Gender Bias in Educational Attainment in India : The Role of Dowry Payments

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Abstract

This paper explores the linkages between dowry payments and educational attainment of women. It formulates an unitary household model that captures how these linkages can potentially impact the educational investment decisions within a household. Based on existing literature and the theoretical model, the following three competing hypotheses arise, namely, (i) dowry do not affect educational attainment (ii) dowry favors educational attainment of women (iii) dowry hampers educational attainment of women. Using a national level household survey from India, we test between these three hypotheses. It adopts an instrumental variable estimation strategy to correct for endogeneity of the dowry measure. It finds strong empirical evidence for the hypothesis that expected dowry payments adversely affects female educational attainment. This is mainly driven by the hypergamous marriage custom, by which a bride is normally matched with a groom of higher educational level, which leads to the perverse outcome of dowry increasing with educational level of both bride and groom. We find that future dowry payments have a significant role in lowering educational attainment among women in India. To our knowledge, this is the first attempt at empirically estimating the impact of dowry system on the educational attainment of women. An Engel curve estimation using household expenses reveals significant ender bias in terms of educational expenses. The extension of the research also shows dowry contributes to the 'missing women' phenomenon, due to the positive influence of dowry on parents' preference for male children.

Keywords: Education; Gender bias; Marriage; Dowry

JEL Classification numbers: J12 J13 J16 I21 I24 I25

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1 Introduction

Social gains from female education are multifaceted, this includes improvement of health outcomes of children, lowering of fertility rates, infant and child mortality rates (Subbarao and Raney, 1995; Paul Schultz, 2002). However, educational investment in the girl child is found to be lower than that of her male counterpart, especially in developing countries. Behrman and Knowles (1999) find that schooling of girls is considered more of a luxury in Vietnam, while Parish and Willis (1993) discover elder female siblings sacrificing lot more for the education of their male younger siblings. Significant within household gender discrimination of educational expenditure is found in Pakistan (Aslam and Kingdon, 2008). Azam and Kingdon (2013) finds a pro-male bias in education enrollment in India as well as discrimination within household expenditure. Lancaster et al. (2006) finds significant gender bias in educational attainment using a sample from three Indian states.

In India, according to the latest available survey on higher education, the enrolment rate of men in higher education stood at 21.6 % while that of women stood at 18.9 % [1]. This gender disparity is prevalent in school enrolment as well. For example, according to latest school enrolment data provided by the government there is a difference of about 4.6 , 8.2 and 6.1 percentage points between enrolment rates of boys and girls at upper-primary, lower secondary and senior secondary levels respectively. [2]

The extant literature posits several reasons for the gender differential or bias [3] in educational attainment. Specific cultural practices and customs play an important role in deciding the extent of this gender discrimination. One such custom widely practiced in South Asia is the Dowry- the payment made by the bride's family to the groom (or his family) at the time of the wedding. In this paper, we explore in detail the impact of dowry payments on the educational attainment of women in India. To our knowledge, this is the first attempt at empirically capturing the impact of dowry system on educational attainment of women.

The existing theoretical models and empirical literature on dowry is not conclusive on its impact on educational attainment in girl children. This is because there are varying motives for payment of dowry, ranging from dowry seen merely as a bequest for women (Botticini and

[1] Source: All India Survey On Higher Education 2011-12

[2] https://data.gov.in/catalog/gross-enrolment-ratio-ger-0

[3] The term gender discrimination or gender bias used in this paper is by default assumed to be favoring the male gender unless explicitly stated otherwise.

Siow, 2003) to a hedonic price for a good match of characteristics of bride and the groom (Rao, 1993b,a). As a result, some literature predict that dowry will have no impact on educational investment, while some other literature predict a positive impact and a negative impact on educational investments in women. We set up these different possibilities as testable hypotheses in the empirical section. We find strong empirical evidence that dowry payments reduce the educational attainment of women in India.

The structure of the paper is as follows. The paper begins by discussing the existing literature on the causes of gender differences in human capital. The paper then provides an overview of the marriage practices in India and the role of dowry payments. It discusses the three potential relationships between the level of education of the bride and dowry payments. The paper then presents a theoretical model that captures the link between future dowry payments and its potential impact on educational investment in female children. The empirical section of the paper tests the theoretical predictions using an instrumental variable estimation strategy. We find that dowry emerges as a significant contributing factor to the reduction in educational attainment of women. The paper provides some further empirical analyzes that confirm the existence of gender bias in educational investment, using the Engel Curve approach proposed by Deaton (1997). It also shows that dowry payments contribute to the 'son preference' among parents and may have contributed significantly to the 'missing women' phenomenon highlighted by Sen (1990).

2 Gender Differences in Human Capital Investments

The long discourse to explain gender differentials in human capital can be classified into three broad categories that are discussed below, focusing on economic returns, parental preferences and cultural factors respectively.

The first strand of literature gives focus on economic returns to human capital. Becker (1981) argues eloquently that both the quantity and the quality of children and associated sex-imbalances respond to income and economic returns. Rosenzweig and Schultz (1982) posits that a higher share of family resources is devoted to the gender that has more earnings potential in future. They find that the gender differential in employment rates can significantly explain the differences in gender specific survival rates in India. This basic intra-household investment model framework when combined the widespread gender differential in earning opportunities can explain a large share of lower educational investment in female children (Aisenbrey and

Brackner, 2008; Kingdon and Unni, 2001). Foster and Rosenzweig (1999) explores the impact of returns to human capital on the survival rates of women. By analyzing a panel data set from India, they find evidence to support that sex-differentials in mortality are sensitive to returns to human capital. In the absence of social safety nets and old age pensions, in most developing economies, parents tend to depend on their son's income in their old age (Wang, 2005). This gives additional economic reasons for investing more in human capital of the boy child, who is responsible for parents' wellbeing in future. Along similar lines, Qian (2008) uses exogenous increases in sex-specific agricultural income in China and finds that increasing female income, holding male income constant, improves survival rates for girls, and increases educational attainment of all children.

The second strand of literature highlights the role of parental preferences and altruism. Thomas (1990) proposes that the gender preferences of the father and mother play an important role on the human capital investment of children. Using empirical data from Brazilian households, he finds evidence that Fathers' prefer sons and Mothers prefer daughters. Hence, the increased income of mother was found to disproportionately favor female health outcomes. Sahn and Stifel (2002) finds similar results using data from 14 African countries, the greater education of mother results in higher human capital investment in the girl child. This line of argument could be extended to educational investment and related gender bias. For instance, King and Bellew (1989) finds that the father's education level had twice the impact on son's education than on daughter's education in Peru, while King and Lillard (1987) finds that mother's education had a significantly positive effect only on daughter's education in Malaysia. Hence the 'son preference' of the wage earning father could further exacerbate the gender bias in educational investments. In addition to the income share of each parent, the mother's 'bargaining position' in household plays an important role in limiting the extent of gender bias. Quisumbing and Maluccio (2003) finds evidence to reject the unitary household model and finds that improved women's bargaining position increases expenditure share on education in the households in South Africa and Bangladesh. On the other hand, Behrman et al. (1982) proposes a model where there is parental preference for equality among siblings, so the parents compensate the child with lesser future earnings potential [4]. Barcellos et al. (2012) cites son-preference of parents as the potential reason for significantly higher childcare time allotted to boys when

[4] It is difficult to explain pro-male gender bias in educational investment using this model, unless we assume a lower relative earnings potential of male child

compared to girls.

The third category of literature emphasizes the role of cultural practices and societal norms. Sen (1990) argues that economic causes for women's deprivation have to be integrated with other social and cultural factors to give depth to the explanation. Marriage customs like the dowry (payments made by the bride's parents to the groom's family), the bride price (the opposite of dowry practiced in parts of Africa) or the practice of brides moving in with in-laws post-marriage (Dyson and Moore, 1983; Rahman and Rao, 2004) or cultural norms related to women's employment (Fernï£¡ndez, 2007) all can contribute to varying degrees to gender differences in human capital investments. For example, Dyson and Moore (1983) posited that cultural bias favoring exogamous marriage in North India and South India's bias favoring endogamous marriage between close kin contributes to the differences in women's autonomy between the two regions. Rahman and Rao (2004) tested these postulations using household level data from north and south India and found that even though "culture" matters to women's autonomy, it may not be in the ways or to the extent that Dyson and Moore (1983) predicted. Rahman and Rao (2004) highlighted the importance of women's economic opportunities and investing in village infrastructure could go far toward increasing women's agency in rural India. Vella (1994) uses a dataset from Australia and finds that attitudes towards traditional gender roles will have substantial impact on educational investments in women.

This paper will look into greater detail the linkages between the role of dowry payments and female educational attainment.

3 Dowry System and the Educational Attainment of Women

In this paper we will explore in detail the role of dowry in determining gender bias in educational investment, specifically in the Indian context. As will be described in the subsequent sections, the existing literature has divergent views on the impact of dowry on educational investment in women. In order to gauge the impact of dowry on educational attainment in women, the starting point will be an analysis of how dowry responds to educational qualification of a potential bride, subsequently, the paper will analyze how this relation will in turn affect the educational investment in female children. The next section will give a broad overview of marriage practices in India and the perceived role of dowry payments.

3.1 Marriage Practices in India and the Dowry system

In India, marriages are near universal because of the societal norms that makes it mandatory for anyone reaching adulthood. One distinguishing feature of Indian marriages is that it considered an alliance of two families and the families play a big role in the marriages. A bride's family normally initiates the search for a suitable groom and the marriage alliance is arranged with the groom's parents or other elders in the groom's family. The alliance is determined by an interplay of religion, caste, class, socio-economic status of families and individual traits of both the groom and the bride.

Another feature of Indian marriage customs is that of 'hypergamy' [5] or the practice of women marrying 'upwards' is prevalent or is the norm in the Indian society.[6] In fact, 'hypergamy' is the socially accepted and more common mixed-class unions in all monogamous societies (Edlund, 1999). The hierarchy in society is being defined by a variety of socially desirable characteristics such as wealth, social status, physical appearance such as height, the professional qualifications of the groom (Basu, 1999). Hence, its customary for a girl with a certain level of education to be matched with a boy of a higher educational level. This practice of assortative matching in terms of personal characteristics (schooling) as well as characteristics of the family have been found to exist in other parts of the world (Quisumbing and Maluccio, 2003; Fafchamps and Quisumbing, 2005).

Exchange of gifts or marriage transactions are not specific to India and it is practiced elsewhere in the world. According to the holy text 'the Laws of Manu' of the predominant Hindu religion, one of the ten paths to reach *moksha* or enlightenment is *kanyadana*, the act of giving a virgin bride to the groom along with financial and/or other gifts that is known as *dakhshina* or dowry (Chowdhury, 2010). In olden days dowry was practiced widely in the North of India, while in the South the opposite custom of brideprice was more common. The almost complete transition from 'bride-price' to 'dowry' in India has been recorded as early as 1980's (Rajaraman, 1983; Caldwell et al., 1983). What used to be an upper caste tradition has become prevalent in all Indian classes now (Srinivasan, 2005). Different theories have been proposed to explain the reason for the survival of this age- old tradition. We explore some of the main cited reasons for dowry payments in the Indian context.

[5] Barbara (1981) argues the strong pressure of hypergamy played a key role in the increased female infanticide in India

[6] For example, in the Rural Economic and Demographic Surveys (REDS) 2006 panel dataset from India, the education level of the bridegroom is found to be 1.5 times the number of schooling years of the bride on average.

Dowry is sometimes viewed partly as a pre-mortem inheritance for daughters. For example, Botticini and Siow (2003) theorize dowry as a way to distribute family wealth among children and postulates that in India the dowry system will eventually disappear with the unfolding of modernization and urbanization, similar to experiences in Greece and Brazil. They argue that it is better for parents to give inheritance to daughters in the form of dowry because this will increase the incentives for sons to work hard with their family assets as they are the sole claimants of the remaining family wealth. However, as noted by Chowdhury (2010) if dowry actually serves only as a bequest to the daughter, then groom's characteristics such as age, education or landholding should not matter in determining the dowry. However, many empirical work on the dowry payments finds strong evidence for the fact that dowry is strongly correlated by groom's desirable characteristics (Dalmia, 2001; Chowdhury, 2010; Srinivasan, 2005; Bloch and Rao, 2002; Rao, 1993a; Dalmia and Lawrence, 2005). Dalmia and Lawrence (2005) further gives two other reasons against dowry being just pre-mortem inheritance, one, in many cases bride's parents spend beyond their capacity (more than any possible inheritance, see also Rao (1993b)) to meet dowry demands and secondly, dowry continues to exist in states such as Andhra Pradesh and Tamil Nadu in spite of their gender-neutral inheritance laws. This suggests that payment of dowry might have other motives beyond just that of pre-mortem inheritance.

Another school of thought theorize Dowry as proxying the extend of economic contribution of women and women's contribution to home productivity. Dowry was predominant in North India, where plough-based wheat cultivation was involved which gave women less opportunities for farm-labour. On the contrary in the South India, where bride price was practiced, the staple crop is rice whose cultivation involved a high degree of female participation. Thus the differences in economic contribution of women was cited as a reason for the differences in marriage payments (Goody, 1973; Miller, 1980). This line of thinking was later extended to more recent contexts in Foster and Rosenzweig (1999); Behrman et al. (1999) and Lahiri and Self (2007). The marriage market responds to economic contribution made by women such as wages earned through labour force participation or through home-schooling of children, whereby be increasing their returns to education. So according to these theories it is women who cannot make such contributions to home productivity or labor force participation that are expected to pay higher dowries as sort of compensation.

Yet another way of conceptualizing dowries, and in fact the one that is more popular among Economists, is that of seeing dowry as the hedonic price that equalizes the 'differentials' or the price for a good match of characteristics between groom's and bride's and their families. This

line of theory was introduced by Rao (1993b), who adapted Rosen's (Rosen, 1974) implicit market model to the Indian marriage market. In this model, a groom's household utility is based on a vector of its own characteristics, and the traits of the groom, represented by G, the value of a consumption good X and the desirable traits of the bride and her family, B. The choice variables of Groom's household will be the private consumption good X and the desirable traits of the bride and her family B.

$$U = U(G, X, B) \tag{1}$$

The utility is maximized over B and X subject to the following budget constraint, where Y^G is the groom's household wealth. The dowry function is modelled in a way to map the differences in traits between the grooms and bride ($B - G$). R is a vector of exogenous shifters of Dowry, such that

$$Y^G + D(B - G, R) = pX \tag{2}$$

Similarly for the bride's household the utility V is composed of household consumption C, traits of groom G and bride's and their household traits B

$$V = V(B, C, G) \tag{3}$$

, which is maximized over G and C subject to the following budget constraint, where Y^B is the household wealth of household

$$Y^B - D(B - G, R) = pC \tag{4}$$

For a set of bride and groom households equilibrium occurs when the ratio of marginal utilities of traits to consumption is equalized for both households (the offer curves) and is tangential to the Dowry curve. This condition is given by the following,

$$\frac{U_{B_i}}{U_X} = D_{B_i} = \frac{V_{G_i}}{V_C} = D_{G_i} \tag{5}$$

The dowry function, $D(B - G, R)$ can be understood as the locus of tangencies of pairs of offer curves of groom's and bride's households. A variety of exogenous shifters of dowry R has also been proposed in the literature. One such factor is the demographic shifts. For instance, Rao

(1993b) integrates the 'marriage squeeze' phenomenon (as noted by Caldwell et al. (1983) in India) associated with population growth and increased supply of women of marriageable age and the resulting increased competition for scarce grooms to induce an upward shift in the dowry function. Another factor that shifts the dowry function is the caste dynamics. For instance, Anderson (2003) argues the reason why dowry practice thrive in south Asia, unlike places like Europe, is due to the caste based stratification in the society and its interplay with modernization which results in higher wealth dispersion. In this conception of dowry, dowry could be seen as a price paid for desirable characteristics of the groom and his household. Fafchamps and Quisumbing (2005) studies the assortative matching of brides and grooms in Ethiopia and associated asset transfers, they find evidence for the fact that some parents give more assets to daughters whenever doing so increases the chances of marrying wealthier grooms.

Dowry has also been seen as a payment for ensuring higher bargaining power for the bride in husband's family and household. Bloch and Rao (2002) finds that the domestic violence experienced by brides increases with noncompliance with dowry demands.

In addition to the debate on the reasons for dowry payment, there has been a series of empirical work aiming to determine whether there has been a real dowry inflation (Rao, 1993b,a; Edlund, 2000; Rao, 2000; Dalmia, 2004; Arunachalam and Logan, 2008). However, we do not enter this strand of debate in our paper. But one thing is clear; the dowry custom continues to exist at large in the Indian society.

3.2 Dowry and the Educational Level of Bride

Due to the different conceptions of Dowry, as discussed in the previous section, there is an inconclusive debate in the existing literature on the relationship between dowry paid by the bride's family ($D_d = D(G, B, R)$) and education level (e_d) of the bride. We state this as three hypotheses below.

Hypothesis 1: *Dowry payments do not depend on the educational level of the bride.*

This would be the case if dowry is seen as a pre-mortem inheritance to the girl child as theorized by Botticini and Siow (2003). If this is the case, dowry should not depend on the education level of the bride or the groom.

Hypothesis 2 : *Dowry reduces with education level of the bride. Hence, brides with higher levels of education pay less dowries.*

In the theoretical model used in Lahiri and Self (2007) this is the case of 'bride-specific' dowry. In this case, bride specific characteristics such as education is seen as an asset that she brings to groom's family and as a result dowry is assumed to fall with increase in educational level of brides. Similarly, in the theoretical model proposed by Foster and Rosenzweig (1999), to explain the economic growth propelled by technical change in altering gender-specific human capital investments, one of the crucial assumptions made is that 'marriage market rewards the human capital of the women by either decreasing the dowry paid to grooms or increasing the bride price for brides with higher levels of human capital' ((Foster and Rosenzweig, 1999) page 9, foot note 10).

Hypothesis 3: *Dowry increases with education level of the bride. Hence, brides with higher levels of education pay more dowry*.

This is essentially the case of groom-specific dowry in the theoretical model used by Lahiri and Self (2007). This line of argument hinges on the fact that in India, hyper-gamous marriage practices are more prevalent. So brides tend to get matched with grooms with education levels higher than of themselves. So as Jejeebhoy and Halli (2006) describes, the more educated a girl becomes, the more limited her marriage options become; she will need a higher dowry to marry someone with equal or higher levels of education, since more educated grooms can ask for a higher dowry from the bride's family. Dasgupta and Mukherjee (2008) argues that educated brides increases the probability of couple's living separately from groom's household, therefore educated brides might have to pay higher dowries as a sort of compensation to groom's parents to this decrease in probability of co-residence. Dalmia (2001) find emprical evidence for the fact that education of women seems to negatively impact their likelihood of marriage. The section 8.1 of appendix gives a simple theoretical model using search and matching framework to show that this equilibrium with higher educated brides paying higher dowries is feasible under the practice of hypergamous marriage practices.

Based on the existing empirical literature on dowry payments in India, it is unclear which of the above three hypothesis holds true in reality. Though in most empirical studies, dowry

payments are seen to be positively and significantly related to education level of bride and the grooms, whereby supporting hypothesis 3. This is the case is Rao (1993b,a); Srinivasan (2005); Bloch and Rao (2002); Dalmia (2004); Dalmia and Lawrence (2005); Chowdhury (2010)[7]. However, problem with all these studies is that the education level of the bride could be endogenous and could be proxying the impact of the household wealth on the dowry payments (Edlund, 2000). Through our empirical analyzes of measuring the impact of expected dowry payments on educational investments in female children, we are able to get around this endogeneity problem.

3.3 Dowry and Educational Investments in Women

The relationship between dowry and education level of the bride can have potential implications for the decisions on educational investment in children. This section describes a unitary household model of intrahousehold utility maximization in order to explore such implications.

3.3.1 A Unitary Household Model of Human Capital Investment

This section will analyze the impact of dowry on premarital parental investment through a unitary household model with intra-household human capital investment model (Becker and Tomes, 1976; Thomas, 1990; Strauss and Thomas, 1995; Alderman and King, 1998). We consider a nuclear family with two children- one boy and one girl. The parents survive for two periods. In the first period, parents make human capital investments in the children and also marry the children resulting in dowry payments. The parents maximize the utility function U_{e_d,e_s}

$$Max\ U_{e_d,e_s} = U(C_1, C_2) \tag{6}$$

$$C_1 = Y - D_d(e_d, R) + sD_s(e_s, R) - pe_d - pe_s \tag{7}$$

[7] Dalmia (2001) analyzes household survey data from 70 Indian villages, conclude that dowry is payment for establishment of a desirable marital alliance, one in which the groom's status, age, height, education, hence, income earning potential is higher than that of the bride. Along similar lines, Chowdhury (2010) uses the Rural Economic and Demographic Surveys of 1971 and 1999 and notes that dowry prevalence increased in India over these years and underscores positive association between bride's education and dowry. As part of the 'Youth in India: Situation and Needs Study' organized by the Population Council, a survey was conducted in 2006-07 among 50,000 youth in India and found that increasing educational level is positively associated with dowry practices.This further revealed that dowry is very much part of the accepted marriage customs of even the educated youth in the country.

$$C_2 = \tau(e_s, e_d) \tag{8}$$

C_1, C_2 are the consumption levels of the parental household in the first and second periods respectively where the price of consumption is normalized to 1. Y is the total income of the parents household, p is the uniform cost of education for son and daughter[8] , D_d is the dowry payment made for the daughter which is a function of the educational level of daughter, e_d, as discussed in the previous section. Similarly, e_s represents the educational level of the son, D_s the dowry payment he brings, of which parents receive a share, s. For simplicity, we assume the second period consumption of the parents, C_2 is funded entirely by transfers from son and daughter, which increases with their education levels.

Parents maximize their lifetime utility levels by determining the optimal level of educational levels of their children. We obtain the following first order conditions:

$$\frac{\partial U}{\partial C_1}(p + \frac{\partial D_d(e_d, R)}{\partial e_d}) = \frac{\partial U}{\partial C_2}\frac{\partial \tau}{\partial e_d} \tag{9}$$

$$\frac{\partial U}{\partial C_1}(p - s\frac{\partial D_s(e_s, R)}{\partial e_s}) = \frac{\partial U}{\partial C_2}\frac{\partial \tau}{\partial e_s} \tag{10}$$

The implication of the above F.O.C's (Equations 2.9 & 2.10) is that parents invest in their children's education to the point where the marginal cost in terms of consumption today equals the marginal benefit of increased consumption tomorrow. The impact of dowry on the decisions of educational investments in children depends on the signs of $\frac{\partial D_d}{\partial e_d}$ and $\frac{\partial D_s}{\partial e_s}$. Let us now proceed to analyze the implications of hypotheses 1, 2 and 3 on this intrahousehold decision making model. For ease of exposition, let us assume that the marginal benefit on right hand side is similar for both daughter and son. Without loss of generality let us assume the following functional form for Dowry:

$$D_i = e_i^{\alpha} R^{\gamma}; \tag{11}$$

where, $i \varepsilon$ {s, d} , therefore,

[8] We assume a uniform cost of education for both the son and daughter. This in fact is a simplification. For the same unit of education, if anything, the daughter's education can cost more as more resources need to be spent to ensure her safety and security, especially in rural areas. Hence if we add this additional cost into the model, it will only exacerbate the marginal cost of female education.

$$\frac{\partial D_i(e_i, R)}{\partial e_i} = \alpha e_i^{\alpha-1} R^{\gamma} \tag{12}$$

The value of α is determined by hypothesis 1, 2 and 3 discussed in the earlier section, will determine the impact of education on dowry.

Scenario 1 : $\alpha = 0$

This would be the case, if hypothesis 1 holds i.e., dowry payment do not depend on educational level of the bride. As a result, it can be seen that how dowry changes with educational level of the bride will not make any difference to the marginal cost of educational investments. Hence, dowry payments will not affect decisions on educational investments in children in this scenario.

Scenario 2 : $\alpha < 0$

This would be the case if hypothesis 2 holds i.e., dowry reduces with educational attainment of brides. [9] In this case, it is clear this potential impact of dowry reduces the marginal cost of educational investment in female children (the left hand side of the FOCs given above) , while it increases the marginal cost of educational investment in male children. Hence, dowry increases the overall educational investment in female children. The dowry payment gives parents an additional reason to invest in education of their daughters because they know that the dowry demand will be lower for educated brides. In a way, parents will be able to reclaim some of the educational investment expenses through this potential reduction in dowry payments. Under this scenario, dowry payments help in reducing gender bias in educational attainment.

Scenario 3 : $\alpha > 0$

This would be the case if hypothesis 3 holds i.e., dowry increases with educational attainment of brides. [10] We can see that the marginal cost of educational investment in girl child is higher due to the dowry payments, while the dowry payments will have the opposite effect on

[9] By virtue of the hypergamous marriage practice discussed earlier, this would imply dowry received by men reduces with their educational attainment.

[10] By virtue of the hypergamous marriage practice discussed earlier, this would imply dowry received by men increases with their educational attainment.

the marginal cost of educational investment of the son (the left hand side of the FOCs given above). This can result in lower educational investment in the daughter compared to that of son as parents realise that if they educate daughters they will have to pay higher dowry to find a suitable groom, as daughters need to be eventually matched with a groom with higher education. Hence, in this scenario dowry payment has a clear detrimental effect on the level of educational investment and educational attainment of daughters. This impact will be exacerbated if we assume that the second period remittance rate from son is higher than that from daughter, as most likely it's the son who is responsible to take care of the parents.

Another point to be noted in the first order conditions above is that the exogenous variables represented by R enters the educational investment decision making of children exclusively through their impact on dowry payments. Hence, these variables provide a valid set of instrumental variables, that would enable estimation of the impact of dowry variable on educational attainment. In the FOCs (2.9) and (2.10) above if we substitute the value of the marginal effect given by (2.12), we obtain the optimal value of e_i as a function of R and p, this is essentially the reduced form equation of the IV 2sls estimation that we will estimate in the empirical estimation discussed in the rest of the paper. In the next section, we analyze using a national level data set from India and explain an empirical model that would allow to test the validity of the three scenarios discussed above.

4 Empirical Estimation

4.1 Data and Key Variables

The paper uses the data from the India Human Development Survey (IHDS) 2004-2005, which is a nationally representative dataset, including 41,554 households from 1503 villages and 971 urban neighborhood areas (Desai et al., 2007).[11] It includes both individual and household-level responses on various topics such as education, employment, health, fertility, gender relations and marriage practices. Especially the dataset provides information on all school attending children in all the households and individual level educational expenditure and details of the school attended.

[11] We thank University of Maryland and National Council of Applied Economic Research, New Delhi [producers], 2007, Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor] for making the dataset available.

We restrict our sample to rural households with female household members between the ages of 5-22. Children start schooling at age 5 in India. By age of 21 (or latest by 22), students are expected to finish their undergraduate degrees. Further, the mean age at effective marriage for females stood at 21.2 years in 2011, according to Indian Census 2011. Hence, in most cases the decision on education beyond undergraduate degree will be influenced by the preferences of in-laws. Since we focus here on parental investments prior to marriage, we restrict our sample to female children of age group 5-22. [12]

The main dependent variable used in our analysis to measure the educational attainment variable is the number of years of education completed by an individual. This variable ranges from 0 to 15, as we restrict our sample to female children of age bracket 5-22, and children normally commence schooling at age 5 in India.

One unique feature of the IHDS dataset enables us to study the impact of future marriage payments on the educational attainment of women. The IHDS collected data on 'expected cash dowry to be paid in your community for a family like yours'. This variable is the key explanatory variable in our analysis and is referred to as 'expected dowry' in our empirical analysis. As shown in summary statistics, the mean value of dowry variable equals almost 19 times the average yearly income of the household. This shows the scale of economic burden imposed by the dowry payment on the bride's family. Further, in our sample marriage is cited as the second most important factor for taking loans.

In addition to the dowry variable, we include covariates in our regression model, which are postulated by the existing literature on educational gender bias outlined in section 2.These covariates varies at the individual level, household level and village level respectively. Individual level covariate includes age of the individual and number of siblings (age-cohort and sex segregated). Covariates such as the education level of the household head, the highest education level of the adult female in the household, the caste category of household, dummy for Muslim households and households falling under scheduled castes and tribes, number of household members, household wealth (captured by land owned and roof type), household income, media exposure of household and status of women in household, varies at the household level. Controls for district or village educational infrastructure are also included. The descriptive statistics of all variables used the empirical estimations are provided in appendix table **??**.

[12] The reason for restricting our sample to rural households is that instrumental variables which we use at the later stage in this paper correspond to village level characteristics. These instrumental variables are not be appropriate for an urban household.

4.2 Empirical Model

Our attempt in this section is to link the three theoretical scenarios explained in section 3.3.1 to empirics. The empirical model that we would like to estimate in the analysis is as follows:

$$Educational\_attainment_i = \alpha + \beta D_d^e + \gamma_i X_i + \gamma_h X_h + \gamma_v X_v + \epsilon_i \tag{13}$$

β captures the impact of the expected dowry payments variable (D_d^e) on educational attainment . X_i, X_h, X_v represent covariates that affects the educational attainment but varies at the individual level, household level and village level respectively. ϵ_i denotes the error term.

Based on the discussions in the earlier section, we know that the educational attainment of brides might have an impact on the expected dowry variable. Hence, due to this reverse causation, the OLS estimation of β can be potentially be biased. We can model the expected dowry payments in the following way. We can empirically estimate the dowry function D(G, B, R) explained earlier. X_g and X_b are respectively the characteristics of the (expected) groom and bride households and R represents the exogenous shifters of Dowry, which can be a good source of instrumental variables and is explored in detail in later section.

$$D_d^e = \alpha + \theta Educational\_attainment_i + \delta_g X_g + \delta_b X_b + \delta_R R + \eta_i \tag{14}$$

θ captures the impact of educational attainment on expected dowry payments (D_d^e).

In this paper, we are interested in estimating β. The sign of the asymptotic bias of the OLS estimation of β, due to reverse causality, is given by the sign of the following term (Basu, 2015).

$$Sign\ of\ bias\ of\ OLS\ estimate\ of\ \beta = sign(\frac{\theta}{1-\theta\beta}) \tag{15}$$

From the discussions above we can infer that if θ and β take non-zero values, then they have to be of opposite signs. [13] Hence, the sign of the asymptotic bias of OLS estimation of β will be equal to that of the sign of θ.

[13] This is because if $\theta > 0$, it would imply that dowry increases with education level of the bride and this would impose a higher marginal cost of educational investment in girl children. Hence, β would be negative as discussed in scenario 3. In case if Dowry reduces with educational level i.e., θ is < 0, then parents will have greater incentives to invest in the education of their daughters due to potential reduction in future dowry payments. So the impact of dowry will result in an increase of the educational attainment of women, which will render β to be positive (i.e., scenario 2).

4.3 Baseline OLS Results

Table 2 provides result of baseline OLS regressions, with robust standard errors clustered at the village level. Except for the dowry variable, most other covariates seem to show the expected direction of linkage with the educational attainment. The educational attainment of household head and female adults increases the educational attainment of women. The educational attainment of female children rises with age. The wealth of the household (measured by land owned and roof type of the house) has a positive impact on educational attainment. One of the perplexing results is that the belonging to the higher caste category (Brahmin) seems to have a negative impact on educational attainment, though this impact seems to be not significant statistically. This discrepancy in the direction of impact and significance level is due to the bias caused by reverse causality of the dowry variable and we rectify the same in the next section. Most importantly we find that future dowry payments seem to positively impact the educational attainment of female children in household, in our OLS regressions. However, as discussed the theoretical section and in the empirical model, the OLS estimation of β could be biased due to reverse causality. In the next section we will proceed to correct for this bias using an instrumental variable (IV) estimation strategy.

4.4 Correction for Endogeneity of the Dowry Variable : An IV approach

In this section we use an instrumental variable (IV) approach to correct for the potential endogeneity bias caused by the dowry variable. We use two instrumental variables for correcting the endogeneity of the dowry variable. As explained earlier, the following equation helps to empirically capture the expected dowry payments.

$$D_d^e = \alpha + \theta Educational\_attainment_i + \delta_g X_g + \delta_b X_b + \delta_R R + \eta_i \tag{16}$$

The exogenous dowry shifting variables R will be appropriate instrumental variables, as they do not affect the educational attainment or educational investment decisions in girl children except through the dowry variable. We obtain two such exogenous dowry shifters from the village survey that accompanied the Indian human development survey.

The first instrumental variable is a measure of the supply of suitable alliances for the potential brides. In India, especially in rural areas, people marry within their own caste and religion. Banerjee et al. (2009) finds evidence for very strong preference for within-caste marriage even

among the emerging middle-class. We use the proportion of population belonging to the same caste or religion within each village could provide a proxy measure for measuring the number of potential alliances. This measure can proxy how many eligible men of the same community resides in the neighborhood.[14] In our sample, more than 90 percent of the respondents say that marriage takes place within the same caste/religious group. Hence, if the supply of eligible men in the locality increases the dowry prices should fall. So we expect this variable to be negatively correlated with the dowry measure of each household. The proportion of population belonging to the same caste or religion within each village also measures the number of alliances that each household can potentially receive for their daughters even from outside the village. This effect too can potentially reduce the dowry demand. This variable can also affect dowry variable in another way. It measures the potential size of the social network of the household. These networks are highly valued in the developing country context, as they provide insurance at times of negative income shocks, act as source of information and assist in job search. These network effects of marriage were explored in detail by Dekker and Hoogeveen (2002); Rosenzweig and Stark (1989) and Watson (1981) in developing country settings. Marriage creates links between the networks of both the grooms and bride's families. So if the bride's family has a large network the groom's family might demand lower dowry, as the network effect will compensate for this reduction in dowry demand. Therefore, by increasing the supply of eligible men in locality, increasing the network effect of bride's family and by increasing the potential number of alliances the instrumental variable will have a downward impact on the expected dowry.

The second instrumental variable is the relative wealth of the own caste and religion in the village. We measure the relative wealth position of the caste/religious group by the proportion of village land owned by that caste or religion. The idea is that if the caste or religious group, which the household belongs to, is relatively wealthy in the locality, there will be an increased expectation of dowry payment from these households. Hence dowry is expected to be positively correlated with the relative wealth of the caste or religion in the locality. We control for household level wealth variable in the education equation, so this own-caste-group wealth effect will not have any direct impact on education attainment variable.

Table 3 provides estimates of the IV-2SLS estimation, using the above two IVs for the expected future dowry payment. The table also provides the first stage regressions associated with

[14] The religion classification divides each family into nine categories, namely, Hindu, Muslim, Christian, Sikh, Buddhist, Jain, Tribal, Others and none. The caste categorical variable classifies caste into Brahmin, SC, ST or Other.

each of the instrumental variable estimation. Both IVs are statistically significant at 5 % or 1% level in all the specifications. [15]

We find that dowry variable emerges to be a strong determinant of educational attainment in female children. Compared to the earlier OLS regressions, we see that the impact of dowry has become more negative and become statistically significant after correcting for endogeneity, implying the earlier simple OLS results were biased upward. The result of the IV 2sls estimation suggest that dowry increases the marginal cost of educating the girl child and expectation of increased dowry payment will reduce the educational investment in girl children. The estimate of β coefficient (table 3 column IV5) is -.015. At the mean value of the dowry variable of Rs. 107000, this would imply that dowry reduces education attainment by 1.6 years, which is approximately 35% of the average educational attainment of women (which stands at 4.5 years) in the sample.

All the other covariates postulated in the literature affects the educational attainment of female children in expected direction. The income and wealth of the family increases the educational attainment, the educational level of the household head and highest educational level of the female member of the household also have a similar impact. The positive impact of family income (Plug and Vijverberg, 2005), parental education on children's education have already been extensively studied (Oreopoulos and Page, 2006; Bjorklund and Salvanes, 2011). Our results support these studies and show that family income, educational attainment of adults (both male and female) in the household increases the educational attainment of female children.

Desai and Kulkarni (2008) highlights the educational inequalities between upper caste Hindus and the scheduled caste, scheduled tribes and Muslims over the period of 1983 - 2000. In accordance with these existing inequalities, our analysis shows that belonging to a high caste (Brahmin) increases the educational attainment, while households of scheduled castes (lower caste groups), scheduled tribes (tribal groups) and Muslims have lower levels of educational attainment.

The impact of siblings on educational attainment is yet to be clearly established. In the past, studies have mainly focused on the impact of siblings on intrahousehold allocation of resources

[15] More tests on the validity of the IV are discussed in section 4.5

(Becker, 1981; Becker and Tomes, 1976; Kessler, 1991; Butcher and Case, 1994).[16] Recent studies have started to also give attention to the direct impact on siblings on educational attainment of other siblings through sibling interactions and spill overs (Oettinger, 2000; Chen et al., 2009; Nicoletti and Rabe, 2014; Nielsen and Joensen, 2015). These studies highlight hetoregeneity of impacts based on birth order and gender composition of siblings. [17] In order to measure impact of siblings, we introduce the number of siblings (age and sex segregated) as covariates in specifications IV2-IV5. In general existence of siblings seems to have a negative impact on female educational attainment. This could be because of the intrahousehold competition among siblings for educational investments.

We introduced controls for district educational infrastructure for IV3- IV5, educational infrastructure seems to have a positive impact on educational attainment. Women's bargaining position in the household measured by whether women's name appears on ownership papers of the house and by the extent of domestic violence, is included as controls in specifications IV4-IV5. The media exposure of the household, in terms of adult males' and adult females' exposure to TV, radio and newspaper, is used as controls in specification IV5. The significance of the negative impact of dowry variable on educational attainment of women increases with the addition of these controls.

4.5 Robustness and Sensitivity Analysis

Durbin Wu-Hausmann (p-value of .0000; Chi-Sq (1)=21.10) and Wu-Hausman (p = .000; F(1,10257) = 21.07) tests rejected the exogeneity of the dowry variable. The Sargan-Hansen test of overidentifying restrictions Instruments, with a null hypothesis that 'the instruments are valid' was not rejected (p-value: 0.49). The underidentification test (Kleibergen-Paap rk LM statistic) with a null hypothesis that 'the instruments are underidentified' was rejected (p value = .01). The test of weak identification (Angrist-Pischke first-stage F statistics test) rejects the

[16] Butcher and Case (1994) uses data from USA between 1920 and 1965 and finds that women's educational choices are affected by the gender composition of siblings, while men's choices were not affected by such factors. Using dataset on twins, Peter et al. (2015) finds that the gender of the co-twin influences both men and women, but in a different way. Men with brothers earn more and are more likely to get married and have children. In case of women, there is an impact on education and age at first birth: women with sisters obtain lower education and give birth earlier.

[17] Nielsen and Joensen (2015) finds that, in terms of educational choices, peer effects among siblings are strongest among closely spaced siblings, in particular brothers. Oettinger (2000) finds that older siblings' achievements have a positive impact on younger siblings' achievement and not vice-versa. In terms of school achievement, Nicoletti and Rabe (2014) finds evidence for modest spillover effect from the older sibling to the younger but not vice versa. Using dataset from Taiwan Chen et al. (2009) finds that birth of a male sibling, relative to a female, has almost no impact on women's or men's college enrollments on the average.

null hypothesis of weak instruments (p value = .000).

The dependent variable 'educational attainment' is potentially censored from both above (at 15) and below (at 0). In order to correct for the censoring bias we ran a IV-Tobit model. All our results remain same in the IV tobit specification, as seen in the table 4 in appendix. In fact the magnitude of negative impact of the dowry variable strengthened further in the tobit specification.

In our regression analysis the clustering was done simultaneously at the village and household level. This level of clustering was changed to the district level, but the significance of dowry variable remained robust to these changes in the level of clustering. To ensure that our results are not driven by extreme values, we removed two states with the highest mean dowry (Delhi and Jammu and Kashmir) from our sample and re-ran our analysis. All the main results holds despite this change, though there was a minor change in the magnitude of impact of dowry. To minimize the impact of extreme values on key results, we took the log values of the dowry variable and repeated the analyzes. The results are provided in table 5 in appendix. We find that the negative impact of dowry remains significant despite the log transformation of the key independent variable. In order to account for the zero values of educational attainment and dowry variable, we conducted an inverse hyperbolic sine transformation of these two variables and repeated the IV 2sls estimations. All the key results remained unchanged even after this transformation.

5 Extensions

5.1 Gender Bias in Educational Expenditures

This section will explore if the gender bias in educational investment in girl children is observable in how much the households spends on educational expenses through analyzing the household expenses data. The Engel curve approach, proposed by Deaton (1997) is used widely to study gender bias in educational expenditure. For instance, Aslam and Kingdon (2008) employs such an approach in the case of Pakistan , Zimmermann (2012) uses the same technique on India, Himaz (2008) applies the approach to Sri Lanka. Education is considered an exclusive 'child good', so we adopt an Engel curve to estimate the gender gap in educational investment within household. The empirical specification of the Engel curve is as follows :

$$w_i = \alpha + \beta \ln(\frac{x_i}{n_i}) + \mu \ln(n_i) + \sum_{k=1}^{K-1} \gamma_k (\frac{n_k}{n_i}) + \tau Z_i + \theta D_i + u_i \tag{17}$$

w_i : share of educational expenses out of total expenditure of the i^{th} household, x_i : total expenditure of the i^{th} household, n_i : total number of household members of the i^{th} household, n_k : total number of household members in the k^{th} age-sex category, Z_i : vector of household specific characteristics, D_i is the expected dowry payment of the household, u_i : normally distributed error term.

The gender bias in educational investment can be estimated by comparing the γ_k coefficients for each age category of male and female household members. We define the age-sex category based on the Indian schooling system. So the K categories in our regression are male and female members of 0-5, 5-10 (lower primary school) , 10-13 (upper primary school), 13-16 (high school), 16-18 (secondary school), 18-21 (undergraduate), 22-55 and 55 above, our reference category is 55+ female category. This classification depending on educational system is important, as some schools cater to only up to certain levels of education and after which the child is required to join another school. Gender bias can play a significant role in these marginal decisions to choose a new school , depending on its proximity to house and quality etc. Hence, we distinguish the analysis in this part of the study from the analysis provided by Zimmermann (2012) that uses similar data set but a different set of age-sex cohorts.

We estimate the Engel curve of household expenditure share using OLS method as well IV 2sls (in cases where we use dowry variable as a covariate) and compare the coefficient between similar age categories and check for gender bias. The regression estimates, using six different specifications, are given in Table 7. We include the following household specific characteristics: the caste of the household (high caste or not), the household wealth and income measures, the educational level of the household head, highest educational level of the female member of the household, media exposure of family members, district educational infrastructure, controls for status of women in the household. We also add the expected dowry payments as an additional control. We conduct an F-test to test the equality of gender specific coefficients of all school going age cohorts (age groups 5-21). We find statistically significant gender bias in the educational investment in the high school, secondary school and university going age cohorts in all specifications. Interestingly, the dowry variable seems to have a positive impact on the share of educational expenses. This could be attributed to the fact in the Engel curve estimation we include both sons and daughters in our sample. While expected dowry payments will have a

negative impact on daughter's educational investments, it will have an opposite impact on educational expenses of sons. The positive sign of the dowry coefficient could be driven by the dominating effect of the presence of sons in our sample.

The specific impact of dowry variable on the observed gender bias in educational expenses could be studied by further analysing the interaction effect of dowry variable on the age-sex cohorts. The empirical model would take the following form.

$$w_i = \alpha + \beta \ln(\frac{x_i}{n_i}) + \mu \ln(n_i) + \sum_{k=1}^{K-1} \gamma_k(\frac{n_k}{n_i}) + \tau Z_i + \theta D_i + \sum_{k=1}^{K-1} \eta_k(\frac{n_k}{n_i}) D_i + u_i \qquad (18)$$

η_k will correspond to the impact of the dowry variable on the gender bias in educational expenditures. However, we are unable to estimate this model using our data set due to two reasons, namely, (i) lack of data on expected dowry received by the male child and (ii) lack of appropriate instrumental variables for the dowry received by the male children. [18] We leave this as a theme for future research.

Deaton (1997), after surveying several studies, concludes that the Engel curve based expenditure methods often fails to show strong gender differences, even in societies where there are clear gender bias in outcomes (like educational attainment). But we are able to observe significant gender bias in educational expenses in crucial schooling years. So the fact that the Engel curve based method was able to pick up the gender bias provides evidence for gender bias in intra-household resource allocation in our sample.[19] The conclusions of the earlier analyzes suggest that dowry could be a key factor that creates this gender differences in educational investments.

[18] However, we estimated the model with the interaction effect just for the female-age cohorts. The dowry variable became insignificant and all the interaction terms were positive and insignificant; the coefficients on the female age cohorts became negative and insignificant. The reason for this change in sign of coefficients needs further analysis.

[19] Aslam and Kingdon (2008) recommends a two-tier hurdle method to estimate the gender bias more accurately, where in the first step household makes a decision whether to send the child to school or not and in the second step , conditional on the decision to incur education expenditure, an appropriate investment amount is chosen. We do not attempt to estimate a hurdle model here, since the main focus area of our paper is not to measure the exact magnitude of gender bias. Azam and Kingdon (2013) estimates a hurdle model using a panel dataset in India and finds that gender bias occurs primarily through differential spending on sons and daughters in the primary and middle school age groups and through the decision to enroll sons and not daughters in the secondary school age group.

5.2 Dowry and 'Missing Women'

Amartya Sen, in his seminal work, had highlighted the problem of 'missing women' in South Asia, West Asia, and China (Sen, 1990).By comparing the actual proportion of women to expected proportion of women, and adding up the resultant deficit in number of women in Asia and North Africa, Sen argued that more than 100 million women are missing in these regions. Both excess female deaths and excess missing of female births contribute to this phenomenon and this problem do not seem to subside with economic development. According to recent estimates, since 1990, the number of missing females has risen by 43 percent (38 million) to 126 million in 2010, and is projected to further increase to 150 million in 2035 . India and China accounted for 90 percent of the total excess prenatal deaths and 71 percent of all excess female deaths estimated for the period 1970 - 2010 (Bongaarts and Guilmoto, 2015) . For instance, in India, the Child Sex Ratio (CSR), defined as number of girls per 1000 of boys between 0-6 years of age, has been showing a declining trend over the last two decades, which is quite alarming. The CSR stood at 945 in 1991 and declined to 927 in 2001 and further to 918 in 2011[20].This CSR trend points at both pre-birth and post-birth gender bias, in terms of sex-selected abortion and discrimination against female children in terms of post-natal child care.

The conclusions from the previous section show that dowry has a negative impact on human capital investment in girl children. This is because dowry adds to the marginal cost of child rearing. So this leads to the question, does this detrimental impact of dowry also percolate down to the fertility preferences and to the very survival of female children? To what extent can dowry be a determining factor for the 'missing women' phenomenon ? As an extension to our main analysis, this section will explore the role of expected dowry payments on the fertility preferences of women.

Guilmoto (2009) posits three pre-conditions for prenatal sex selection to reach significant levels, namely, 1) strong son preference, 2) ready access to prenatal diagnosis, and 3) low fertility. Using the data set we are able to analyze how dowry is a determining factor for son preference. The IHDS questionnaire proposes the following question to eligible women in household 'If you could go back to the time you did not have any children and could choose the number of children have in your life, how many would that be?'. The gender segregated response to this question is coded, which helps us to know if the preferred number of male children is higher

[20] source http://wcd.nic.in/BBBPScheme/main.htm

than that of female children. We create a dummy variable to code this preference for male children. We use this dummy as the dependent variable and estimate the following empirical model.

$$Preference\_for\_male\_children = \alpha + \beta D_d^e + \gamma_h X_h + \gamma_v X_v + \epsilon_i \tag{19}$$

We postulate that the dowry variable will have a significant and positive impact on the preference for male children. We conduct an instrumental variable- probit analysis for this empirical model. In this estimation we use only the relative wealth position of caste/religious group as the instrumental variable. [21] The results are presented in table 6 of appendix. We find that expected dowry payments exert a strong positive impact on preference for male children. This preference for male children in more prevalent in the scheduled castes, scheduled tribes and among Muslims, while the upper caste and wealthier households seem to have lesser probability for preference of male children. This preference for male children drops significantly with the increase in educational attainment of adults in the household.

6 Discussion and Points for Future Research

The government of India has recently launched a campaign called 'Beti Bachao, Beti Padhao' (Save girl child, Educate girl child) to create awareness and to promote women's education. During, India's Republic day celebration this year (January 26th, 2016), a new campaign was launched which encouraged the most-educated young woman of each village to hoist the national flag, in order to encourage and reward schooling for the girl child. Ms. Nirmala Devi, who was selected to hoist the flag in her village of Haryana was asked about three things she would like to change about India, interestingly, the first thing she called for is the abolishment dowry [22]. This suggestion made by the most-educated woman of this village can be regarded as perhaps a vindication of the findings of this paper that dowry has as a detrimental impact on female education in India.

A point to be noted is that in this paper we looked at the educational attainment variable rather than educational expenses oh the household. This is primarily because the data on past

[21] This is because the other instrumental variable measures the eligible men in the neighborhood, which could directly impact the preference for male children

[22] Read the news item on this in national media :http://www.ndtv.com/blog/my-father-took-me-by-train-to-college-every-morning-1270192?pfrom=home-opinion

educational expenses is limited to just one year and is unavailable for two-thirds of the sample. Even if one argues that dowry will impact more the type of schooling (quality) rather than the number of years of schooling (quantity) itself, this can only potentially downward bias our estimate of dowry's impact on educational attainment. Hence, if we incorporate this 'quality' aspect of education as well, the impact of dowry could be even more strongly detrimental to educational attainment of women. For example, it needs to be studied if parents invest more in their son's, by giving them access to more expensive and higher quality private schools and professional colleges. This may be further researched using appropriate dataset in the future.

The extension of the analysis of the paper reveals that dowry also has an impact on son-preferences of households. This in turn implies that dowry also determines the fertility decisions and the number of girl children in the family. Hence, ideally, the impact of dowry on fertility decisions should also need to be incorporated into the estimations of impact of dowry on educational investments in children. However, it is reasonable to assume that once the fertility choice decisions are incorporated the detrimental impact on dowry would only be aggravated. This is because dowry is expected to have a negative impact on number of daughters as shown by the analysis in the paper. The proof of the same has been left for further investigation.

The empirical analyzes in the paper support the argument that the expected dowry payment negatively affects the educational attainment in female children. The expected dowry payment adds to the marginal cost of educational investment in female children and hence provides less incentive for the parents to invest in the girl child. This adds to the harmful consequences associated with the dowry system, which includes high prevalence of dowry related violence. Dowry has a pernicious impact on human capital investment in the girl child at an early stage of her life itself. Though Dowry has been made illegal in India since 1961, it still prevails and thrives in the society. Greater public policy intervention is called for to curb this practice and make the society aware of its deleterious impact on the human capital investment in female children and also in furthering gender bias in the society. However, as discussed in the paper, there could be multiple reasons for the payment of dowry. Chowdhury (2010) particularly points out two important reasons for a bride's family to pay dowry, which are not mutually exclusive : firstly, dowry could be voluntary and as a means to provide bequest to the daughter; this reason may not lead to negative social outcomes, especially when daughter's legal inheritance rights are restricted. secondly, dowry paid by excessive compulsion from the groom's family and to attract better quality groom. For instance, (Bloch and Rao, 2002) proposes a theoretical model and empirical evidence for husband's family resorting to violence on bride to signal dissatisfaction from

marriage (as well as low dowry payments) and to extract more dowry payments from bride's family in future. This form of dowry can also create detrimental societal impacts, including the negative impacts on female human capital investments as discussed in our analysis. There should be systematic research on how to limit this latter reason for dowry payment. By promoting formal mechanisms to ensure rightful bequest to daughters complemented by more efficient cracking down on marriage related dowry bargaining could be a step in the right direction.

The paper conducted a homogenous treatment of the entire rural sample data and did not delve into regional variations. Specific dowry practices, the magnitude of dowry, and motives of payment of dowry could vary across caste groups and across geographic regions in India. Future research could explore further such geographic and caste group level heterogeneities, using appropriate datasets.

Further, it will be interesting to study further societies where 'bride price' (the opposite of dowry) prevails. A corollary of our hypothesis 3 would imply that bride price can act as an impetus for parents to improve the human capital investment of the girl child. The better human capital indicators (especially health indicators) of women in parts of Africa, where bride-price is practiced, is a case in point that calls for future research.

7 Conclusion

This paper explored the links between the dowry system and the educational attainment of women. Based on existing literature on dowry and a unitary household model of human capital investment, three competing hypotheses arise : (i) dowry do not affect educational attainment (ii) dowry favors educational attainment of women (iii) dowry hampers educational attainment of women. These hypotheses were tested using an empirical model and data from a national level household survey in India. The empirical estimation supports the hypothesis that dowry increases the marginal cost of educational investment in girl child and reduces the incentive for making educational investments in female children, whereby exacerbating the gender bias in educational attainment. Using a IV-2SLS procedure, we find that the educational attainment of women is significantly reduced by expected future dowry payments. The average value of dowry payment in our sample results in a reduction of 1.6 years of educational attainment in women. An Engel Curve analysis of household expenses found evidence of significant gender bias in educational investment across majority of school going age categories. Further analysis also revealed that dowry could be a significantcontributing factor to the 'missing women' phenomenon,

due to its significant positive impact on son-preference of parents. The paper throws light on several detrimental impacts of the dowry system on women and identifies several pointers for further research in this area.

8 Appendix

8.1 A Search and Matching Model in Marriage Market

In this section, we provide support for hypothesis 3 described in the paper, i.e., the case where higher educated brides end up paying higher dowries. We adapt a search and match equilibrium framework from labour economics (Diamond, 1982; Mortensen and Pissarides, 1994). We model the marriage market following a labour market as described in Albrecht and Vroman (2002). We allow for heterogeneity in educational levels of both potential brides and grooms. We derive the dowry payments that exists in an equilibrium, where brides with low education are matched with grooms of both high and low education, while the high educated brides are matched only with grooms of high education levels. This is in line with the hypergamous marriage practice observed in India. We observe dispersion in dowry payments both within and between educational categories.

The way link the labour market model with marriage market is as follows. We conceptualize the grooms as unemployed workers seeking job. The job here is the marriage and the firms are the families of brides. Hence, unmarried women in market are the vacancies. The job-quality (marriage quality) is determined by the educational level of the brides, hence higher educated bride's translates to a high skilled job while the low-educated bride signifies the low-skilled job. The dowry can be understood as the wages paid to workers (grooms in our case) by the firms (bride's family). For simplicity let us assume that dowry is paid in installments every month just like wages and the flow of dowry stops when the marriage breaks apart.

We assume an exogenous distribution of educational levels across the brides and grooms. Let e_l and e_h be the educational levels corresponding to low and high education levels of the grooms. Let the proportion of single men in the market be *u* and the proportion of single women in market be *v*. The random meeting of single men and single women meet is determined by a CRS function , *m(u,v)*. Such that

$$m(u,v) = m(1,\frac{v}{u}) = m(\theta)u,\ where\ \theta = \frac{v}{u} \tag{20}$$

Let γ be the proportion of single men who possess low education (e_l). Let ϕ be the proportion of single women who are of low- education. The effective arrival rate of marriage proposal to single men with low education will be $\phi m(\theta)$. On similar lines, the single women meet single men at the rate $\frac{m(\theta)}{\theta}$. The higher-educated single women meets eligible single men at $(1-\gamma)\frac{m(\theta)}{\theta}$.

The set of four variables θ, ϕ, γ, u characterize the steady-state equilibrium satisfying the following conditions:

1. The match formed between the bride and the groom constitutes a Nash equilibrium. 2. The time frame associated with our model is long run with families with marriageable single women freely entering and exiting the marriage market, hence the entry of a family with marriageable single women in the market satisfies the zero-value condition. 3. The flow of single men, with their respective education levels, into and out of the state of being single are equalized in the steady state.

8.2 Steady state Match formation and Dowries

As postulated by the nash bargaining theory of marriages (Manser and Brown, 1980; McElroy and Horney, 1981; Lundberg and Pollak, 1993; Kanbur and Haddad, 1994; Lundberg and Pollak, 1994), marriage is conceived as a production function and people engage in marriage due to increase the total production levels by exploring the gains through cooperation. Hence matches in marriage market are formed whenever the joint utility for the bride and the groom exceed the utility associated with them being single. Let *U(e)* be the value of being single for a man with education level *e* and let *M(e,y)* be the utility enjoyed by a man with education level *e* of being married to a bride type *y*. Let V(y) be the utility to bride's family of having an unmarried daughter with education level y and let *F(e,y)* be the utility derived by the family of the bride type *y* from marrying the daughter to a groom of education level *e*. Thus the basic condition to be satisfied by any successful match is that:

$$M(e,y) + F(e,y) \geq U(e) + V(y) \tag{21}$$

A nash bargaining between the prospective grooms and the bride's family determines the dowry payments, *D(e,y)*, as a result the dowry will be an exogenous share , β , of the total marriage utility surplus.

$$D(e,y) = M(e,y) - U(e) = \beta[M(e,y) + F(e,y) - U(e) - V(y)] \tag{22}$$

Let *r* be the discount rate, δ be the rate at which marriage breaks up and let *s* be the instantaneous value of being single for men.

We proceed to define various value functions attached to the model. The value of being in

marriage for a groom of education level *e* to a bride of type *y* is :

$$M(e,y) = \frac{D(e,y) + \delta U(e)}{r+\delta} \tag{23}$$

The value to the family of the bride from having married their daughter of type *y* to a groom of education level *e*

$$F(e,y) = \frac{y - D(e,y) - c + \delta V(y)}{r+\delta} \tag{24}$$

The value of being single for low and high educated men are different, as their effective rates of arrival of prospective alliances are different, we define these value functions below:

$$rU(e_l) = s + \phi m(\theta)[M(e_l,e_l) - U(e_l)] \tag{25}$$

$$rU(e_h) = s + m(\theta)\{\phi[M(e_h,e_l) - U(e_h)] + (1-\phi)[M(e_h,e_h) - U(e_h)]\} \tag{26}$$

The final value functions that need to be defined are those related to the value of an unmarried girl of educational level y $s.t$ y takes values e_l or e_h

$$rV(e_l) = -c + \frac{m(\theta)}{\theta}\{\gamma[F(e_l,e_l) - V(e_l)] + (1-\gamma)[F(e_h,e_l) - V(e_l)]\} \tag{27}$$

$$rV(e_h) = -c + \frac{m(\theta)}{\theta}\{(1-\gamma)[F(e_h,e_h) - V(e_h)]\} \tag{28}$$

The value of a low educated single women accounts for the fact that both high and low educated men can potentially form marriage alliances with them. On the other hand, for the high educated women only the arrival rate of higher educated men matters. The long run nature of the model , with free entry and exit of both low and high educated single women ensures that the zero value condition holds for these above value functions in the steady state, i.e., $V(e_l) = V(e_h) = 0$

Substituting these value functions into the necessary condition for forming a match, we get the following condition:

$$y - c \geq rU(e) \tag{29}$$

The dowry payment for a groom with educational level *e* marrying a bride of type *y* is given

by:

$$D(e, y) = \beta[y - c] + (1 - \beta)[rU(e)] \tag{30}$$

Hence, three kind of dowry payments are possible at the equilibrium:

$$D(e_l, e_l) = \beta[e_l - c] + (1 - \beta)[rU(e_l)] \tag{31}$$

$$D(e_h, e_l) = \beta[e_l - c] + (1 - \beta)[rU(e_h)] \tag{32}$$

$$D(e_h, e_h) = \beta[e_h - c] + (1 - \beta)[rU(e_h)] \tag{33}$$

Based on these dowry payments we can derive three propositions :

1. Proposition 1 : Men with higher education receive higher dowry than their less educated counterparts.

2. Proposition 2: Families of brides who are higher educated need to pay higher dowries, as they can only be matched with higher educated grooms.

3. Proposition 3: Families with low educated single women need to pay less dowry, as they can be matched with both low and higher educated grooms. However, a higher educated groom will have to be paid a higher dowry, but this dowry is lower than that received by the higher educated groom who married a higher educated bride.

The stability conditions of this equilibrium are discussed in Albrecht and Vroman (2002) under the case for cross-skill matching. Two conditions that would facilitate this equilibrium based on the equilibrium conditions are as follows : (i) smaller spread between the productivities of the low educated and high educated women (ii) larger the proportion of eligible men and women with low education.

8.3 Empirical Evidence

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Educational Attainment	11656	4.49	3.76	0	15
Dowry	11656	107.09	125.92	0	2050
Measure of Eligible Men	9341	32.19	30.46	0	100
Relative caste wealth	9153	33.54	32.64	0	100
Age	11656	13.64	4.91	6	22
Education level of household head	11656	7.25	4.80	0	15
Highest education level of female adult	11656	3.59	4.40	0	15
Land owned (in acres)	11656	0.04	0.08	0	1.9
Roof_type	11656	3.84	2.72	1	10
Brahmin	11656	0.06	0.24	0	1
OBC	11656	0.38	0.49	0	1
ST	11656	0.11	0.31	0	1
SC	11656	0.17	0.38	0	1
Muslim	11656	0.11	0.31	0	1
Number of Persons in household	11656	7.82	3.55	2	33
Preference for Son	11656	0.31	0.46	0	1
No of Male siblings (children)	11656	1.11	1.14	0	10
No of Male siblings (teenage)	11656	0.63	0.83	0	6
No of Male siblings (adults)	11656	0.62	0.95	0	6
No of female siblings (children)	11656	1.00	1.16	0	8
No of female siblings (teenage)	11656	0.17	0.99	0	7
No of female siblings (adults)	11656	0.04	0.37	0	6
District Educational Infrastructure					
Number of primary schools	11656	11.24	7.37	0	41
Number of middle schools	11656	9.66	6.51	0	40
Number of secondary schools	11656	3.73	2.42	0	11
Number of senior secondary schools	11656	1.55	1.74	0	8
Number of colleges	11656	0.73	1.09	0	6
Number of Government colleges	11656	0.08	0.28	0	2
Number of Vocational or Technical Institutes	11656	0.04	0.22	0	2
Status of Women in Household					
Beat wives if goes out without telling husband	11656	0.45	0.50	0	1
Beat wives if dowry expectation not met	11656	0.28	0.45	0	1
Beat wives if household work is neglected	11656	0.35	0.48	0	1
Beat wives if cooking is bad	11656	0.29	0.46	0	1
Beat wives if suspected of extramarital affair	11656	0.90	0.30	0	1
Women's name in ownership or rental papers for home	11656	0.13	0.34	0	1
Media Exposure					
Women's exposure to radio	11656	0.57	0.70	0	2
Women's exposure to newspaper	11656	0.25	0.55	0	2
Women's exposure to TV	11656	0.90	0.85	0	2
Men's exposure to radio	11656	0.73	0.73	0	2
Men's exposure to newspaper	11656	0.58	0.72	0	2
Men's exposure to TV	11656	0.92	0.79	0	2
Additional variables used in Engel Curve Estimation					
Share of educational expenses	20401	0.01	0.03	0	0.8
Number of persons (log)	20401	1.6	0.5	0.00	3.50
Per capita expenses (log)	20401	8.80	0.66	3.87	12.10
Share of age-sex cohort in household					
share of males (age 0-5)	20401	0.04	0.09	0.00	0.6
share of males (age 5-10)	20401	0.07	0.11	0.00	0.75
share of males (age 10-13)	20401	0.03	0.07	0.00	0.66
share of males (age 13-16)	20401	0.03	0.08	0.00	0.66
share of males (age 16-18)	20401	0.02	0.06	0.00	1
share of males (age 18-21)	20401	0.21	0.14	0.00	1
share of males (age 21 -55)	20401	0.05	0.12	0.00	0.50
share of females (age 0-5)	20401	0.04	0.09	0.00	0.60
share of females (age 5-10)	20401	0.06	0.10	0.00	0.75
share of females (age 10-13)	20401	0.03	0.07	0.00	0.66
share of females (age 13-16)	20401	0.01	0.06	0.00	0.66
share of females (age 16-18)	20401	0.03	0.89	0.00	1
share of females (age 18-21)	20401	0.21	0.13	0.00	1

Figure 1: Expected Dowry Payments

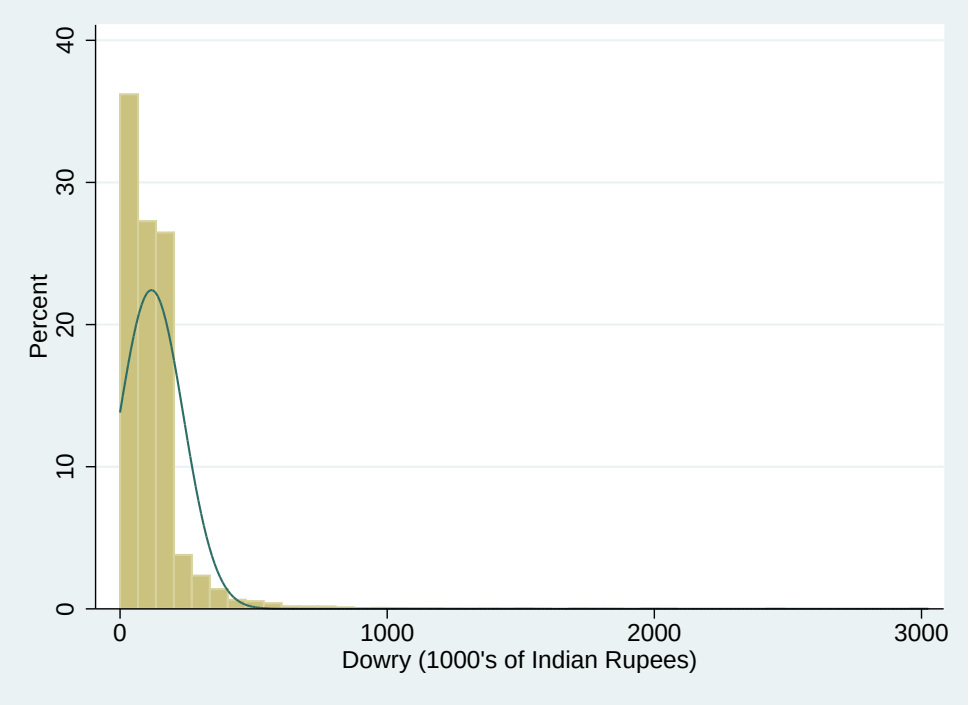

Figure 2: Completed Years of Schooling

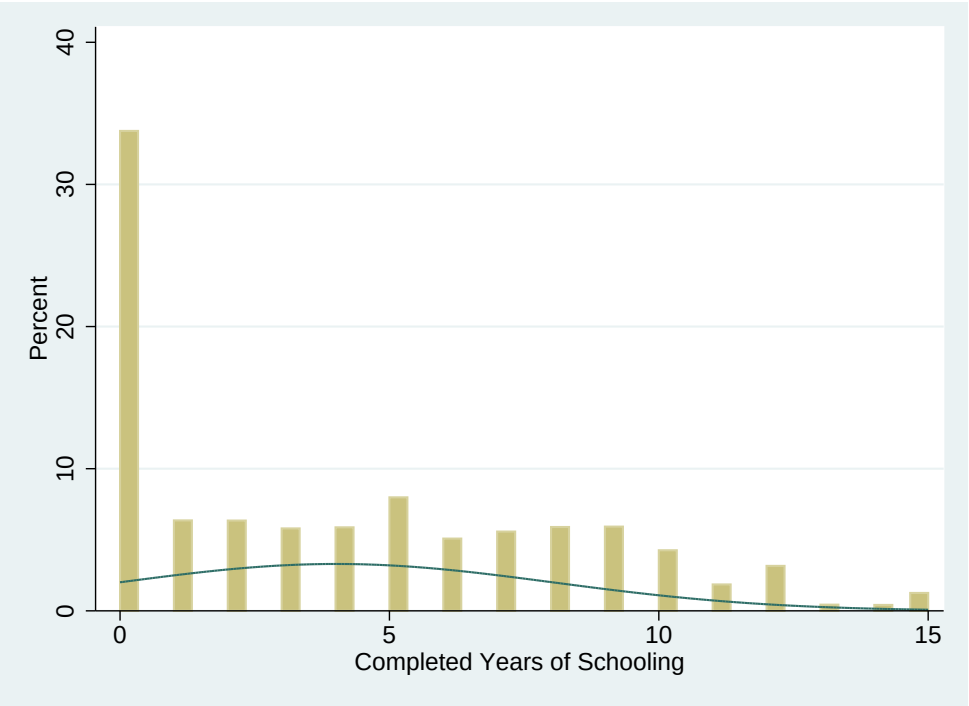

Table 2: OLS Regression Results

	OLS1	OLS2	OLS3	OLS4	OLS5
Dowry	**0.001*****	**0.001*****	**0.001*****	**0.001*****	**0.001*****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age	0.328***	0.316***	0.310***	0.314***	0.317***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Education level of household head	0.136***	0.133***	0.132***	0.124***	0.107***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Highest education level of female adult	0.179***	0.179***	0.176***	0.173***	0.140***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Land owned	0.803	0.436	0.680	0.620	0.162
	(0.621)	(0.597)	(0.587)	(0.546)	(0.550)
Roof type	0.058***	0.059***	0.053***	0.056***	0.035**
	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)
Brahmin	-0.120	-0.141	-0.081	-0.089	-0.099
	(0.128)	(0.124)	(0.128)	(0.132)	(0.134)
OBC	-0.575***	-0.533***	-0.498***	-0.470***	-0.368***
	(0.094)	(0.090)	(0.094)	(0.094)	(0.098)
ST	-0.766***	-0.748***	-0.714***	-0.792***	-0.782***
	(0.147)	(0.143)	(0.147)	(0.145)	(0.152)
SC	-0.776***	-0.726***	-0.683***	-0.636***	-0.535***
	(0.114)	(0.110)	(0.110)	(0.111)	(0.112)
Muslim	-0.900***	-0.900***	-0.824***	-0.835***	-0.653***
	(0.138)	(0.135)	(0.141)	(0.143)	(0.147)
Number of household members	-0.141***	0.117***	0.108***	0.110***	0.103***
	(0.011)	(0.026)	(0.026)	(0.027)	(0.027)
Male siblings (children)		-0.389***	-0.370***	-0.359***	-0.332***
		(0.045)	(0.046)	(0.048)	(0.048)
Male siblings (teen)		-0.018	-0.012	-0.006	-0.010
		(0.053)	(0.054)	(0.054)	(0.054)
Male siblings (adults)		-0.502***	-0.494***	-0.501***	-0.521***
		(0.049)	(0.050)	(0.052)	(0.054)
Female siblings (children)		-0.240***	-0.224***	-0.217***	-0.198***
		(0.033)	(0.033)	(0.034)	(0.036)
Female siblings (teen)		-0.331***	-0.322***	-0.313***	-0.305***
		(0.038)	(0.039)	(0.040)	(0.040)
Female siblings (adults)		-0.252***	-0.246***	-0.252***	-0.235***
		(0.080)	(0.082)	(0.085)	(0.091)
Controls for district educational infrastructure	No	No	Yes	Yes	Yes
Controls for status of women in the household	No	No	No	Yes	Yes
Controls for media exposure	No	No	No	No	Yes
Constant	-0.374**	-1.141***	-0.902***	-0.473**	-0.843***
	(0.156)	(0.167)	(0.187)	(0.224)	(0.229)
R^2	0.407	0.425	0.422	0.425	0.442
Observations	14559	14559	14099	12696	11656

Notes : Dependent Variable is Number of Years of Schooling (women)
Robust standard errors clustered at village and household level are reported in parenthesis.
Significant at 90(*), 95(**), and 99(***) percent confidence.

Table 3: IV 2sls Estimation

	FS1	IV1	FS2	IV2	FS3	IV3	FS4	IV4	FS5	IV5
Dowry		**-0.011***		**-0.011***		**-0.013***		**-0.015****		**-0.015****
		(0.006)		(0.006)		(0.007)		(0.007)		(0.008)
Age	-0.102	0.304***	-0.078	0.295***	-0.135	0.293***	-0.268	0.295***	-0.298	0.295***
	(0.256)	(0.011)	(0.249)	(0.011)	(0.247)	(0.011)	(0.224)	(0.011)	(0.254)	(0.012)
Education level of household head	2.241***	0.161***	2.212***	0.162***	2.012***	0.160***	2.015***	0.159***	0.808	0.124***
	(0.520)	(0.017)	(0.565)	(0.018)	(0.554)	(0.018)	(0.534)	(0.021)	(0.593)	(0.018)
Highest education level of female adult	1.949**	0.207***	1.904**	0.210***	1.798**	0.208***	2.033***	0.209***	1.497*	0.167***
	(0.784)	(0.018)	(0.753)	(0.019)	(0.755)	(0.020)	(0.768)	(0.021)	(0.826)	(0.019)
Land owned	76.772**	1.075	74.509**	0.781	90.898**	1.365	102.430**	1.396	90.665**	0.718
	(35.968)	(1.00)	(36.677)	(1.009)	(38.782)	(1.135)	(40.172)	(1.256)	(40.944)	(1.231)
Roof type	6.715***	0.133***	6.694***	0.138***	6.047***	0.131***	5.845***	0.151***	4.990***	0.114**
	(0.832)	(0.045)	(0.832)	(0.045)	(0.864)	(0.044)	(0.802)	(0.049)	(0.853)	(0.044)
Brahmin	42.897***	0.444	43.036***	0.430	46.496***	0.617	53.618***	0.717	56.151***	0.830
	(15.598)	(0.396)	(15.526)	(0.393)	(15.315)	(0.449)	(16.037)	(0.524)	(15.900)	(0.563)
OBC	-27.525***	-0.993***	-27.004***	-0.962***	-25.091***	-0.905***	-20.206**	-0.882***	-15.314*	-0.684***
	(9.158)	(0.192)	(9.068)	(0.191)	(8.904)	(0.191)	(8.851)	(0.212)	(8.731)	(0.207)
ST	-67.761***	-1.758***	-67.163***	-1.766***	-61.471***	-1.718***	-57.331***	-1.909***	-55.313***	-1.795***
	(6.206)	(0.465)	(6.196)	(0.459)	(6.359)	(0.459)	(6.169)	(0.504)	(6.491)	(0.494)
SC	-39.824***	-1.422***	-39.026***	-1.380***	-36.124***	-1.332***	-31.426***	-1.357***	-25.236***	-1.127***
	(7.540)	(0.291)	(7.475)	(0.285)	(7.453)	(0.277)	(7.221)	(0.299)	(6.821)	(0.275)
Muslim	22.473	-0.868***	22.983	-0.835***	27.923	-0.611**	21.823	-0.652**	17.896	-0.465*
	(17.352)	(0.265)	(17.380)	(0.272)	(17.257)	(0.284)	(15.292)	(0.314)	(11.785)	(0.282)
Number of household members	0.838	-0.117***	3.106*	0.149***	2.712	0.141***	2.376	0.146***	2.839	0.161***
	(0.690)	(0.015)	(1.765)	(0.038)	(1.757)	(0.039)	(1.852)	(0.042)	(2.071)	(0.046)
Male siblings (children)			-2.173	-0.372***	-1.755	-0.357***	-1.066	-0.344***	-1.046	-0.350***
			(2.793)	(0.061)	(2.722)	(0.063)	(2.780)	(0.069)	(3.057)	(0.075)
Male siblings (teen)			-3.461	0.002	-3.216	0.000	-2.370	0.007	-4.724	-0.045
			(3.257)	(0.075)	(3.190)	(0.076)	(3.333)	(0.081)	(3.879)	(0.086)
Male siblings (adults)			-4.316	-0.557***	-3.774	-0.551***	-4.083	-0.572***	-4.345	-0.615***
			(3.143)	(0.073)	(3.198)	(0.076)	(3.406)	(0.081)	(3.486)	(0.084)
Female siblings (children)			-2.290	-0.228***	-1.742	-0.212***	-1.164	-0.199***	-0.825	-0.185***
			(2.875)	(0.051)	(2.802)	(0.053)	(2.923)	(0.060)	(3.233)	(0.067)
Female siblings (teen)			-2.463	-0.349***	-1.963	-0.335***	-2.823	-0.336***	-3.698*	-0.347***
			(1.877)	(0.049)	(1.895)	(0.050)	(1.934)	(0.055)	(2.152)	(0.062)
Female siblings (adults)			-2.617	-0.193*	-3.744	-0.232**	-2.862	-0.196*	-3.502	-0.209*
			(3.824)	(0.108)	(3.866)	(0.114)	(4.149)	(0.117)	(4.339)	(0.125)
Eligible men (IV)	-0.767***		-0.767***		-0.691***		-0.679***		-0.664***	
	(0.233)		(0.232)		(0.225)		(0.231)		(0.233)	
Caste wealth (IV)	0.521**		0.522**		0.443**		0.495**		0.534**	
	(0.225)		(0.225)		(0.222)		(0.226)		(0.224)	
Controls for district educational infrastructure	no	no	no	no	yes	yes	yes	yes	yes	yes
Controls for status of women in the household	no	no	no	no	no	no	yes	yes	yes	yes
Controls for media exposure	no	no	no	no	no	no	no	no	yes	yes
Constant	77.878***	0.777	69.982***	-0.081	75.422***	0.272	64.590***	0.598	59.045***	0.218
	(9.417)	(0.48)	(10.653)	(0.455)	(12.496)	(0.501)	(14.007)	(0.511)	(14.515)	(0.515)
Observations	10903	10903	10903	10903	10903	10903	9837	9837	9028	9028

Notes : Robust standard errors clustered at village and household level are reported in parenthesis.
Significant at 90(*), 95(**), 99 (***) percent confidence.
FS1, FS2, FS3, FS4 and FS5 correspond to the first stage regressions.

Table 4: Robustness check : IV Tobit Estimations

	(i)	(ii)	(iii)	(iv)	(v)
Dowry	**-0.015***	**-0.016***	**-0.018****	**-0.021****	**-0.022****
	(0.009)	(0.008)	(0.009)	(0.010)	(0.011)
Age	0.319***	0.309***	0.307***	0.308***	0.308***
	(0.014)	(0.013)	(0.014)	(0.014)	(0.015)
Education level of household head	0.216***	0.217***	0.213***	0.214***	0.169***
	(0.025)	(0.025)	(0.024)	(0.029)	(0.024)
Highest education level of female adult	0.251***	0.254***	0.250***	0.254***	0.205***
	(0.025)	(0.025)	(0.025)	(0.029)	(0.026)
Land owned	1.396	1.029	1.771	1.875	1.094
	(1.336)	(1.327)	(1.454)	(1.687)	(1.687)
Roof_type	0.172***	0.176***	0.166***	0.193***	0.149**
	(0.063)	(0.062)	(0.058)	(0.068)	(0.062)
Brahmin	0.591	0.567	0.773	0.946	1.148
	(0.540)	(0.530)	(0.587)	(0.712)	(0.780)
OBC	-1.340***	-1.298***	-1.216***	-1.204***	-0.946***
	(0.264)	(0.258)	(0.249)	(0.288)	(0.281)
ST	-2.425***	-2.425***	-2.327***	-2.622***	-2.499***
	(0.658)	(0.640)	(0.609)	(0.702)	(0.699)
SC	-1.828***	-1.768***	-1.686***	-1.748***	-1.459***
	(0.408)	(0.392)	(0.364)	(0.412)	(0.382)
Muslim	-1.156***	-1.111***	-0.808**	-0.847*	-0.571
	(0.379)	(0.382)	(0.390)	(0.433)	(0.382)
Number of household members	-0.144***	0.181***	0.167***	0.170***	0.192***
	(0.020)	(0.049)	(0.050)	(0.054)	(0.061)
Male siblings (children)		-0.461***	-0.437***	-0.416***	-0.426***
		(0.080)	(0.082)	(0.090)	(0.099)
Male siblings (teen)		-0.016	-0.014	0.001	-0.071
		(0.097)	(0.098)	(0.106)	(0.114)
Male siblings (adults)		-0.678***	-0.668***	-0.691***	-0.748***
		(0.096)	(0.099)	(0.107)	(0.111)
Female siblings (children)		-0.319***	-0.294***	-0.267***	-0.249***
		(0.070)	(0.071)	(0.081)	(0.090)
Female siblings (teen)		-0.349***	-0.330***	-0.339***	-0.358***
		(0.064)	(0.065)	(0.073)	(0.084)
Female siblings (adults)		-0.224*	-0.272*	-0.224	-0.244
		(0.134)	(0.141)	(0.148)	(0.159)
Controls for district educational infrastructure	No	No	Yes	Yes	Yes
Controls for status of women in the household	No	No	No	Yes	Yes
Controls for media exposure	No	No	No	No	Yes
Constant	0.411	-0.611	-0.113	0.369	-0.113
	(0.670)	(0.621)	(0.658)	(0.695)	(0.710)
N	10903	10903	10903	9837	9028

Notes : Robust standard errors clustered at village and household level are reported in parenthesis.
Significant at 90(*), 95(**), 99 (***) percent confidence.

Table 5: Robustness check : Log Transformation

	(i)	(ii)	(iii)	(iv)	(v)
log dowry	**-2.353*** **	**-2.499*** **	**-2.726*** **	**-2.910*** **	**-2.793*** **
	(0.735)	(0.747)	(0.808)	(0.840)	(0.869)
Age	0.303***	0.295***	0.292***	0.298***	0.295***
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Education level of household head	0.201***	0.209***	0.207***	0.209***	0.162***
	(0.023)	(0.024)	(0.024)	(0.025)	(0.020)
Highest education level of female adult	0.218***	0.224***	0.218***	0.215***	0.167***
	(0.015)	(0.015)	(0.015)	(0.016)	(0.014)
Land owned	1.712**	1.488**	2.467***	2.613***	1.570*
	(0.685)	(0.696)	(0.890)	(1.014)	(0.902)
Roof_type	0.219***	0.227***	0.214***	0.221***	0.178***
	(0.051)	(0.052)	(0.051)	(0.050)	(0.047)
Brahmin	0.640**	0.612**	0.879***	1.033***	0.963***
	(0.265)	(0.263)	(0.313)	(0.352)	(0.358)
OBC	-1.188***	-1.175***	-1.061***	-0.962***	-0.827***
	(0.166)	(0.169)	(0.157)	(0.156)	(0.154)
ST	-3.793***	-3.921***	-3.867***	-4.124***	-3.875***
	(0.887)	(0.901)	(0.904)	(0.932)	(0.950)
SC	-1.782***	-1.761***	-1.638***	-1.571***	-1.376***
	(0.279)	(0.282)	(0.264)	(0.266)	(0.256)
Muslim	-1.265***	-1.267***	-0.998***	-0.783***	-0.674***
	(0.161)	(0.166)	(0.146)	(0.149)	(0.150)
Number of household members	-0.100***	0.160***	0.139***	0.128***	0.136***
	(0.013)	(0.030)	(0.029)	(0.029)	(0.029)
Male siblings (children)		-0.332***	-0.295***	-0.267***	-0.279***
		(0.047)	(0.049)	(0.054)	(0.054)
Male siblings (teen)		0.049	0.066	0.107	0.070
		(0.057)	(0.058)	(0.065)	(0.064)
Male siblings (adults)		-0.608***	-0.600***	-0.555***	-0.606***
		(0.064)	(0.064)	(0.061)	(0.062)
Female siblings (children)		-0.207***	-0.175***	-0.156***	-0.138***
		(0.041)	(0.042)	(0.046)	(0.047)
Female siblings (teen)		-0.356***	-0.328***	-0.322***	-0.315***
		(0.043)	(0.043)	(0.047)	(0.047)
Female siblings (adults)		-0.175	-0.234**	-0.175	-0.186
		(0.108)	(0.108)	(0.118)	(0.117)
Controls for district educational infrastructure	No	No	Yes	Yes	Yes
Controls for status of women in the household	No	No	No	Yes	Yes
Controls for media exposure	No	No	No	No	Yes
Constant	9.223***	8.838***	10.094***	10.101***	9.486***
	(2.876)	(2.883)	(3.172)	(3.057)	(3.166)
N	10898	10898	10898	9393	9024

Notes : Robust standard errors clustered at village and household level are reported in parenthesis.
Significant at 90(*), 95(**), 99 (***) percent confidence.

Table 6: Extension1 : Impact of Dowry on Son Preference

	(i)	(ii)	(iii)
Dowry	**0.006*** **	**0.007*** **	**0.006*** **
	(0.001)	(0.001)	(0.002)
Education level of household head	-0.013***	-0.013***	-0.003
	(0.004)	(0.004)	(0.004)
Highest education level of female adult	-0.029***	-0.037***	-0.028***
	(0.004)	(0.005)	(0.005)
Land owned	-0.781***	-0.846***	-0.503**
	(0.172)	(0.213)	(0.228)
Roof type	-0.049***	-0.051***	-0.039***
	(0.006)	(0.007)	(0.009)
Brahmin	-0.273***	-0.315***	-0.274**
	(0.071)	(0.103)	(0.117)
OBC	0.235***	0.233***	0.191***
	(0.030)	(0.034)	(0.036)
ST	0.475***	0.549***	0.473***
	(0.056)	(0.070)	(0.095)
SC	0.317***	0.295***	0.232***
	(0.036)	(0.047)	(0.059)
Muslim	-0.153***	-0.086*	-0.117**
	(0.050)	(0.047)	(0.051)
Number of household members	-0.030***	-0.032***	-0.032***
	(0.009)	(0.010)	(0.010)
Number of children (0-12 age group)	0.081***	0.076***	0.076***
	(0.017)	(0.023)	(0.022)
Number of teenage children	0.049***	0.055***	0.061***
	(0.015)	(0.019)	(0.018)
Controls for status of women in the household	No	Yes	Yes
Controls for media exposure	No	No	Yes
Constant	-0.866***	-0.787***	-0.835***
	(0.051)	(0.078)	(0.070)
Observations	10947	9430	9057

Notes : Dependent variable is a dummy variable, which takes the value 1,
if the stated preference by mother for ideal number of sons is greater than that of daughters.
Robust standard errors, clustered at village level, reported in parenthesis.
IV-2sls estimations
Significant at 90(*), 95(**), 99 (***) percent confidence.

Table 7: Extension 2: Education Expenses Engel Curve Estimation

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
no of persons (log)	0.0076***	0.0025***	0.0003	0.0001	0.0008	0.0010
	(0.00056)	(0.00082)	(0.00142)	(0.00132)	(0.00149)	(0.00154)
per capita expense (log)	0.0078***	0.0044***	-0.0006	-0.0010	-0.0008	-0.0010
	(0.00060)	(0.00069)	(0.00188)	(0.00173)	(0.00200)	(0.00196)
share of cohort_m0	-0.0195***	-0.0177***	-0.0165***	-0.0158***	-0.0174***	-0.0189***
	(0.00221)	(0.00319)	(0.00435)	(0.00419)	(0.00591)	(0.00599)
share of cohort_m1	0.0123***	0.0151***	0.0153***	0.0159***	0.0150***	0.0129**
	(0.00260)	(0.00330)	(0.00381)	(0.00378)	(0.00553)	(0.00560)
share of cohort_m2	0.0291***	0.0307***	0.0295***	0.0291***	0.0235***	0.0212***
	(0.00350)	(0.00468)	(0.00524)	(0.00518)	(0.00691)	(0.00686)
share of cohort_m3	0.0321***	0.0470***	0.0454***	0.0455***	0.0407***	0.0377***
	(0.00407)	(0.00588)	(0.00573)	(0.00562)	(0.00733)	(0.00745)
share of cohort_m4	0.0233***	0.0374***	0.0378***	0.0376***	0.0432***	0.0418***
	(0.00500)	(0.00658)	(0.00774)	(0.00766)	(0.00941)	(0.00951)
share of cohort_m5	0.0096**	0.0150***	0.0197***	0.0204***	0.0205***	0.0198**
	(0.00402)	(0.00544)	(0.00656)	(0.00650)	(0.00790)	(0.00819)
share of cohort_m6	-0.0059***	-0.0119***	-0.0085**	-0.0081**	-0.0158***	-0.0168***
	(0.00179)	(0.00317)	(0.00412)	(0.00393)	(0.00605)	(0.00651)
share of cohort_m7	-0.0086***	-0.0114***	-0.0115***	-0.0110***	-0.0197**	-0.0211**
	(0.00196)	(0.00353)	(0.00430)	(0.00427)	(0.00794)	(0.00834)
share of cohort_f0	-0.0187***	-0.0163***	-0.0153***	-0.0145***	-0.0150**	-0.0171***
	(0.00213)	(0.00305)	(0.00424)	(0.00412)	(0.00584)	(0.00603)
share of cohort_f1	0.0042*	0.0106***	0.0113***	0.0123***	0.0095*	0.0070
	(0.00222)	(0.00311)	(0.00390)	(0.00385)	(0.00564)	(0.00574)
share of cohort_f2	0.0205***	0.0251***	0.0261***	0.0260***	0.0199***	0.0198***
	(0.00364)	(0.00530)	(0.00607)	(0.00593)	(0.00730)	(0.00759)
share of cohort_f3	0.0206***	0.0295***	0.0211***	0.0216***	0.0177**	0.0153**
	(0.00383)	(0.00502)	(0.00593)	(0.00584)	(0.00732)	(0.00744)
share of cohort_f4	0.0070	0.0082	0.0111	0.0113	0.0114	0.0085
	(0.00445)	(0.00575)	(0.00698)	(0.00693)	(0.00789)	(0.00798)
share of cohort_f5	-0.0001	0.0020	0.0037	0.0043	0.0027	0.0023
	(0.00265)	(0.00373)	(0.00461)	(0.00457)	(0.00639)	(0.00668)
share of cohort_f6	0.0036**	-0.0022	-0.0042	-0.0039	-0.0060	-0.0070
	(0.00151)	(0.00194)	(0.00258)	(0.00255)	(0.00589)	(0.00625)
Education level of household head		0.0009***	0.0008***	0.0008***	0.0007***	0.0007***
		(0.00010)	(0.00014)	(0.00014)	(0.00014)	(0.00014)
Highest education level of female adult		0.0004***	0.0003	0.0002	0.0003	0.0002
		(0.00011)	(0.00016)	(0.00016)	(0.00017)	(0.00016)
land owned		0.6766	-0.0685	-0.0018	-0.3047	-0.4425
		(0.71569)	(0.84156)	(0.83298)	(1.14150)	(1.14255)
Roof_type		0.0003**	-0.0006*	-0.0006**	-0.0006*	-0.0006*
		(0.00014)	(0.00030)	(0.00029)	(0.00032)	(0.00032)
Brahmin		0.0022	-0.0017	-0.0010	-0.0017	-0.0017
		(0.00141)	(0.00236)	(0.00239)	(0.00298)	(0.00312)
OBC		0.0018*	0.0043***	0.0048***	0.0048***	0.0047***
		(0.00097)	(0.00144)	(0.00141)	(0.00158)	(0.00164)
ST		0.0010	0.0071**	0.0071**	0.0067**	0.0067**
		(0.00135)	(0.00299)	(0.00289)	(0.00301)	(0.00310)
SC		0.0006	0.0045**	0.0043**	0.0033*	0.0031*
		(0.00116)	(0.00185)	(0.00172)	(0.00184)	(0.00185)
Muslim		0.0008	0.0010	0.0016	0.0006	0.0011
		(0.00166)	(0.00196)	(0.00194)	(0.00161)	(0.00166)
Dowry			0.0001***	0.0001***	0.0001**	0.0001**
			(0.00004)	(0.00004)	(0.00005)	(0.00005)
Constant	-0.0704***	-0.0419***	-0.0045	-0.0014	0.0066	0.0087
	(0.00553)	(0.00693)	(0.01519)	(0.01384)	(0.01701)	(0.01653)
N	20401	12543	10030	10030	7928	7609
P-value : Cohort 1 comparison	0.001***	0.154	0.277	0.305	0.170	0.140
P-value : Cohort 2 comparison	0.045**	0.304	0.569	0.597	0.594	0.840
P-value : Cohort 3 comparison	0.023**	0.014**	0.000***	0.000***	0.003***	0.006***
P-value : Cohort 4 comparison	0.008***	0.000***	0.005***	0.006***	0.004***	0.003***
P-value : Cohort 5 comparison	0.044**	0.036**	0.030 **	0.027 **	0.044 **	0.059*

Notes : Robust standard errors, clustered at village level, reported in parenthesis.
Significant at 90(*), 95(**) and 99 (***) percent confidence.
Cohort 1 : age group 5 to 10 (primary school) ; Cohort 2 : age group 11 to 13 (upper primary);
Cohort 3 : age group 14 to 16 (high school); Cohort 4 : age group 17 to 18 (secondary school) ; Cohort 5:age group 18 to 21 (university)
Cohort 6 : age group 22-55 ; cohort 7: age group 55 above

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