, Ghana and Brazil.

[3] McElroy (1990) introduced extra-household environmental parameters, which shift the maximum utility attained by the individual in the single/divorced state, such as, parental wealth and government transfers.

influences child survival, nutrition and demographic structure of the household[4]. Women who participate in household decision-making are likely to have greater bargaining power. Social norms, such as restrictions on freedom of movement, the practice of wearing a veil and physical abuse reflect cultural and social aspects of female autonomy. Though cultural norms are reflected in quantitative determinants of bargaining they might have an independent effect on household resource allocation.

I use data available from an extensive household survey in India to develop an indicator for the mother's status in the household. This indicator of status and autonomy within the household and the level of education of the mother are the two determinants of her bargaining strength. I go beyond analyzing the gender preferences of mothers and fathers to look at whether this preference differs by the birth order of the child. Differences in allocation in resources within a household by order of birth of a child might exist due to financial or time constraints, biological and cultural factors[5].For instance, parental preferences might differ by the children's birth order due to differences in division of labor within the household. In particular, it is possible that early born daughters' time is a closer substitute of mothers' time than later born daughters' if mothers depend more on elder daughters help in performing household chores. In this scenario, mothers may favor schooling of younger daughters more as compared to older daughters[6].

The empirical results of this paper suggest that there exists a strong effect of mother's bargaining power on the gender bias against girls' schooling in India. Mother's with greater autonomy and higher education show a significant preference in investing in daughter's education. Grade attainment of a girl child is higher by 0.01 standard deviation relative to her cohort mean for a one standard deviation increase in the mother's autonomy index. Mother's education has a dramatic impact on increasing the schooling of the girl child. A girl whose mother has completed primary schooling attains a 0.25 standard deviation higher grade than a girl whose mother has less than primary schooling. I find evidence that the gender bias in education is not uniform across the order of birth of children. Early born children tend to have better educational outcomes than later borns. However, this birth order gap is narrower for daughters, with the marginal attainment of last born girls being higher than that of first born girls. But this preference for last born girl declines as the mother's bargaining power rises.

[4] Blumberg (1988), Das Gupta (1995)

[5] Behrman and Taubman (1986) find empirical evidence of higher years of schooling for early born children in the U.S. Parish and Willis' (1993) findings for Taiwan show that credit constraints limit the attempts of parents to finance their child's education with the older sisters bearing the cost of educating younger siblings of both sexes. Birdsall (1991) looks at time constraint of the non-working mother (viz. helping with homework), which tends to favor the first and last-borns. The psychology literature (Zajonc, 1976) claims that lower birth orders have a biological advantage since they reside in households with higher average education. Cultural factors, such as the importance of the oldest son for funeral rites, old age security can cause parents to prefer first born sons.

[6] Recent work using Philippine (Ejrnaes and Portner, 2002) and Brazilian (Emerson and Souza, 2002) data shows that lower birth order children are more likely to be discriminated against when it comes to educational investments.

The rest of the paper is organized as follows. The conceptual background and theoretical framework is presented in section 2. Section 3 is a discussion of the data and the empirical model. Section 5 presents the results while sections 6 and 7 discuss the empirical results and conclude, respectively.

2 Background

2.1 Conceptual Framework

In 1998-99 female literacy in India was 52% and school enrollment for 6-10 year old girls was 78% against 85% for boys. The gender gap widens dramatically at higher levels of schooling, to more than thirteen percentage points[7]. This bias could arise due to factors which are primarily socio-cultural and economic in nature. In most north Indian states, marriages are exogamous (Dyson and Moore, 1983). That is, women marry men who are unrelated in kinship and often reside geographically far from the bride's current residence. Thus, a daughter is considered as outside her natal community when she is married and as a result is not expected to contribute significantly to her parent's economic well-being in old age. This patrilineal system is associated with limited inheritance rights of women over physical assets, particularly land, which is usually divided among the male heirs. This reinforces the low expectations of economic support from a daughter. In most of south India, on the other hand, females marry closer to their natal home and in some instances they also have property rights.

From an economic perspective, the higher the expected future productivity of a child the greater is the resource investment in that child by the parents[8]. In India the returns to education for a female are lower due to limited economic opportunities as well as the male and female wage differential. The economic and socio cultural factors, thus, reinforce each other and provide the rationale for discrimination against the girl child across and within regions.

These sociological and economic factors are reflected in the poor status of *married* women within the household. Less than a third of married women in India work for pay outside the home, about half are involved in decisions regarding the purchase of major household items, and freedom of movement is limited (NFHS, 1988-99). Women almost completely lose control over their dowry after marriage unlike women in some other Asian countries, such as China[9]. Opportunities outside marriage are limited in the society, which has nearly a 100% marriage rate and high social costs of

[7] NFHS (1998-99) summary statistics
[8] Rosenzweig and Schultz (1982)
[9] Bloch and Rao (2002) show how physical violence is used as a bargaining instrument to extract larger transfers from the wife's family in three villages in South India.

divorce. It is interesting to note, however, that in regions with relatively higher female autonomy, particularly the south, the gender gap in schooling is significantly lower[10]. A natural question arises, as to whether a stronger bargaining position of the mother in the household has any influence on the gap in schooling between the male and female child.

Demographic studies suggest that men have a strong preference for boys and are more willing to limit family size if they have sons, particularly in developing countries (Mason and Taj, 1987). Recent research for the U.S. finds that women are more likely to be divorced or unmarried if they bear daughters and a first born daughter is less likely to be living with her father than a first born son (Dahl and Moretti, 2003). The psychology literature documents that fathers are more likely to spend time with their sons and play a bigger role in their development that that of daughters (Lamb, 1987; Morgan, Lye and Condran, 1988). The gender disparity in returns to investment could be another possible cause for divergence in resource allocations made by men and women. If boys are more likely to help the father on the family farm or in business, then men may favor schooling of sons more. In matrilineal society mothers are more likely to interact with their daughters and be less dependent on the sons for financial support. This may induce greater investment by women in daughter's education. Differences in gender preferences of men and women may, therefore, reflect the technology of rearing, as suggested by the psychology literature, or differences in tastes and preferences arising from economic or cultural factors.

2.2 Analytical Model

The motivation for the empirical analysis comes from the intra household bargaining model developed by McElroy and Horney (1981). Consider two individuals, *h* and *w*, who are married to each other and bargain over the allocation of resources within the household. Each individual has a threat point, which is divorce or remaining single. *h* and *w*'s utility from a cooperative equilibrium is represented by a von Neuman-Morgenstern utility function,

$$U^i = U^i(q, x_0^i, x_1^i) \qquad i = h, w \tag{1}$$

I assume that q is a vector of the quality of children born within marriage, $q_c = q_c(\theta, \eta_h, \eta_q)$ where θ is a vector of child c's individual characteristics including age, gender and order of birth, η_h is a vector of household characteristics (such as number of siblings, religion and caste) and η_q represents

[10] In the four largest north Indian states of Madhya Pradesh, Rajasthan, Bihar and Uttar Pradesh, on an average, the gap in school enrollment of male and females in 6-17 age group is 18 percentage points as compared to 6 percentage points in the

community characteristics (such as access to schools and local employment opportunities). Child quality, therefore, is a pure public good produced within the household and x^i_0 is the private goods consumed by *h* and *w*. x^i_1 is leisure of individual *i*. If *h* and *w* do not marry, they maximize utility outside marriage subject to their budget constraint. This is represented by the indirect utility function,

$$V^i = V^i(p, I^i, \alpha^i) \tag{2}$$

where, *p* is the vector of prices $p = p(p_0, p_1^h, p_1^w)$. p_q is normalized to 1 and I assume it is the same for all q_c. Thus, *p* is the vector of prices of the private goods relative to the public good *q*. *I* is non-wage, exogenous income. α^i is a vector of individual characteristics which reflecting *i*'s bargaining power (for instance level of education and social status). Thus, V^i serves as the threat point or the utility from remaining single. We can derive the demand functions for the public and private goods by maximizing the Nash social welfare function or the product of the gains from cooperation[11],

$$Z = [U^h(q, x_0^h, x_1^h) - V^h(p, I^h, \alpha^h)][U^w(q, x_0^w, x_1^w) - V^w(p, I^w, \alpha^w)] \tag{3}$$

subject to the total household budget constraint,

$$q + p_0 x_0^h + p_0 x_0^w + p_1^h x_1^h + p_1^w x_1^w = (p_1^h, p_1^w)T + I^h + I^w \tag{4}$$

T is the total time available for work. The solution to this maximization problem generates a set of demand conditions for *q*. Assuming $\alpha^h = 1$,

$$q_c = \mathrm{e}\,(p, I^h, I^w, \alpha^w, \theta, \eta_h, \eta_q) \tag{5}$$

If the wife's bargaining strength, α^w is an increasing function of her level of education and her social status or the index of her autonomy, $\frac{\partial V^w}{\partial \alpha^w} > 0$. The magnitude and direction of $\frac{\partial q_c}{\partial \alpha^w}$ would, then be a function of the sex, birth order and other individual characteristics of the child *c*.

The implication of the model above can be illustrated in terms of a utility possibility frontier in Fig.1 below. If the wife's threat point rises from V^{w1} to V^{w2} due to an increase in α^w, while the

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south Indian states of Tamil Nadu, Andhra Pradesh, Karnataka and Kerela (NFHS, 1998-99).

[11] A more general theoretical model proposed by Chiappori (1988a) assumes that households make Pareto efficient allocations. The social welfare function can be written as a weighted sum of individual utility functions. The individual weights are a function of prices, individual income and other characteristics of the individual such as α. The weights are, therefore, an increasing function of the bargaining power of that household member. The resulting demand functions would again be a function of prices, individual income and α.

husband's threat point remains at V^h, then the new bargaining equilibrium shifts from point c to point d. Thus, the wife's utility within marriage rises to U^{w2} from U^{w1} while that of the husband falls to U^{h2}, implying that the wife is able to attain an intra household allocation of resources closer to her preference.

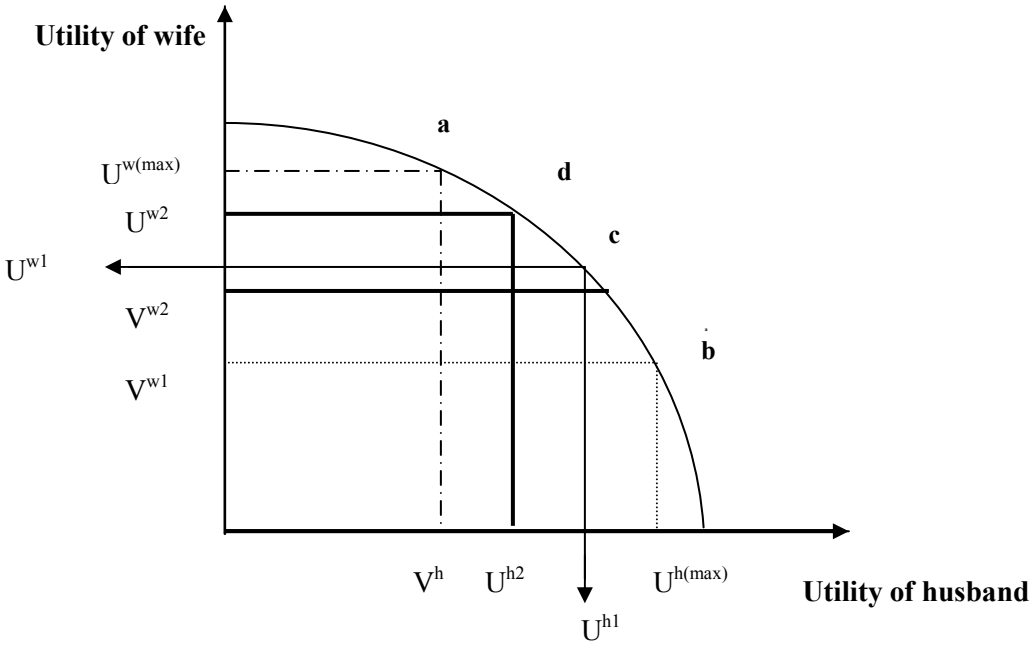


Fig.1: Utility Possibility Frontier

3 Data and Empirical Methodology

3.1 Data

The National Family Health Survey (NFHS II) 1998-99 is a cross-sectional, nationally representative household survey of more than 92,000 rural and urban households and 90,000 women in the reproductive age group belonging to these households. The survey is conducted at the household as well as individual level. The household data contains information on each member currently residing in the household- their sex and age, education, work and marital status. Though the survey does not collect information on household income, it provides data on ownership of assets such as durable goods and land by the household. A standard of living index has been created using the information on asset ownership by the NFHS[12]. This index represents the permanent income of

[12] The NFHS constructs a standard of living index by ranking households according to their ownership of assets into 1=low, 2=medium and 3=high standard of living.

the household and is, therefore, more representative of resources available for the household to invest in the children's schooling than current income[13]. The individual data contains information on the health, labor force participation, education and pre and ante natal care, for all ever married women in the households surveyed and who are aged 15-49. Extensive information is also available on the reproductive history of these women. In addition, the individual survey participants were also asked questions on household decision-making and their socio cultural status within the household.

Primary schooling in India begins at age 5 or 6 and high school is expected to be over by age 18. However, the average age at marriage for females in India is very low, typically less than 18[14]. Since the household data includes only those children who are currently residing in the household, the empirical analysis is restricted to all children in the school going age group of 6-15 whose mother is currently married.

The sample summary statistics are presented in Table 1. The sample includes a total of 68,224 children of which 48% are girls. The mean age of the children in the sample is 10.15. 29% of the children are first born and the average number of children per family is almost 4. A little over 80% of the children are currently enrolled in school and the average grade attainment is third grade. Parent's education is included in terms of single years of schooling. On an average the mother is likely to have completed less than primary school or have just 3 years of schooling while the father is more likely to have completed primary schooling. The mean standard of living of the child's household is medium or less, considering that 70% of the sample is rural.

3.2 Empirical Methodology

There are two questions addressed in this paper-

1. How does the bargaining power of the mother within a household affect her children's schooling by gender?
2. Are there any birth order effects on educational attainment for female and male child and is there any interaction between birth order and the mother's bargaining power?

Q_i, the quality of child i, generated by cooperative Nash bargaining can be expressed as,

$$(6) \qquad Q_i = \beta_0 + \beta_1 D_i + \beta_2 A_i^m + \beta_3 A_i^{m2} + \beta_4 D_i A_i^m + \beta_5 D_i A_i^{m2} + \beta_6 E_i^m + \beta_7 D_i E_i^m + \beta_8 \mathbf{Z}_i + \mu_i$$

[13] In a rural economy, there could be seasonal variations in earnings opportunity and income.
[14] The average age at first marriage in the NFHS survey is 17.4 for all women and 16.9 for women with at least one child in the age group of 6-15.

D_i is a dummy for female child. A_i^m is the autonomy of child i's mother m. The effect of autonomy on child's schooling could be non linear. For instance, if a more autonomous mother is more active outside the household, higher bargaining power may affect child's schooling if less time is spent by the mother on helping the child with homework or other school work. The mother's education E_i^m, takes into account possible non-linearity in the impact of mother's schooling by including dummy variables for whether she has completed primary school, middle school or high school or more. The excluded category is less than primary schooling. $\mathbf{Z_i}$ is a vector of individual and household characteristics which may affect the child quality. As the sibling size increases, it may reduce the quality per child. The socio-economic status of the household is reflected by the age of mother and father, the religion, caste and gender of the head of household[15]. In India Muslim, lower caste and female headed households are more likely to belong to the deprived sections of the population. The permanent income of the household is represented by a standard of living of household index based on the ownership of assets. The impact of the index of autonomy of the on the girl child mother is the sum of $(\beta_2 + \beta_3 + \beta_4 + \beta_5)$, while $(\beta_6 + \beta_7)$ is the effect of the education of the mother on quality of the female child.

As pointed out earlier, there exists considerable regional variation in the mother's education level and status in India. Therefore, the autonomy index and the education of the mother might be correlated with unobservable regional characteristics which will bias the coefficients. They would reflect regional variation in women's empowerment rather then the impact of the variables of interest. The analysis is, thus, further controlled for these unobservable characteristics by using a state fixed effects model for the entire sample in equation 7. D_s is the dummy for the state in which the child currently resides.

$$(7) \qquad Q_{is} = \beta_0 + \beta_1 D_{is} + \beta_2 A_{is}^m + \beta_3 A_{is}^{m2} + \beta_4 D_{is} A_{is}^m + \beta_5 D_{is} A_{is}^{m2} + \beta_6 E_{is}^m + \beta_7 D_{is} E_{is}^m + \beta_8 \mathbf{Z}_{is} + D_s + \mu_{is}$$

Next, we identify the effect of birth order on child quality. Population level birth order might proxy for availability of school resources over a period of time for the entire population. Thus, early born children might have lower schooling not necessarily because of their lower order of birth but due to the unavailability or limited accessibility to schools for their cohort. Later born children could be in an advantageous position because over time the availability and accessibility of schools might have improved. Therefore, in order to identify the effect of order of birth within a family rather than cohort effects, I use a dummy variable to represent whether the child is a first or last born within the family.

[15] Scheduled caste (SC), scheduled tribe (ST) and other backward castes (OBC) are listed in the constitution of India as economically and socially deprived sections of the population. $\mathbf{Z}_i$ includes a dummy for whether the child comes from a household whose head is an SC, ST or OBC.

(8) $$Q_i = \alpha_0 + \alpha_1 D_i + \alpha_2 F_i + \alpha_3 L_i + \alpha_4 F_i D_i + \alpha_5 L_i D_i + \alpha_6 \mathbf{Z}_i + \mu_i$$

F_i is a dummy variable for i being a first born and L_i is a dummy variable for being a last born child in the household in equation 8. The birth order of each child is constructed from the natural birth order as reported by the mother after deleting all siblings who died by or before the age of 5 and by including all siblings irrespective of their current residence[16]. $(\alpha_3 + \alpha_5)$ is the impact of being a last born girl on female child quality. However, if parents desire more children, then current investment decisions in child quality may be affected by future fertility decisions and complicate the birth order effect. For instance, parents planning to have additional children might reduce investments in their last born because of financial constraints. Thus, the coefficient α_2 would be biased downwards. In order to correct for the possible endogeneity of fertility decisions, I restrict the analysis to children of only those families which are complete.[17]

(9) $$Q_i = \gamma_0 + \gamma_1 F_i + \gamma_2 L_i + \gamma_3 D_i + \gamma_4 A_i^m + \gamma_5 A_i^{m2} + \gamma_6 E_i^m + \gamma_7 \mathbf{Z}_i + \gamma_8 L_i A_i^m + \gamma_9 L_i E_i^m + \gamma_{10} D_i L_i A_i^m + \gamma_{11} D_i L_i E_i^m + \mu_i$$

To estimate the effect of greater empowerment of the mother on differential investment in child quality by birth order, I introduce interaction terms in equation 9 between mother's autonomy and level of education and being a last born child. The marginal impact of an increase in mother autonomy and level of education on a last born female child is given by $(\gamma_8 + \gamma_{10})$ and $(\gamma_9 + \gamma_{11})$, respectively. As in equation 7, I estimate a state fixed effects model to control for impact of regional cultural factors.

The primary concern with the analysis is that regional and local heterogeneity in economic opportunities for women may be correlated with women's bargaining power and influence schooling of the girl child as well since, returns to female education may differ between regions. The data is, therefore, restricted to rural India for whom village level information is available. I am then able to control for heterogeneity in local opportunities by analyzing a village fixed effects model. As a final robustness check, the impact of female empowerment on gender bias within families is estimated controlling for differences in gender gap in schooling at the state level. A family fixed effects model is, therefore, able to difference out any unobservable family characteristics such as family environment that may influence the coefficients for female empowerment as well as schooling of

[16] Siblings who died before reaching the school going age are not expected to influence the education investment decisions made by the parents for the surviving children.
[17] The individual survey asks mothers on contraceptive use and desire for future children. I consider all children whose mother or father was sterilized or whose mother did not desire future children, or is infecund and was not currently pregnant, as belonging to completed families.

children. At the same time, controlling for regional gender gap would remove unobservable heterogeneity in culture and economic opportunities for families within a region.

3.3 Defining the Index of Autonomy

In order to determine the position of a woman within the household in terms of the intra-household environment, I construct an index of autonomy of mother m of child i, A_i^m, by using the response to the qualitative questions asked in the individual survey. The questions can be grouped into four categories – 'decision-making authority', 'freedom of movement', 'physical abuse' and 'access to money'. The survey asks the following questions of all ever-married women in the age group of 15-49[18] –

1. Decision-making Authority:
Who makes the following decision in your household?

(COOK)[19] What items to cook?
(HEALTH) Obtaining health care for yourself?
(JEWELRY) Purchasing jewelry or other major household items?
(FAMILY) Your going and staying with parents and siblings?

The responses are scaled[20] as: 1= husband or others in the household, 2= respondent jointly with husband or others in the household, 3=respondent only

2. Freedom of Movement:
Do you need permission to:
(MARKET) Go to the market?
(RELATIVE) Visit relatives or friends?
The responses are scaled as: 1=not allowed to go, 2= yes, 3= no

3. Physical Abuse:
(BEAT) How often have you been beaten or mistreated physically in the last 12 months?[21]

[18] These responses are not likely to be affected by the presence of the husband or mother-in-law since almost 98% of the interviews were conducted with only the respondent present.
[19] The questions have been labeled by the author and not NFHS.
[20] The scale has been slightly modified for responses for decision-making and physical abuse from that in the original data in order to construct the autonomy index. The original scaling was as follows for decision-making authority: 1=respondent,

The responses are scaled as: 1=many times, 2= few times or once, 3=none

4. Access to Money:

(MONEY) Are you allowed to have money set aside that you can use as you wish?

The responses are scaled as: 1=no, 3=yes

The responses are scaled by the degree of autonomy, 1 being low autonomy and 3 being high for all of the questions. Table 2 presents the correlation matrix for the eight autonomy indicators including three additional indicators, the level of education, employment status and the contribution to family earnings of the woman. The correlation matrix is obtained for all currently married women in the individual survey of the NFHS. All the variables are significantly correlated with each other. A woman who is more likely to take her own decisions regarding cooking, purchasing health care and household items is also more likely to have freedom of movement and have access to money. However, a woman is more likely to be physically abused if she is working for cash. This can be better understood from the negative correlation between education and employment. Less educated women are more likely to belong to low income families and therefore have a higher probability of working for pay in order to contribute to the household income and have a higher probability of being physically abused. The negative correlation between the level of education and cooking decisions can again be explained by the fact that better educated women are likely to belong to higher income families which can afford to employ housekeepers/cooks.

I employ common factor analysis to develop an index of female autonomy using the eight indicators of female status described above[22]. Common factor analysis aggregates the various measures of autonomy into one variable which can be interpreted as a single indicator of a woman's position within the household. The analysis captures the maximum information which is common to all the observed variables. For instance, suppose we have data on GDP, telephones per capita, vehicles per capita, population, national income and area of various countries. The variation of nations along these variables can be described along two hypothetical dimensions – economic development and size. The common factor of economic development can, thus, explain variation in GDP, telephones per capita, vehicles per capita and national income across countries and can be interpreted as an index of economic development. Common factor analysis, then, is the means of extracting an aggregate economic development factor. The common factor is an unobservable, hypothetical variable that contributes to the variance of at least two of the observed variables.

2=husband, 3=jointly with husband, 4=others in the household, 5=jointly with others in the household. For physical abuse the original scale was: 1=once, 2=few times, 3=many times, 4=not beaten.

[21] 90% of the women, who reported being physically abused, were beaten by their husbands. I construct the variable BEAT, therefore, only for physical abuse by husband.

As shown in the correlation matrix, the autonomy variables are significantly correlated with each other, implying the existence of certain factors which are common to all the indicators of a woman's status in the household and can be used as a comprehensive measure of autonomy in the regression analysis[23]. Further, the data can be presented and analyzed more succinctly by reducing the number of variables along which the characteristics of the individuals are described in the data. Factor analysis, therefore, groups the interdependent indicators of a woman's status into one descriptive category, an index of autonomy along which the individuals can be ranked.

Table 3 presents the results of the factor analysis for the eight autonomy variables discussed earlier[24]. The analysis results in a total of 8 factors of which the first factor explains 92% of the variance in the eight autonomy variables and has an eigenvalue greater than 1. Factor analysis retains four common factors which have an eigenvalue greater than 0. The factor loadings on the first factor suggest that it is positively correlated with each indicator of autonomy, the correlation being high with decision making authority on health, purchasing jewelry or other household items, visiting family, the market or relatives and having access to money. I use the first common factor as a comprehensive indicator of female autonomy in the regression analysis.

Figures 1-5 relate the first factor, standardized with mean 0 and standard deviation of 1, to a woman's age, education, work status, ethnicity and the household standard of living. As expected, the greater the age of the woman the higher the value of the first factor. This implies that older woman have greater autonomy in a household which is in keeping with the finding of anthropologist Das Gupta (1995) that in India the status of a woman rises as she grows older. While the cohort of younger women is likely to be more autonomous than the older cohort, the age effect dominates the cohort effect. Figures 2-5 show that more educated women, those who are currently working and women who belong to households with a high standard of living have greater autonomy. Thus, the first factor is represents an inclusive set of characteristics of a woman that indicate her position within the household.

As noted earlier in the paper, there exists considerable spatial distribution in the social status of women in India. Table 4 presents the mean of the first factor for each of the 27 states. The mean for northern states such as Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan are negative. The southern and north-eastern states, such as Tamil Nadu, Karnataka, Meghalaya and Sikkim which have traditionally exhibited higher female status, have positive means. These analyses suggest that the first common factor is a reliable representation of the spatial cultural and social factors that affect a woman's status

[22] Refer to the appendix for a discussion on common factor analysis methodology.
[23] I do not include work status in the index because the decision to work may be endogenous to the schooling decisions of the children in the household. Mother's education is included separately in the regressions and is not a part of the index.

I also regress the first factor on several female characteristics that might determine her autonomy, particularly in Indian culture in Table 5. Again, age, education and work status have significant positive coefficients. Muslim women are less likely to be autonomous. A female head of household or non-residence of the husband in the household gives a woman greater authority. The number of male children residing in the household raises her status since in the traditional Indian society a male child is more coveted.

4 Results

Child quality is measured by the deviation of the highest grade attained from the cohort mean. The analysis is restricted to 6-15 year old children whose mother is currently married. Since schooling is not complete for this age group, grade attainment relative to one's cohort is a good approximation of the educational attainment of the child, in addition to taking into account delayed enrollment, drop outs and grade repetition. The deviation of highest grade obtained by the child from the cohort mean has a standard normal distribution with mean 0 and standard deviation 1. Individual weights for the mother are used in the analysis to make the results nationally representative.

4.1 Impact of mother's empowerment on grade attainment

As a preliminary analysis I bypass the autonomy index and use the eight female status variables which have a standard normal distribution in the analysis. Table 6 presents the results of regressing the outcome variable on these autonomy indicators used in the common factor analysis. In column 1 I regress the attainment outcome separately on each indicator. In each of these regressions I include household and individual characteristics which might have an independent influence on the dependent variable and might be correlated with the autonomy indicators. The coefficient for all the eight indicators is positive and very significant. The greatest impact on the child's attainment is of freedom of movement and less physical abuse of the mother. The R-squares are not very different for each of the regressions, re establishing that the autonomy variables do not differ much in explanatory power and are correlated with each other. In column 2 grade attainment is regressed on all the autonomy variables to sift out the indicators which have an independent effect. Decision making authority is mostly represented by the autonomy in the decision on what to cook and freedom of

[24] In Stata, factor analysis can be conducted using regression or Bartlett method. The results are similar for both methods. The table presents the results of the regression method.

movement is characterized by the authority to visit the local market without needing permission. Access to money and lower domestic violence has an independent effect on the child's attainment.

Having confirmed that the autonomy indicators influence the child's level of schooling, I use the first factor as a comprehensive indicator of the mother's status in Table 7. The index has a standard normal distribution, with mean 0 and standard deviation of 1. In column 1 I exclude education of the mother and father as explanatory variables in the regression. The significant negative coefficient for the female child dummy confirms the well-acknowledged fact that a female child is likely to have lower educational attainment than a male child in India. Mother's autonomy raises grade attainment for both male and female children but has a differentially higher effect on the female child's schooling shown by the positive coefficient for the interaction of the female dummy with the autonomy index. However, the impact of the autonomy of the mother has a negative impact on attainment at higher levels for both sons and daughters.

Since the autonomy index is correlated with mother's level of education, the coefficient of the index might represent the impact of mother's education rather than her status in column 1. In column 2, therefore, the level of schooling of the mother is included as regressors. The coefficient of mother's autonomy for a female child is lower but significant. Mother's education has a greater effect on the schooling of the girl child relative to a male child represented by the positive coefficients for the interaction of mother's education with the female child dummy. A girl child whose mother has completed primary schooling has 0.27 standard deviation higher grade attainment compared to a girl whose mother has less than primary schooling. However, the marginal effect of mother's education declines with increasing levels of her schooling but the differential impact on girls schooling increases as the mother's level of education rises. The gender gap, therefore, narrows as the educational attainment of the mother rises.

Column 3 includes father's level of schooling which may be correlated both with mother's education and autonomy, if there is assortative mating. Inclusion of father's education reduces the significance of mother's education for boys more than for girls. But there is no significant change in the coefficients for autonomy. It is interesting to note that the impact of father's education on grade attainment is also differentially higher for female child but much smaller than the differential impact of mother's schooling on the girl child's attainment. Also, impact on grade attainment increases in father's level of education while the impact of mother's education declines.

As discussed in section 4.2, unobservable cultural and regional factors could bias the coefficients of interest. In column 4, I analyze a state fixed effects model. Low levels of mother's autonomy are no longer significant for the male child but higher levels of autonomy reduce male child's attainment. A one standard deviation increase in mother's autonomy raises the educational attainment of the daughter by approximately 0.03 standard deviations from the cohort mean relative

to a boy. The impact of mother's education on the attainment of boys is significantly lower. Higher level of schooling of the mother has a negative effect on grade attainment of the male child but the coefficients for the impact of the female child continue to be positive and slightly larger. The differential impact of the father's education on grade attainment of daughters is smaller.

The NFHS data also contains information on village characteristics. Within state heterogeneity on economic opportunities may not be able to account for local variation in returns to schooling. A further robustness check for whether the coefficients on mother's bargaining power reflect geographical variations in returns to female education would be compare children across families within a village. Thus, I restrict the data to rural India and include village dummies in column 5 in table 7. Certain characteristics of the village correlated with the autonomy index reduce the magnitude of the coefficient, but it continues to be significant. Interestingly, higher levels of mother's education are now more detrimental to grade attainment for male and female children but mothers show a larger and significant preference for educating daughters. Father's preference for investing in daughters declines further.

From the analysis in Table 7, I conclude that a more empowered mother reduces the gap in grade attainment between boys and girls. But as a mother's empowerment rises, the marginal impact on schooling of both male and female child is smaller. Since mother's are generally more likely to help with homework and meet other schooling requirements of the child, a more empowered mother might be more involved in activities outside the house and less involved in the education of her children, thus, negatively affecting their progress through school.

The coefficient for the index of female autonomy may be representing unobservable family characteristics which influence both mother's status and girls' schooling. Heterogeneity in the tastes and preferences of families and unobservable background characteristics may bias the coefficients. Table 8, therefore, analyses a family fixed effects model to difference out within family heterogeneity[25]. In column 1 the sample includes all children in the 6-15 age group while column 2 restricts the sample to children belonging to families with at least one girl and one boy in this age group. The coefficients for the variables of interest are similar in the first two columns since in column 1 the source of the variation in the data would be from families included in column 2 regression. In columns 3 and 4, I include state dummies interacted with female child to control for within state gender gap in school while comparing boys' and girls' schooling within families. The magnitude of the impact of mother's autonomy is smaller but significant. The magnitude of the effect of father's education at higher levels is larger while that of the mother is smaller. However, the

[25] In India households are typically extended, consisting of more than one family. In my models, the family fixed effect is equivalent to mother fixed effects.

marginal impact of mother's education on daughters' schooling is still significantly higher than that of father's.

4.2 Impact of birth order on grade attainment

The impact of birth order on grade attainment is presented in table 9. The exogenous variable of interest is the dummy for whether the child, who is currently residing in the household, is the first-born or the last born in two parent families. The excluded group, then, is the middle birth order children of the family. In column 1 I exclude indicators of mother's empowerment and father's education from the analysis. Surprisingly, being a female does not affect grade attainment but being a first born female implies attaining a lower grade than a last born compared to middle order siblings. However, last born male child is likely to attain as high a grade as a first born male. In column 2 I include mother's autonomy index as a regressor. The results for birth order are similar to those in column 1. As expected from the analysis in the last section, mother's autonomy has a differentially large effect on a female child's attainment. Mother's level of education is included in column 3, which reduces the size of the coefficients on autonomy but the conclusions remain unchanged.

The analysis in columns 1-3 included children belonging to families which may have additional new births. Fertility decisions are endogenous to family size and the children's gender composition. Thus, if parents are still making fertility decisions, the coefficients for birth order would be biased. I restrict the sample, therefore, to children of only those families, which are complete and include father's education as an additional control variable in columns 4-7. Last-born daughters continue to have an advantage compared to early born daughters, though the magnitude of the coefficient for a fist born female is smaller.

A state fixed effects model is estimated in columns 5-6, to account for unobservable heterogeneity across regions. In column 5, interestingly, inclusion of state fixed effects shows that there is a bias towards schooling of a first born son. In the cross sectional analysis there is no evidence of impact of birth order on schooling of boys. A possible explanation for this result is that early born girls are more likely to be burdened by household chores, taking care of their younger siblings and in some instances working outside the home to financially support the family. Most child labor is not for wages, and it is likely that early born girls engage in helping in cooking, cleaning, collecting firewood, taking care of younger siblings. In the Indian society first born sons are the main inheritors, perform religious rites and are expected to take care of their parents when they are old. Thus, socio-cultural factors may produce this bias in favor of first born sons. The implications for mother's autonomy and education on attainment are similar to those drawn in tables 7 and 8. A more

educated mother continues to significantly prefer investing in the schooling of her daughter vis-à-vis her son.

Two interaction terms are included in an alternative model by multiplying the last-born dummy with the level of education of the mother and the autonomy index in column 6. The interaction of mother's education (defined in years of schooling) with a dummy for a last born, has a significant negative effect on the education of the last born children. This might imply that as the opportunity cost of mother's time increases, she devotes less time to rearing of the later born children whose educated is affected more. A similar impact is found for interaction of the autonomy index with a last born female child. More educated mothers favor first born sons while more autonomous mothers don't reveal any birth order bias towards sons. However, they do reduce the gap between early and last born daughters' attainment as do more autonomous mothers. In column 7, the model is estimated with village dummies. The interpretation of the results is unchanged.

Table 10 presents the results of within family analysis controlling for the gender bias at the state level. The magnitude of the birth order coefficients is higher and they are more significant. On the margin, female early born attain a lower grade while later born girls perform better. The more educated the mother, the greater is the bias against last born male and female children.

In order to interpret these results, I present Figures 6-9 showing the predicted and fitted values for the effect of the variation in the mother's bargaining power on the gender gap in attainment. The predicted values are obtained for 11 year old girls and boys with 3 siblings whose mother is 34 years old and father is 40. The child belongs to a Hindu, non-SC/ST/OBC, urban household whose head is male, standard of living is medium and whose father resides in the household. The father has completed middle school. The figures represent all-India effects of female bargaining strength.

Figure 6 shows the fitted values for grade deviation when the autonomy index is varied by one standard deviation from the mean, keeping the mother's education constant at less than primary schooling. As suggested by the regression analysis, the relationship between grade attainment and the autonomy index is concave. The gap in grade attainment declines as the index increases. The results are more dramatic for mother's schooling. More than 80% of the women in the sample have completed only primary school education. The effect of higher level of education of the mother is exaggerated because of the smaller sample sizes for middle and higher levels of mother's schooling. So the more relevant comparison groups are women with less than primary schooling and those which have primary school education. In Figure 7, raising the mother's schooling from less than primary schooling to at least complete primary schooling reverses the gap in grade attainment. A one standard deviation increase in the index of autonomy from the mean reduces the gap in deviation of highest grade attained from cohort mean by 24%. Note that at higher levels of mother's schooling, the

marginal impact on grade deviation from cohort mean declines more sharply for girls than boys. Similar conclusions can be drawn from figures 8-9 which show the impact of mother's autonomy and schooling on the predicted probability of current school enrollment.

5 Discussion

The empirical analysis re establishes the widely acknowledged fact that in India there exists a bias towards education of boys. Female autonomy and education are the two conduits which impact empowerment in the analysis. A more autonomous woman is one, who has greater control over her own decisions in terms of freedom of movement, family decision making and disposing property or income. Higher autonomy, could therefore be a reflection of greater access to market opportunities, ownership of property or assets outside marriage or it could represent basic personality characteristics. Thus, a woman who has greater command over personal and household decisions would also have greater say in the education of her children. Though education and autonomy are correlated, as shown in figure 2, education might have an independent effect on children's schooling. A more educated woman would have higher returns in the labor market and be less dependent on the males in the family, including the sons for economic support. A more empowered woman is thus more likely to resent discrimination against the girl child and overcome social and family pressures to conform to cultural norms.

Given the existing gender gap in education, I find strong evidence in support of my claim that greater empowerment of females reduces the gap in education between boys and girls across and within different cultural milieu. This gap is wider for early born children who are educationally more deprived than their later born siblings. However, this gap is narrower for girls.

The analysis reveals that a more autonomous woman would show a preference towards higher investment in the education of her daughter. But as a woman's control over household decisions rises, it affects adversely the progress through school of both sons and daughters. The index of autonomy is positively correlated with the probability that the mother works for cash or is self employed or is involved in activities outside the home. The opportunity cost of time of a more autonomous mother on household activities would, therefore, be higher. In India it is less likely that husbands participate actively in the education of their children and their progress through school. Women are more involved in child rearing activities. Even if mothers are not directly involved with schooling of the kids, the opportunity cost of schooling of the child would rise if mother works outside home. There could, therefore, be a substitution of mother's time spent in household chores by

children spending more time in daily household activities, thus reducing their leisure or learning time or both[26].

The effect of mother's education on reducing the gender gap in education is larger in magnitude than that of father's education. However, higher levels of schooling of the mother have a lower marginal effect on grade attainment of both daughters and sons. Impact on current school enrollment of daughters is smaller if the mother has completed high school than if she has completed middle school. The implication of this result is that the biggest jump in the attainment of girls in the country can be achieved by ensuring that mothers have completed primary school. The average level of schooling of mothers in the data is less than primary schooling. Only five years of primary education of mothers may not only wipe out the gap but even reverse it. The reason for lower marginal impact of higher levels of mother's education on children's grade attainment can be explained by a similar argument presented in the previous paragraph. This argument is bolstered by the increasing marginal effect of father's level of education on children's schooling. Father's are more occupied in income generating activities outside the household and less likely to participate in child nurturing. Their income earning ability rises with higher education and so does their desire for more educated children.

In India, sons inherit land and property. Usually, the eldest son is considered to have the first right on property. The first born son is expected to support his parents in old age and is also important for performing funeral and other religious rites. Thus, parents could have pure preferences in order of birth of sons due to cultural factors. Additionally, it is possible that the household is less resource constrained when the family is smaller, or the technology of child rearing is such that parents are able to devote more time to early borns resulting in better outcomes for them. Thus, both cultural, technological and economic factors could reinforce each other to increase allocation to early born sons. On the other hand, if the earnings capacity of parents increases over their life time, investments in later born children may be higher. In this scenario, first born children might be expected to be economically active at an early age and contribute to the family income. Since resource constrained families are likely to withdraw a daughter from school first, on an average, therefore, the gap between early and later born sons is larger than between early and later born daughters. Research for developing countries has also found that girl's time is a closer substitute for mother's time (Rosenzweig, 1981). In developing countries, older girls are more likely to be burdened with household chores, expected to contribute to the income of the household by working for wages or on

[26] This result is supported by Rosenzweig's (1981) finding for rural India, that where adult female wages are high both sons and daughters are less likely to attend school in contrast to places where male adult wages were high and both sons and daughters were more likely to be in school. His results also suggest that the time of mothers and female children are closer substitutes than those of mothers and male children.

the family farm or drop out of school and marry at an early age. Therefore, the early born daughters may be subsidizing the education of younger daughters in the family.

6 Conclusion

In this paper I present qualitative and quantitative evidence of the impact of a woman's bargaining power on educational attainment of her children, by sex and order of birth, in India. I use common factor analysis to construct an index of intra-household female autonomy using the response to qualitative questions asked in the National Family Health Survey of India. The index of autonomy represents socio cultural norms which enhance a woman's access to resources outside marriage. Woman's education and index of autonomy are used as the twin determinants of her bargaining power.

Across as well as within regions, the bargaining power of the mother has significant impact on raising the educational attainment of the girl child. The impact of autonomy differs significantly by gender. Grade attainment of female children rises by 0.01 standard deviation relative to her cohort mean with a one standard deviation increase in mother's autonomy index. Mother's education has a dramatic effect on increasing the schooling of the girl child. A girl whose mother has completed primary schooling attains a 0.25 standard deviation higher grade than a girl whose mother has less than primary schooling. The marginal effect of both autonomy and mother's education is smaller at higher levels for girls' and boys' progress through school. These conclusions are in keeping with results of research on impact of greater bargaining power of the mother on health and mortality of girls versus boys in India.

The discrimination against investment in the education is not uniform by the order of birth. First born girls and boys are more likely to attain a higher grade than last born. However, last-born girls have better educational attainment relative to first born girls. Evidence suggests that this gap in grade attainment between early and later born children increases with the bargaining power of the mother.

From a policy perspective, the results suggest that empowerment of women can have a significant effect on raising the level of schooling of the girl child. It is essential to not only educate females but also to change social and cultural norms which constrain their intra-household freedom and decision-making authority. This calls for mobilization of women's groups and participation by the government and other non government organizations in this effort. One of the important channels through which this can be achieved is the formation of women's self-help groups such as 'Mahila Mandals' and 'Stree Shakti' at the grass roots level. Though a first attempt has been made at the formation of such groups, there is a long way to go before they become effective. The Central scheme

of providing loans through the 'Sampoorn Gram Samriddhi Yojana (SGSY)' scheme and other micro credit programs can help in increasing women's self reliance and lowering their dependence on males for financial support. Adult education programs need to be strengthened and brought back to the forefront of the fight against illiteracy. Thus, direct interventions to raise women's literacy and their social status can be very effective in reducing the gender gap in schooling in India.

A primary concern with the analysis is that there may be some unobservable factors which simultaneously determine woman's empowerment and the schooling of the girl child. Looking at the cross section, it may be that regional cultural factors drive the coefficient for female bargaining upwards. The analysis addresses the issue of omitted variables by including a regional fixed effects model. A two stage least squares approach, using an instrument for the index of autonomy may be another strategy for correcting simultaneity bias which would require data on natal resources or assets at the time of marriage. But as discussed earlier, Indian women have little, if any, control over their dowry after marriage and any control may be endogenous to other household decisions. Another concern with the analysis is the endogeneity of fertility decisions. That is, unobserved determinants of family size may be correlated with birth order dummy and education. Pure sex preference for boys might imply that there is differential stopping behavior, entailing larger sibling size for girls and therefore less household resources per female child in the cross section. Some of the endogeneity issue has been controlled by comparing only those families which are no longer making fertility decisions. Household level panel data on completed education, birth order and female autonomy and status would be useful in checking the robustness of the results obtained from the cross section and also to determine the relationship between the evolution of female bargaining power over time and its impact on the gender gap in schooling in India. Public policy would be more effective if there was a clearer understanding of the channels through which the gender gap in education functions, particularly the impact of the order of birth of the child.

Table 1. Summary Statistics

Variables	Observations	Mean	Standard Deviation	Minimum.	Maximum
Female	68,224	0.48	0.50	0	1
Age	68,224	10.15	2.83	6	15
First born	68,224	0.29	0.45	0	1
Last born	68,224	0.24	0.43	0	1
Number of Siblings	68,224	2.96	1.69	0	13
Current enrollment	68,224	0.81	0.39	0	1
Highest grade attained	68,224	3.11	2.75	0	11
Mother's age	68,224	33.82	5.74	19	49
Father's age	68,224	39.76	7.07	15	96
Mother’s autonomy index	68,224	0.00	1.00	-2.64	2.49
Mother's years of schooling	68,224	2.93	4.22	0	22
Father's years of schooling	68,224	5.73	4.94	0	22
Muslim household	68,224	0.15	0.35	0	1
SC/ST/OBC household	68,224	0.59	0.49	0	1
Standard of Living of household	68,224	1.89	0.70	1	3
Rural household	68,224	0.71	0.46	0	1

Table 2. Weighted Correlation Matrix of Autonomy Indicators For All Currently Married Women

N=84,461	COOK	HEALTH	JEWELRY	FAMILY	MARKET	RELATIVE	MONEY	BEAT	EMPLOY	CONTRIBUTE	MOMEDU
COOK	1										
HEALTH	0.1893	1									
JEWELRY	0.1798	0.4078	1								
FAMILY	0.1529	0.4051	0.6057	1							
MARKET	0.1449	0.2319	0.2239	0.2497	1						
RELATIVE	0.1191	0.2237	0.2231	0.2825	0.6784	1					
MONEY	0.0990	0.1613	0.1723	0.1721	0.2183	0.1994	1				
BEAT	-0.0266	0.0213	0.0286	0.0307	0.0253	0.0230	0.0521	1			
EMPLOY	0.1067	0.0311	0.0543	0.0537	0.0673	0.0742	0.0004	-0.0889	1		
CONTRIBUTE	0.0987	0.0493	0.0794	0.0729	0.0834	0.0780	0.0343	-0.0845	0.8273	1	
MOMEDU	-0.0731	0.0894	0.0836	0.0901	0.1485	0.1162	0.1948	0.1275	-0.2176	-0.1423	1

Source: Author's calculations from NFHS 1998-99, Individual Survey
Note: All correlations are significant at 5% level

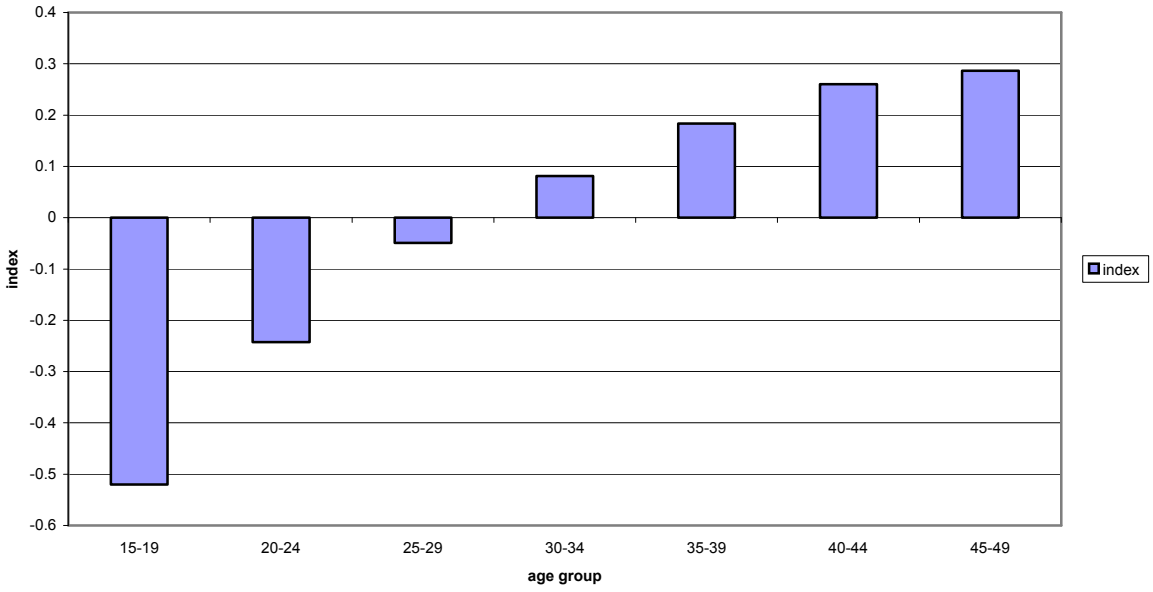
COOK	1=husband or others only, 2=jointly with husband or others, 3=respondent only
HEALTH	1=husband or others only, 2=jointly with husband or others, 3=respondent only
JEWELRY	1=husband or others only, 2=jointly with husband or others, 3=respondent only
FAMILY	1=husband or others only, 2=jointly with husband or others, 3=respondent only
MARKET	1=not allowed to go, 2=yes, 3=
RELATIVE	1=not allowed to go, 2=yes, 3=no
MONEY	1=no, 3=yes
BEAT	1=many times, 2=few times/once, 3=none
EMPLOY	1=not working, 2=unpaid or self employed, 3=paid
CONTRIBUTE	1=none, 2=half or less, 3=more than half or all of household income
MOMEDU	1=no schooling, 2=primary school complete, 3=secondary school or more

Table 3. Factor Analysis Results For All Currently Married Women

N=84,461	Factor loadings				
Variable	1	2	3	4	Uniqueness
COOK	0.2487	0.0759	-0.1354	0.0828	0.9072
HEALTH	0.4880	0.2165	-0.0436	0.0447	0.7110
JEWELRY	0.5857	0.3732	0.0182	-0.0322	0.5118
FAMILY	0.6194	0.3346	0.0339	-0.0534	0.5004
MARKET	0.6466	-0.4263	-0.0079	-0.0037	0.4000
RELATIVE	0.6453	-0.4177	-0.0002	-0.0368	0.4078
MONEY	0.3215	-0.0266	0.0628	0.1019	0.8816
BEAT	0.0509	-0.0018	0.1632	0.0559	0.9677

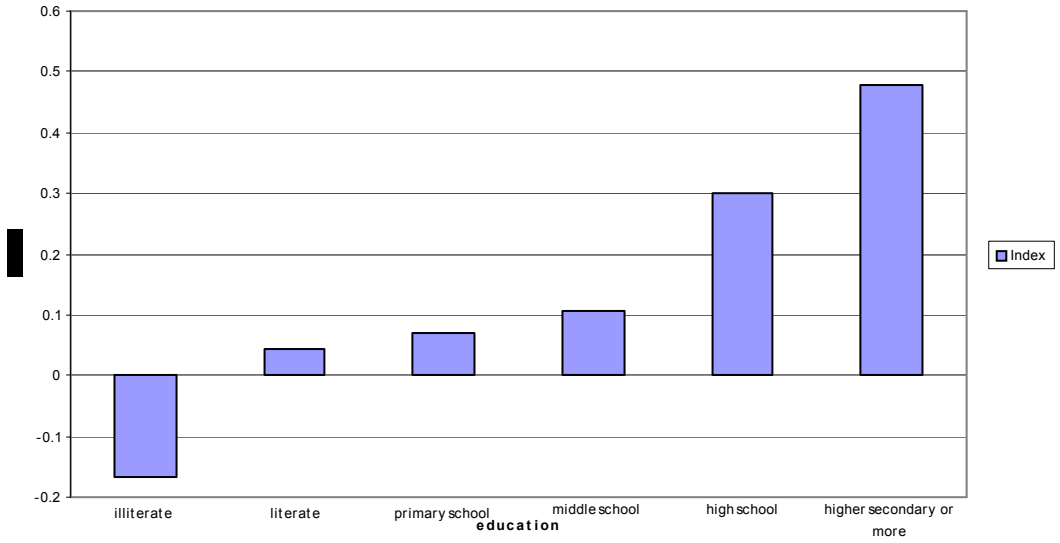
Source: Author's calculations from NFHS 1998-99, Individual Survey

Figure 1: Index by Age Group for all Currently Married Women



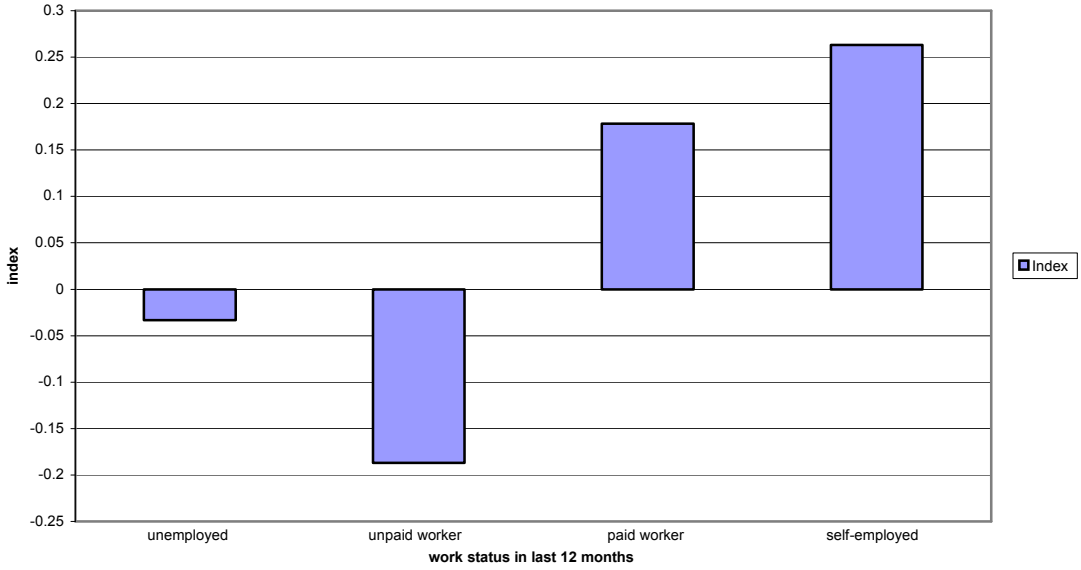
Note: The index has mean 0 and standard deviation 1, there could be some excluded group for whom the X variable is missing.
Source: Author's calculations from NFHS 1998-99, Individual Survey

Figure 2: Index by Education Level for all Currently Married Women



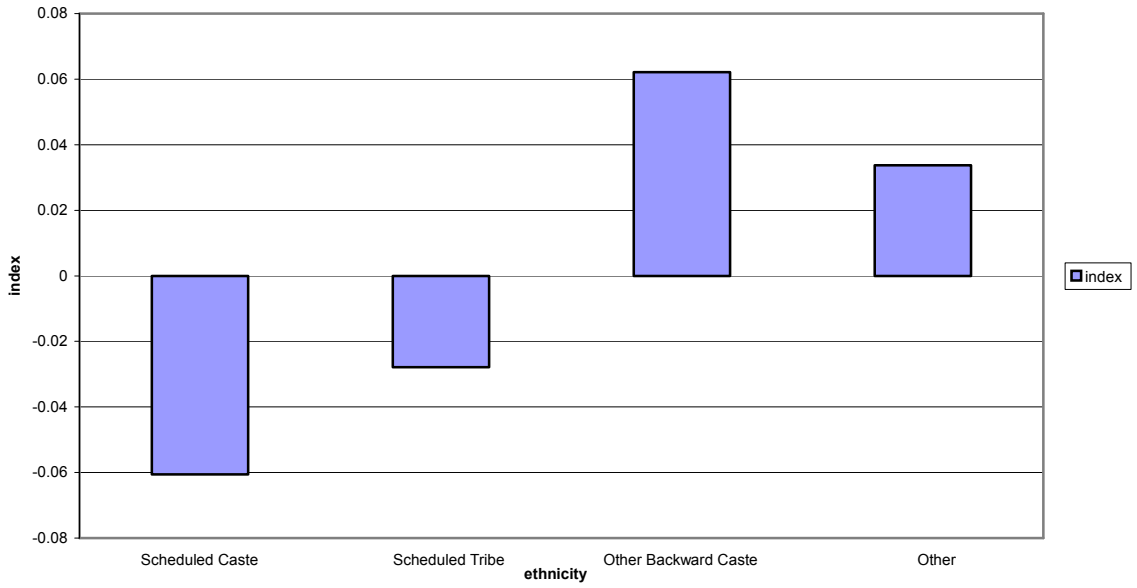
Source: Author's calculations from NFHS 1998-99, Individual Survey
Note: The index has mean 0 and standard deviation 1, there could be some excluded group for whom the X variable is missing.

Figure 3: Index by Work Status for all Currently Married Women



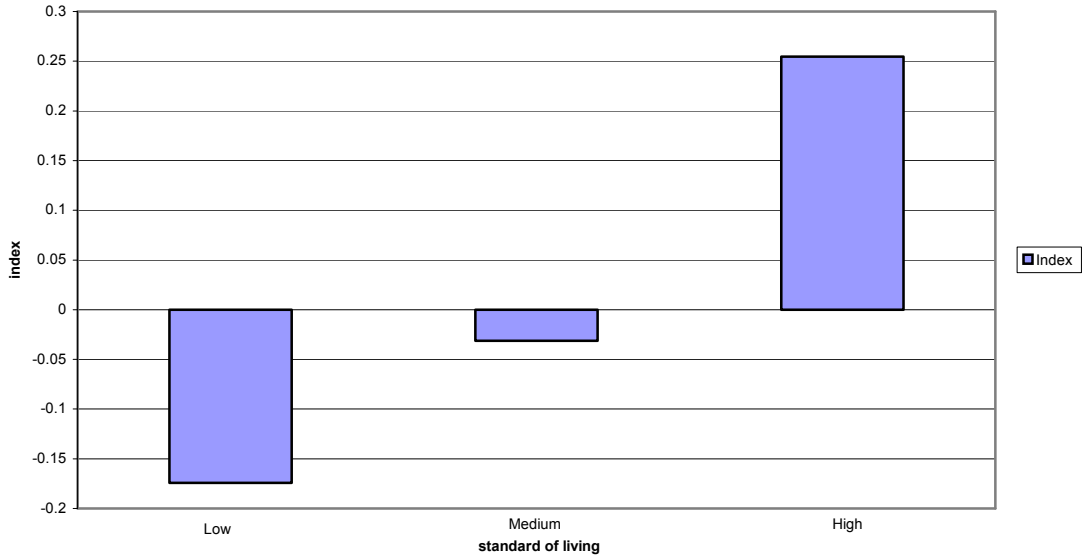
Source: Author's calculations from NFHS 1998-99, Individual Survey
Note: The index has mean 0 and standard deviation 1, there could be some excluded group for whom the X variable is missing.

Figure 4: Index by Ethnicity for all Currently Married Women



Source: Author's calculations from NFHS 1998-99, Individual Survey
Note: The index has mean 0 and standard deviation 1, there could be some excluded group for whom the X variable is missing.

Figure 5: Index by Standard of Living for all Curently Married Women



Source: Author's calculations from NFHS 1998-99, Individual Survey
Note: The index has mean 0 and standard deviation 1, there could be some excluded group for whom the X variable is missing.

Table 4. Weighted Means of Autonomy Index by State for all Currently Married Women

State	Mean	Std. Dev.
Andhra Pradesh	-0.08	0.87
Arunachal Pradesh	0.63	0.87
Assam	-0.25	0.71
Bihar	-0.29	1.00
Goa	0.87	1.05
Gujarat	0.56	0.96
Haryana	0.21	0.79
Himachal Pradesh	0.48	0.75
Jammu	-0.24	0.78
Karnataka	-0.02	1.05
Kerela	0.42	1.03
Madhya Pradesh	-0.33	0.94
Maharashtra	0.04	1.03
Manipur	0.06	0.82
Meghalaya	0.54	0.94
Mizoram	0.65	0.83
Nagaland	0.01	0.62
New Delhi	0.29	0.91
Orissa	-0.38	0.83
Punjab	0.42	0.78
Rajasthan	-0.37	0.87
Sikkim	0.31	0.86
Tamil Nadu	0.76	1.02
Tripura	-0.27	0.98
Uttar Pradesh	-0.44	0.92
West Bengal	-0.08	1.07

Source: Author's calculations from NFHS 1998-99, Individual Survey
Note: The index has mean 0 and standard deviation 1. All India individual weights have been used in the analysis.

Table 5. OLS Regression of Autonomy Index on Female Characteristics for all Currently Married Women

Variables	Coefficient	Standard Error
Age of woman	0.03***	0.002
Muslim woman	-0.08***	0.010
Woman's Education level:		
Primary Schooling	0.07***	0.010
Middle Schooling	0.11***	0.013
High Schooling or more	0.26***	0.012
Husband's education level:		
Primary Schooling	0.00	0.009
Middle Schooling	-0.03***	0.011
High Schooling or more	0.01	0.010
Woman worked in last 12 months	0.12***	0.007
SC/ST/OBC woman	0.02***	0.007
Number of sons living in household	0.01*	0.003
Age difference with husband	0.01***	0.001
Number of children at age 5 or less	-0.03***	0.003
Standard of living of household	-0.02***	0.006
Female head of household	0.27***	0.014
Husband not residing in household	0.35***	0.015
Marital duration	-0.03***	0.010
Age at marriage	-0.00	0.002
Rural household|	-0.29***	0.008
Constant	-0.87***	0.154
State Fixed Effects	Yes	
Observations	83,074	
Adjusted R^2	0.2125	

Source: Author's calculations from NFHS 1998-99, Individual Survey
Note: All-India individual weights used in the analysis.
* significant at 10%, ** significant at 5% , *** significant at 1%

Table 6. OLS Regressions of Deviation of Highest Grade Attained from Cohort Mean on Mother's Bargaining Power

N=68,224	(1)	R^2	(2)
Cook	0.02***	0.1715	0.01***
	(0.005)		(0.005)
Health	0.03***	0.1719	0.01*
	(0.005)		(0.006)
Jewelry	0.03***	0.1717	0.00
	(0.005)		(0.007)
Family	0.03***	0.1719	0.01
	(0.005)		(0.007)
Market	0.06***	0.1745	0.05***
	(0.005)		(0.007)
Relative	0.05***	0.1730	0.00
	(0.005)		(0.007)
Money	0.04***	0.1727	0.03***
	(0.005)		(0.006)
Beat	0.04***	0.1726	0.04***
	(0.005)		(0.005)
			$R^2 = 0.1773$

Note: Standard error in parentheses. Standard errors have been adjusted for clustering on the family. Controls for each regression include dummies for level of education of mother and father, number of alive siblings, number of alive siblings squared, age of child, age of child squared, age of mother, age of father, dummy for head of household Hindu, dummy for head of household Muslim, ownership of assets by household, dummy for SC, ST or OBC head of household, dummy for female head of household, dummy for father currently not residing in household and dummy for rural household.

* significant at 10%, ** significant at 5% , *** significant at 1

Table 7. OLS Regression of Deviation of Highest Grade Attained from Cohort Mean on Mother's Bargaining Power

	(1)	(2)	(3)	(4)	(5)
Female child	-0.119	-0.203	-0.230	-0.243	-0.281
	(0.012)	(0.014)	(0.017)	(0.016)	(0.013)
Mother's autonomy	0.052	0.052	0.056	0.006	0.004
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Mother's autonomy squared	-0.014	-0.014	-0.015	-0.009	-0.010
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Mother's autonomy*female child	0.045	0.025	0.026	0.025	0.020
	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)
Mother's autonomy squared*female child	-0.010	-0.006	-0.006	-0.006	-0.002
	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Mother's schooling:					
Primary school complete		0.263	0.182	0.083	0.013
		(0.017)	(0.017)	(0.016)	(0.020)
Middle school complete		0.251	0.145	0.031	-0.057
		(0.023)	(0.024)	(0.024)	(0.031)
High school complete		0.147	0.033	-0.076	-0.137
		(0.020)	(0.022)	(0.022)	(0.033)
Primary schooling*female child		0.270	0.239	0.241	0.268
		(0.022)	(0.023)	(0.022)	(0.028)
Middle schooling*female child		0.272	0.236	0.239	0.281
		(0.028)	(0.030)	(0.030)	(0.042)
High schooling*female child		0.280	0.241	0.243	0.308
		(0.024)	(0.028)	(0.027)	(0.045)
Father's schooling:					
Primary school complete			0.247	0.218	0.169
			(0.018)	(0.017)	(0.016)
Middle school complete			0.298	0.311	0.249
			(0.020)	(0.019)	(0.020)
High school complete			0.346	0.410	0.374
			(0.018)	(0.018)	(0.018)
Primary schooling*female child			0.068	0.064	0.060
			(0.025)	(0.024)	(0.023)
Middle schooling*female child			0.061	0.060	0.050
			(0.027)	(0.025)	(0.027)
High schooling*female child			0.066	0.059	0.056
			(0.024)	(0.023)	(0.025)
Constant	-0.473	-0.541	-0.553	-0.558	-0.073
	(0.075)	(0.074)	(0.074)	(0.072)	(0.076)
Tests of Equality:					
Mother's primary edu=Father's primary edu for female child			0.00	0.00	0.00
Mother's middle edu =Father's middle edu for female child			0.00	0.00	0.00
Mother's higher edu=Father's higher edu for female child			0.00	0.00	0.00
State of residence dummy	No	No	No	Yes	No
Village of residence dummy	No	No	No	No	Yes
Observations	68224	68224	68224	68224	45727
R^2	0.1795	0.2011	0.2195	0.2760	0.3224

Note: Standard errors in parentheses. Standard errors have been adjusted for clustering on family. Controls include mother's education, father's education, age of mother, age of father, dummy for head of household Hindu, dummy for head of household Muslim, ownership of assets by household, dummy for SC, ST or OBC head of household, dummy for female head of household, dummy for father currently not residing in household and dummy for rural household. P-values reported for F-test for equality of coefficients.

Table 8: OLS Regression of Deviation of Highest Grade Attained from Cohort Mean on Mother's Bargaining Power

	(1)	(2)	(3)	(4)
Female child	-0.334	-0.321	0.026	-0.226
	(0.015)	(0.015)	(0.390)	(0.420)
Mother's autonomy*female child	0.027	0.027	0.003	0.003
	(0.009)	(0.009)	(0.010)	(0.010)
Mother's autonomy squared*female child	0.011	0.010	0.015	0.015
	(0.007)	(0.007)	(0.007)	(0.007)
Mother's schooling:				
Primary schooling*female child	0.280	0.271	0.216	0.210
	(0.028)	(0.028)	(0.028)	(0.028)
Middle schooling*female child	0.323	0.312	0.248	0.239
	(0.040)	(0.039)	(0.040)	(0.040)
High schooling*female child	0.330	0.319	0.244	0.235
	(0.038)	(0.038)	(0.039)	(0.038)
Father's schooling:				
Primary schooling*female child	0.124	0.120	0.127	0.123
	(0.024)	(0.024)	(0.024)	(0.024)
Middle schooling*female child	0.085	0.082	0.106	0.102
	(0.028)	(0.028)	(0.028)	(0.028)
High schooling*female child	0.086	0.083	0.136	0.132
	(0.025)	(0.025)	(0.026)	(0.026)
Tests of Equality:				
Mother's primary edu= Father's primary edu for female child	0.00	0.00	0.02	0.03
Mother's middle edu =Father's middle edu for female child	0.00	0.00	0.01	0.01
Mother's higher edu=Father's higher edu for female child	0.00	0.00	0.05	0.06
Family fixed effects	Yes	Yes	Yes	Yes
State dummy*female child	No	No	Yes	Yes
Village dummy*female child	No	No	No	No
Observations	68224	33256	68224	33256
Adjusted R^2	0.4869	0.4894	0.4906	0.4946

Note: Standard errors in parentheses. Child's age and age squared included as controls.

(1) Children belonging to a family with at least one child in the 6-15 age group.
(2) Children belonging to a family with at least one male and one female child in the 6-15 age group.
(3) Children belonging to a family with at least one child in the 6-15 age group.
(4) Children belonging to a family with at least one male and one female child in the 6-15 age group.

Table 9. OLS Regression of Deviation of Highest Grade Attained from Cohort Mean on Birth Order and Mother's Bargaining Power

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female child	0.039	0.036	-0.107	-0.112	-0.167	-0.161	-0.131
	(0.037)	(0.038)	(0.039)	(0.045)	(0.044)	(0.043)	(0.043)
First born	0.017	0.018	0.010	0.031	0.046	0.033	0.056
	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)	(0.017)
Last born	0.032	0.029	0.032	0.032	0.003	0.000	-0.018
	(0.014)	(0.014)	(0.014)	(0.015)	(0.014)	(0.048)	(0.018)
First born*female child	-0.038	-0.034	-0.039	-0.024	-0.022	-0.027	-0.032
	(0.023)	(0.023)	(0.023)	(0.026)	(0.025)	(0.025)	(0.024)
Last born*female child	0.053	0.053	0.051	0.066	0.076	0.306	0.152
	(0.022)	(0.022)	(0.022)	(0.023)	(0.022)	(0.075)	(0.026)
Mother's autonomy		0.057	0.054	0.058	0.008	0.005	0.002
		(0.007)	(0.007)	(0.008)	(0.008)	(0.009)	(0.008)
Mother's autonomy squared		-0.015	-0.014	-0.017	-0.012	-0.012	-0.009
		(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)
Mother's autonomy*female child		0.034	0.021	0.023	0.021	0.032	0.029
		(0.010)	(0.010)	(0.011)	(0.010)	(0.012)	(0.011)
Mother's autonomy squared*female child		-0.009	-0.006	-0.007	-0.006	-0.004	-0.003
		(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.012)
Mother's schooling:							
Primary school complete			0.271	0.171	0.080	0.103	0.049
			(0.017)	(0.018)	(0.017)	(0.018)	(0.022)
Middle school complete			0.265	0.137	0.035	0.072	-0.007
			(0.023)	(0.024)	(0.025)	(0.026)	(0.034)
High school complete			0.169	0.044	-0.058	0.009	-0.052
			(0.020)	(0.023)	(0.023)	(0.026)	(0.039)
Primary schooling*female child			0.256	0.228	0.238	0.248	0.263
			(0.023)	(0.025)	(0.023)	(0.024)	(0.031)
Middle schooling*female child			0.247	0.213	0.222	0.242	0.279
			(0.028)	(0.031)	(0.031)	(0.033)	(0.048)
High schooling*female child			0.244	0.207	0.218	0.253	0.303
			(0.025)	(0.031)	(0.030)	(0.034)	(0.053)
Last born*mother's autonomy						0.014	0.008
						(0.014)	(0.014)
Last born*mother's education						-0.042	-0.040
						(0.007)	(0.011)
Last born female*mother's autonomy						-0.057	-0.038
						(0.023)	(0.020)
Last born female*mother's education						-0.041	-0.046
						(0.011)	(0.017)
Constant	-0.617	-0.529	-0.557	-0.715	-0.796	-0.775	-0.416
	(0.079)	(0.079)	(0.078)	(0.084)	(0.082)	(0.082)	(0.087)
Tests of Equality:							
First born boy=Last born boy	0.37	0.52	0.17	0.97	0.01	0.50	0.00
First born female=Last born female	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Father's level of schooling	No	No	No	Yes	Yes	Yes	Yes
Completed Family	No	No	No	Yes	Yes	Yes	Yes
State dummy	No	No	No	No	Yes	Yes	No
Village dummy	No	No	No	No	No	No	Yes
Observations	68224	68224	68224	58796	58796	58796	38529
R^2	0.1769	0.1812	0.2020	0.2202	0.2763	0.2783	0.3274

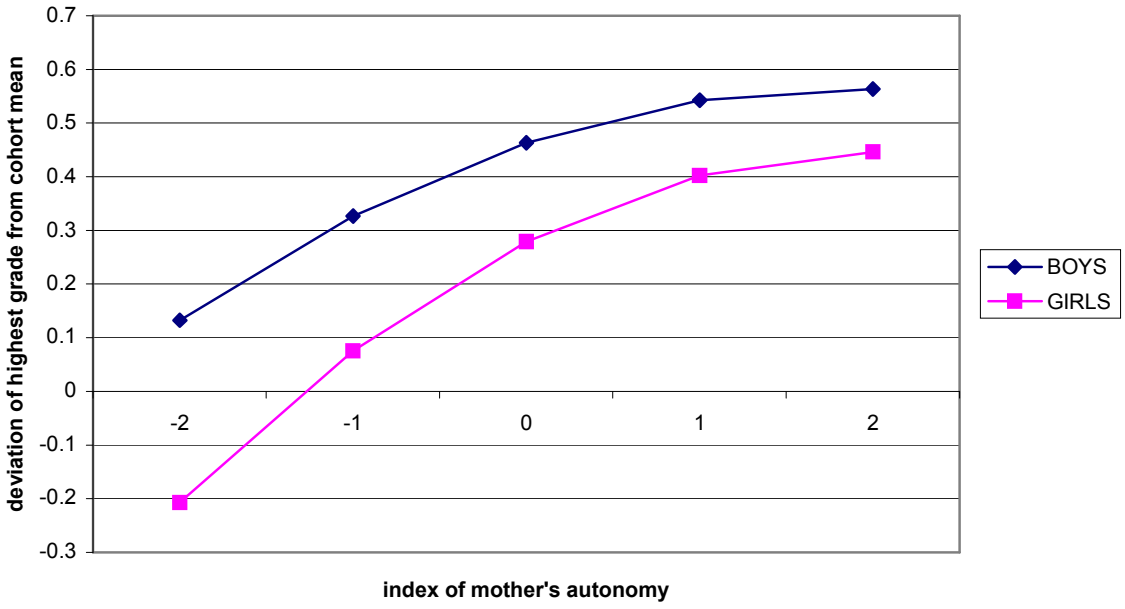
Note: Standard errors in parentheses. Standard errors have been adjusted for clustering on family. Controls include number of alive siblings, number of alive siblings squared, age of mother, age of father, dummy for head of household Hindu, dummy for head of household Muslim, ownership of assets by household, dummy for SC, ST or OBC head of household, dummy for female head of household, dummy for father currently not residing in household and dummy for rural household. P-values reported for F tests for joint significance.

Table 10: OLS Regression of Deviation of Highest Grade Attained from Cohort Mean on Birth Order and Mother's Bargaining Power

	(1)	(2)
Female child	-0.330	-0.266
	(0.441)	(0.438)
First born	0.303	0.257
	(0.023)	(0.023)
Last born	-0.365	-0.193
	(0.021)	(0.072)
First born*female child	-0.051	-0.045
	(0.034)	(0.033)
Last born*female child	0.173	0.264
	(0.033)	(0.115)
Mother's autonomy*female child	-0.005	-0.002
	(0.010)	(0.012)
Mother's autonomy squared*female child	0.014	0.014
	(0.007)	(0.007)
Mother's schooling:		
Primary schooling*female child	0.206	0.211
	(0.028)	(0.030)
Middle schooling*female child	0.220	0.239
	(0.040)	(0.043)
High schooling*female child	0.212	0.219
	(0.039)	(0.048)
Last born*mother's autonomy		-0.015
		(0.022)
Last born*mother's education		-0.104
		(0.013)
Last born female*mother's autonomy		-0.018
		(0.035)
Last born female*mother's education		-0.045
		(0.022)
Tests of Equality:		
First born boy=last born boy	0.00	0.00
First born female=last born female	0.00	0.08
Father's level of schooling	Yes	Yes
Completed Family	Yes	Yes
Family dummy	Yes	Yes
State dummy * female child	Yes	Yes
Village dummy * female child	No	No
Observations	29964	29964
Adjusted R^2	0.5110	0.5176

Note: Standard errors in parentheses. Controls include child's age and age squared, female child*number of siblings, female child*number of siblings squared, level of father's education* female child. Sample includes children belonging to a family with at least one male and one female child in the 6-15 age group.

Figure 6: Predicted Deviation of Highest Grade Attained from Cohort Mean



Note: The index of autonomy has 0 mean and standard deviation 1. The predicted probability is calculated for within 2 standard deviations change of the index from the mean.

Figure 7: Predicted Deviation of Highest Grade Attained from Cohort Mean

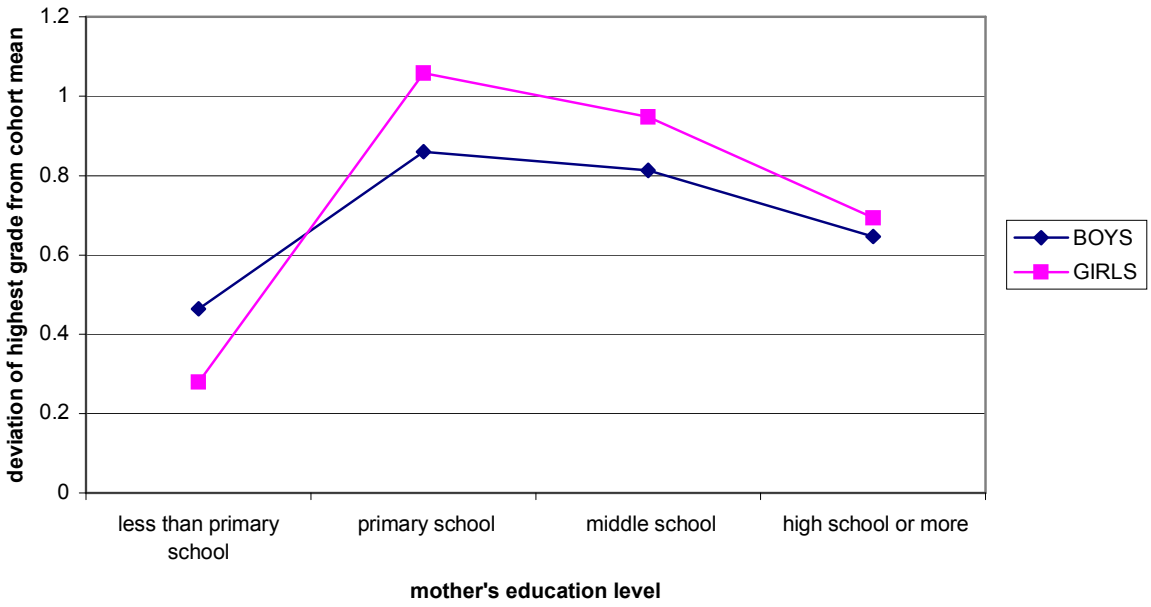
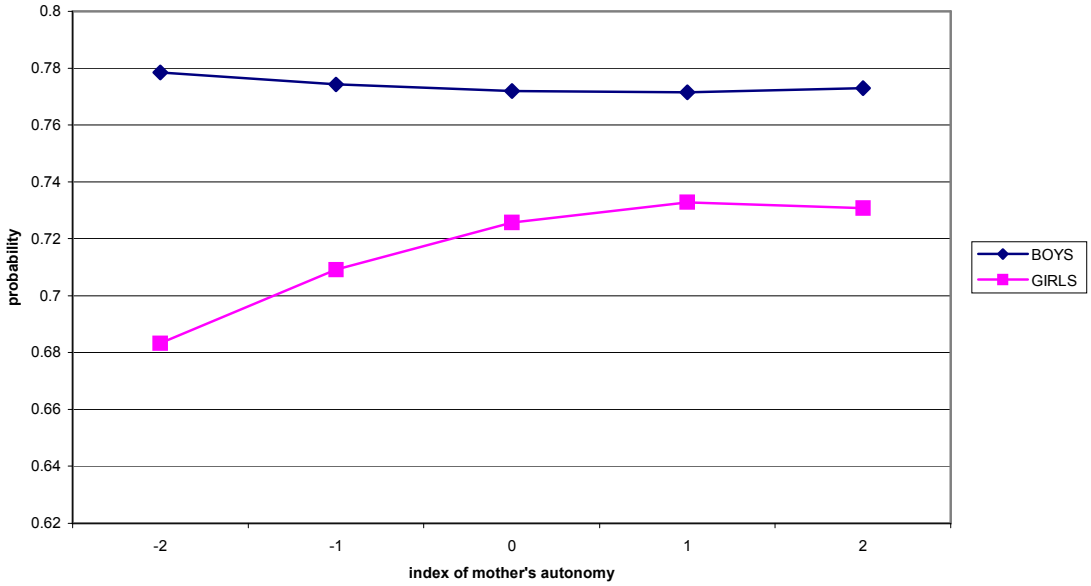
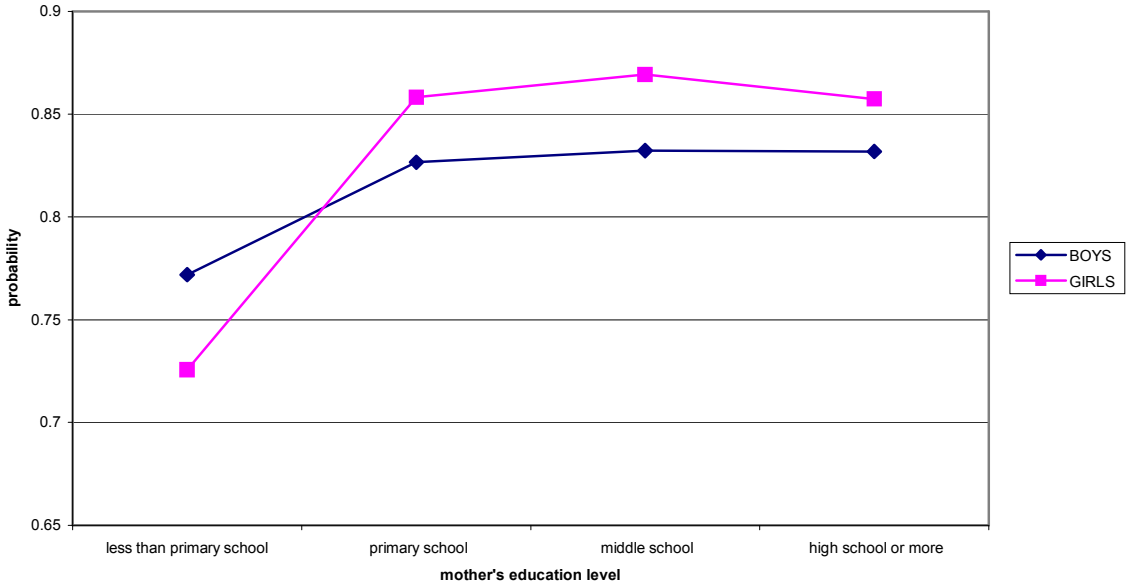


Figure 8: Predicted Probability of Current Enrollment



Note: The index of autonomy has 0 mean and standard deviation 1. The predicted probability is calculated for within 2 standard deviations change of the index from the mean.

Figure 9: Predicted Probability of Current Enrollment



Appendix

Common Factor Analysis

The following explanation of the common factor analysis is based on *R.J. Rummel's 'Applied Factor Analysis', Northwestern University Press, 1970.*

Common factor analysis is based on the assumption that data on a variable consists of common and unique parts. The part common to a set of variables defines a common vector space. The unique parts are uncorrelated with each other and the common parts. The object of the analysis is to define or extract the common factors.

The autonomy variables can, therefore, be expressed in terms of the common factor model –

$$X_1 = a_{11}S_1 + a_{12}S_2 + \ldots\ldots\ldots + a_{1p}S_p + a_{1u}S_{1u}$$

.

.

.

$$X_m = a_{m1}S_1 + a_{m2}S_2 + \ldots\ldots\ldots + a_{mp}S_p + a_{mu}S_{1u}$$

where, X_m is the autonomy variable

S_l is the common factor

a_{jl} is a scalar that weights the contribution of each S to the common variance of X_m

p is the number of common factors

S_{ju} is the unique factor

The variance of the standardized autonomy variables, X_m can be expressed as-

$$I_{mxm} = H^2_{mxm} + U^2_{mxm}$$

where, I_{mxm} is an identity matrix and H^2_{mxm} is a square matrix of common variance and U^2_{mxm} is a diagonal matrix of unique variance. Common factor analysis, then, determines the set of factors that contribute to the common variance component.

Let R_{mxm} be the correlation matrix of the standardized X_m variables. Then, common factor analysis expresses it as,

$$R_{mxm} = F_{mxp} F'_{pxm} + U^2_{mxm}$$
$$R_{mxm} - U^2_{mxm} = F_{mxp} F'_{pxm}$$

Where F_{mxp} is the common factor matrix of m variables and p common factors, p<m. The common factor matrix is obtained by determining the eigenvalues and eigenvectors of the matrix ($R_{mxm} - U^2_{mxm}$) in which the uniqueness of each variable is subtracted from the correlation with itself.

$$R_{mxm} - U^2_{mxm} = (E_{mxm} \lambda^{1/2}_{mxm}) (\lambda^{1/2}_{mxm} E'_{mxm})$$
$$F_{mxp} = (E_{mxm} \lambda^{1/2}_{mxm})$$

Since the matrix is symmetric, the eigenvalues, λ are real and the eigenvectors, E are orthogonal to each other. Each column in F_{mxp} corresponds to a hypothetical common factor, which contributes to the common variance in the data. Common factor analysis reduces the common variance to a smaller number of linearly independent factors than the original number of variables m, in the data.

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