Saving for Marriage Expenses and the Nutrition of Children in Early Childhood: Evidence from India

Sounak Thakur *

September 3, 2018

Abstract

Daughters' weddings in India are known to be very expensive and to severely constrain the household budget. I document that the higher castes customarily spend more on their daughters' marriages than the lower castes, and find that the presence of an additional unmarried daughter is associated with a greater reduction (by 0.33 standard deviation) in height-for-age z-scores of children aged 5 years or less in higher caste households as compared to the corresponding reduction amongst their counterparts in lower caste households. In view of the fact that households seem to start saving early for their daughters' weddings, I argue that the above finding is suggestive of saving for marriage expenses crowding out resources for the purchase of food, thereby adversely affecting nutritional outcomes of children in early childhood.

JEL Classification: D15, I14, J16; O12

*I am grateful to George-Levi Gayle, Robert Pollak, Limor Golan, Gaetano Antinolfi, Michele Boldrin, Nazmul Ahsan, Ardina Hasanbasri, David Lindequist, Lin Shao and Faisal Sohail, Juan Ignacio Vizcaino and Yinghong Zhang for providing helpful comments and critiques. All remaining errors are my own.

1 Introduction

Indian marriages are typically expensive affairs. The widespread prevalence of the practice of dowry[1] in India makes daughters' weddings especially expensive. Sons' weddings, being in part financed by the dowry received from the bride, are much less costly as compared to daughters' weddings. Hence, the birth of a daughter constitutes a greater negative shock to the lifetime household income than the birth of a son. These facts, compounded with imperfect credit markets and the obligation of parents to marry off daughters at a socially acceptable age, might lead forward-looking parents to start saving right from the time a daughter is born. Such saving could potentially crowd out resources for the purchase of food and adversely affect nutritional outcomes of children in the family.

In this paper, I use data from the two rounds of the India Human Development Survey (IHDS) to provide evidence that supports the above hypothesis. First, I find that the reduction in household monthly consumption expenditure per capita associated with the presence of an additional daughter is greater than the reduction in the same associated with the presence of an additional son. This is suggestive of households with more daughters saving more. Second, I find that the customary amount of expenses on a daughter's wedding is higher amongst "higher/forward caste" households than amongst "lower caste" households at comparable levels of income and assets. This gap in the obligatory amount of daughter's wedding expenses across the two caste categories is mirrored in the nutritional outcomes of children belonging to very poor families in the following way. The presence of an additional unmarried daughter aged 18 years or less is associated with a *greater* deterioration in the nutritional outcomes of children aged 5 years or less in "higher" caste households (which, by custom, have to bear the burden of more expensive marriages for daughters) as compared to corresponding amount amongst their counterparts in "lower" caste households. Interestingly, there is no evidence that this differential worsen-

[1] Dowry is a transfer at marriage from the bride or her family to the groom or his family. The opposite of this, bride price, is rare in India (see Anderson (2007)).

ing of nutritional outcome depends on the child's gender. The association is weak or non-existent among children older than 11 years. These findings indicate that a daughter's marriage does put a big burden on her family, and faced with this burden families do start saving early and that nutritional outcomes of children in such families are adversely affected. In view of the well-established connection between childhood height and health, cognitive ability and future earnings potential [2], high marriage expenses appear to be a serious cause for concern.

2 Related Literature and Contribution

This paper draws on and contributes to two related literatures. First, it draws on the literature on transfers and other expenses at marriage. Anderson (2007) documents that the direction and magnitude of transfers vary across societies and over time and that in India the typical transfer is a dowry rather than a bride price. Some studies have claimed that the real value of dowry has been rising over time in India (see Rao (1993), Anderson (2003)).[3] These papers estimate that the amount of dowry is often 4 to 8 times the annual family income or about 70% of the value of family assets and is, therefore, a large tax on the family of the girl.[4] Gupta (2002) and Kodoth (2005) find evidence that income constrained families may be forced to sell productive assets in a bid to pay for large dowries. This makes it plausible that dowry causes son-preferring behaviors (such as sex-selective abortion, infanticide or gender-differentiated investments in children) as has been suggested by several authors (see Arnold *et al.* (1998), Miller (1981), Harris (1993), Das Gupta *et al.* (2003)). However, none of these papers establish a causal connection between transfers at marriage and any observable behavior or indicator of well-being.

A few papers in the literature attempt to establish a causal connection between

[2] See Glewwe & Miguel (2007), Guven & Lee (2015), Strauss & Thomas (1998), Case & Paxson (2008), Hoddinott *et al.* (2013)

[3] However, the phenomenon is disputed by Logan & Arunachalam (2014).

[4] I find very similar numbers in the IHDS data.

marital transfers and household-level choices and/or outcomes, and the present paper is most closely related to this strand of literature. Brown (2009) finds evidence in China that a higher dowry might improve the bargaining power of the newlywed woman at her in-laws' place.[5] Ashraf *et al.* (2016) find evidence that the increase in female enrollment in response to the INPRES school construction program in Indonesia was higher for ethnic groups that customarily had a higher bride price than ethnic groups that had a lower bride price. Corno *et al.* (2016) find evidence in Tanzania that adverse rainfall shocks during teenage years increase the probability of girls' early marriages and early fertility to a greater extent in villages where bride price payments are typically higher. Bhalotra *et al.* (2016) try to quantify the causal impact of dowry on the mortality of girls relative to boys in India. They provide evidence that the real value of dowry is positively associated with the price of gold and exploit a sharp unexpected rise in gold price in 1980 to obtain an exogenous variation in the expected amount of dowry. Using a difference-in-discontinuities design they find evidence that the gold price hike is reflected in an increase in girl relative to boy mortality amongst neonates and infants. Further, they find that surviving women born after the gold-price shock have a shorter adult stature than those born before the gold price shock. The present paper contributes to this literature by providing suggestive evidence that anticipated marriage expenses may be responsible for a deterioration in age-appropriate height (height-for-age) of all surviving children in early childhood. This is an important finding because previous literature has found that height in childhood predicts adult stature (see Tanner *et al.* (1956)) and taller adults have higher cognitive skills (see Glewwe & Miguel (2007); Guven & Lee (2015)) and higher earnings (Strauss & Thomas (1998); Case & Paxson (2008); Hoddinott *et al.* (2013)). In the light of the established link between height in childhood and future earnings potential, my findings indicate that high marriage expenses may be responsible for a deterioration in lifetime earnings potential.

A branch of economic and demographic literature has documented the existence

[5] Most societies that practise dowry are patrilocal (see Anderson (2007)).

of son-preferring behaviors in the Indian context. Clark (2000) and Jensen (2002) provide evidence consistent with couples practising "differential stopping behavior" (ie the likelihood of stopping to have children at any parity is increasing in the proportion of sons in the existing stock of children). Jayachandran & Pande (2017) find evidence in favor of eldest-son preference in India. Further, there is evidence of gender-differentiated investments in children favoring boys over girls in terms of antenatal care, breastfeeding, immunization and vaccination (see Bharadwaj & Lakdawala (2013), Jayachandran & Kuziemko (2011), Chakravarty *et al.* (2010) and Oster (2009)). In a closely related line of enquiry several papers explore the intrahousehold allocation of resources in the event of an income shock. Behrman & Deolalikar (1990) find that the nutrient intake of females is more sensitive to price and income fluctuations, Rose (1999) finds that favorable rainfall shocks increase the probability of female relative to male survival in early childhood and Sekhri & Storeygard (2014) find that a decline in rainfall increases the reported number of dowry deaths. In contrast to these findings, I find that the worsening of nutritional outcomes does not depend on the gender of the child. This seems to indicate absence of discrimination in respect of allocation of nutrients in the event of a shock to lifetime income. Rather, the effect of growing up in households that have a large number of unmarried daughters of marriageable age depends on the age of the child, with children aged 5 years or less being the worst sufferers.

3 The Data and Descriptive Statistics

I use data from the India Human Development Survey (IHDS-1) (Desai *et al.* (2005)) and IHDS-2 (Desai *et al.* (2015)). The IHDS is a two-wave panel of a representative sample of Indian households. The first wave (IHDS-I) was conducted in 2004-05 and the second wave (IHDS-II) was conducted in 2011-12. IHDS-I is a nationally representative survey of 41,554 households. IHDS-II reinterviewed 83% of these households as well as split households (if located in the same town or village). IHDS-

II had a replacement sample of 2,134 households. Both IHDS-I and IHDS-II contain detailed information on household level consumption, income, resident and non-resident members of the household and socioeconomic characteristics elicited through a "Household Questionnaire" answered by a knowledgeable respondent — typically the head of the household. In each household an ever-married woman aged 15-49 answered a "Woman's Questionnaire" that elicited information on health, education, complete fertility history, family planning and gender relations in the household and the community. Importantly, we have height and weight measurements for children aged 0-5 and 8-11 years at the time of the survey and for the eligible woman from IHDS-I. IHDS-II provides height and weight measurements of all children aged 0-18 years at the time of the survey, the eligible woman in the household and the person who answered the "Income and Social Capital" questionnaire[6]. Also, we have responses from the interviewed woman in each household to questions that ask the upper and lower bounds of the customary amount of expenses in a daughter's and son's wedding in her social class and caste.[7] I deflated all nominal variables in IHDS-2 using the seasonally adjusted deflator provided in the IHDS-2 dataset.

The data on consumption is available at the household level. Detailed information on the consumption of foods, non-foods, durables and non-durables is elicited. These information are used to calculate monthly per capita consumption expenditure (COPC) of the household. Both rounds of IHDS collected detailed data on all possible sources of income from all economic activities[8] conducted by the members of the household. These were used to calculate net annual household income. IHDS-1 and IHDS-2 asked households what assets they possessed from a list of 30 assets (33 for IHDS-II). The sum of these asset possession indicators provided an assets score for the household. I scaled the assets score to vary between 0 and 30. Using the

[6] This is the equivalent of the "Household Questionnaire" from IHDS-I

[7] The questions were, "What is the usual amount of money spent on a daughter's (son's) wedding in your social class and caste?" The interviewer was asked to probe for a single number in each case but was allowed to accept a range if provided by the respondent.

[8] These include detailed information on farm activities, income from sale of products derived from livestock, wage and salary income and income from up to three household businesses.

data on height of children I compute z-score based measures for nutritional outcomes recommended by the World Health Organization to monitor child growth standards. Height-for-age z-score is a measure of age-appropriate height and is recommended for the monitoring of child growth.These z-scores are calculated with respect to an international reference population recommended by the WHO which consists of a sample of healthy children drawn from USA, Norway, Oman, India, Ghana and Brazil. The height-for-age z-score of a child is computed as follows:

$$\text{Height-for-age Z-score} = \frac{\text{Height of child - Median}}{\text{SD}}$$

where the median and SD are the median height and standard deviation of height among children of the same age (measured in months) in the reference population. I use the six broad categories[9] of household caste available in IHDS-2 to create an indicator variable $\mathbf{1}$(Forward Caste) which takes the value 1 if the household is either Brahmin or some other "Forward Caste" which is not Brahmin, and takes the value 0 otherwise.

Tables 1 & 2 provide descriptive statistics. We note that the average child aged 5 years or less is close to stunted. (Stunting is defined as a height-for-age z-score less than -2.). The average age at marriage is around 17 years. Figure 1 shows that most women marry before attaining 20 years of age. Levels of schooling are rather low (7 years on an average) and marriage expenses are high relative to income, especially for the bottom 25 percentiles of the income distribution (see Tables 3 & 4). Note also that the "Forward Castes" have costlier marriages at similar levels of income (also see Figures 2 and 3). Around 26% of the sample households are Forward Caste (see Table 5) and there is some variation in the number of unmarried daughters aged 18 or less across households (see Table 6). These two variations are crucial for identification. Table 7 shows that marriage is universal. By age 20, around 89% of

[9] The six categories are Brahmin, Other forward (not Brahmin), Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Castes (OBC) and Others

individuals had married at least once. Divorce seems to be a rather rare occurrence.

4 The Methodology

As mentioned before Hindus who belong to the upper castes customarily spend more money on their daughters' weddings. Also, the difference between the wedding expenses of girls and boys is higher for the Forward Caste than the base category. I ascertain these by running the following OLS regression and noting that the coefficient on the indicator **1**(Forward Caste) is positive.

$$\text{Daughter's marriage expense}_{it} = \beta_0 + \beta_1 \mathbf{1}(\text{Forward Caste})_i + \beta_2 X_{it} + \epsilon_{it} \quad (1)$$

where i and t index a household and time period respectively, Daughter's_marriage_expense is the customary amount of money that is spent marrying off a daughter in a household of the relevant social class and caste as declared by the interviewed woman and X is a vector of controls that includes household income, assets index and the wave of the panel. I also run the same specification replacing the dependent variable with the difference between the expenses in a daughter's wedding and that in a son's.

If our hypothesis that parents save money for their daughters' wedding is true we must observe that all else equal, within the set of families that have the same number of children, families with more unmarried daughters of marriageable age spend less on consumption. This can be tested by running the following regression:

$$\begin{aligned}\text{Per-capita Consumption Expenditure}_{it} = \alpha_i + \gamma_1 \text{Income}_{it} + \gamma_2 \text{No. of children}_{it} \\ + \gamma_3 \text{No. of daughters}_{it} + \gamma_4 X_{it} + \epsilon_{it}\end{aligned} \quad (2)$$

Here α_i denotes household fixed effects.

Finally, I must tease out the causal effect of dowry on the nutritional outcome of children. I use a difference-differences model for the purpose. Consider potential outcomes given by the following two equations.

$$N_{i,UC(n_i \geq 0)} = n_i \alpha_{UC} + \gamma_{UC} + \delta_{n_i} + X_i \beta + \epsilon_{i,UC(n_i)} \tag{3}$$

$$N_{i,LC(n_i \geq 0)} = \gamma_{LC} + \delta_{n_i} + X_i \beta + \epsilon_{i,LC(n_i)} \tag{4}$$

where $N_{i,UC(n_i \geq 0)}$ denotes the nutritional outcome of child i if (s)he lives in an upper/forward caste (UC) household which has a total of n_i unmarried females aged 18 or less while $N_{i,LC(n_i \geq 0)}$ denotes the nutritional outcome of the same child if (s)he lives in a lower caste (LC) household with the same number of unmarried females aged 18 or less. The potential nutritional outcome is allowed to depend on the following:

1. If i lives in an upper caste household, (s)he is potentially "treated" with high marriage expenses. The effect of living in an upper caste household with a total of one unmarried female aged 18 or less is denoted by α_{UC}. The intensity of "treatment" depends on the total number of unmarried females aged 18 or less, hence the effect of treatment is $n_i \alpha_{UC}$. If i lives in a lower caste household, (s)he is not treated.

2. A caste-fixed effect (denoted by γ_j, $j \in \{UC, LC\}$). This term accounts for unobservables unrelated to marriage expenses that could affect nutrition and could potentially vary by caste. Plausible examples include dietary patterns, sanitary practices, the disease environment, etc.

3. A "number of daughters" effect (denoted by δ_{n_i}) that *does not* vary across the two caste categories. This accounts for the fact that families that have different numbers of unmarried daughters of marriageable age may have different "preferences" that might be consequential for nutrition of a child in the family.

4. An idiosyncratic component ϵ.

My objective is to identify α_{UC}. This is accomplished in the following manner.

Taking a single difference as below eliminates all the *marriage-expense-neutral* channels through which caste and omitted variables correlated with caste affect nutrition.

$$\mathbf{E}\big[N_{i,UC(n_i=k+1)} - N_{i,UC(n_i=k)}\big] = \alpha_{UC} + [\delta_{k+1} - \delta_k] \tag{5}$$

$$\mathbf{E}\big[N_{i,LC(n_i=k+1)} - N_{i,LC(n_i=k)}\big] = [\delta_{k+1} - \delta_k] \tag{6}$$

(5) – (6) yields

$$\mathbf{E}\Big[\big[N_{i,UC(n_i=k+1)} - N_{i,UC(n_i=k)}\big] - \big[N_{i,LC(n_i=k+1)} - N_{i,LC(n_i=k)}\big]\Big] = \alpha_{UC} \tag{7}$$

which establishes identification. The crucial assumption here that facilitates identification is that the part of the effect of the number of unmarried females (aged 18 or less) that is independent of marriage expenses does not vary by caste. In other words, δ_{n_i} does not have a caste subscript in equations (3) and (4). Empirically, I identify the coefficient of interest by running the following regression.

$$\begin{aligned} N_{ijc} = {} & \alpha_0 + \alpha_1 Umf_j + \mathbf{1}(\text{Forward Caste})_j + \alpha_2 Umf_j * \mathbf{1}(\text{Forward Caste})_j \\ & + \alpha_3 \mathbf{1}(\text{Female})_{ijc} + \alpha_4 X_{ijc} + \epsilon_{ijc} \end{aligned} \tag{8}$$

where N_{ijc} refers to the nutritional outcome (as measured by the height-for-age Z-score) of child i living in household j belonging to caste c, Umf_j denotes the number of unmarried girls aged 18 or less in household j and $\mathbf{1}(.)$ denotes the indicator function. However, the concern that households with different numbers of unmarried daughters could be systematically different from one another in a manner that might be consequential for nutrition poses a challenge to the interpretation of α_2 in equation (8) above as causal. In an attempt to address this concern, I specify the following household fixed-effects model.

$$N_{ijt} = \alpha_j + \alpha_2 Umf_{jt} * \mathbf{1}(\text{Forward Caste})_j + \alpha_3 Umf_{jt} + \alpha_4 \mathbf{1}(\text{Female})_i + \alpha_5 X_{ijt} + \epsilon_{ijt} \tag{9}$$

Here, t indexes time and α_j denotes household fixed effects. In equation (9), α_2 is identified off "within-household" variation in the number of daughters, and hence, estimates thereof are not subject to the endogeneity concern mentioned above.

Finally, to check if the differential worsening of nutritional outcomes (consequent upon the presence of an additional daughter) across castes differs by the gender of the child, I use the following triple difference specification.

$$\begin{aligned} N_{ijc} = {} & \alpha_1 Umf_j + \alpha_2 Umf_j * \mathbf{1}(\text{Forward Caste})_j \\ & + \alpha_3 Umf_j * \mathbf{1}(\text{Forward Caste})_j * \mathbf{1}(\text{Female})_{ijc} \\ & + \alpha_4 \mathbf{1}(\text{Forward Caste})_j * \mathbf{1}(\text{Female})_{ijc} + \alpha_5 \mathbf{1}(\text{Forward Caste})_j \\ & + \alpha_6 \mathbf{1}(\text{Female})_{ijc} + \alpha_7 \mathbf{1}(\text{Female})_{ijc} * Umf_j \\ & + \alpha_8 X_j + \epsilon_{ijc} \end{aligned} \tag{10}$$

Here, the coefficient of interest is α_3. A negative estimate of α_3 would indicate discrimination against girls.

5 Results

In each of the regressions standard errors are clustered at the Primary Sampling Unit (PSU) level[10] and the sample is restricted to households that were in both waves of the panel[11]. Tables 8-12 provide results of different variants of equation (1). Tables 8 and 9 demonstrate that controlling for assets, the wave of survey, location and state fixed effects, both girls' and boys' marriage expenses are higher amongst the so-called forward castes at comparable levels of income. The dependent variable here is the lower or upper bound of marriage expenses (as revealed by the eligible woman) customarily incurred at a son's and daughter's wedding in the social class and caste the household belongs to. Tables 10 and 11 reveal that the same is true for the ratio of marriage expenses to annual income. We also notice that the gap in

[10] A PSU is a neighborhood in an urban area and a village in a rural area.

[11] The results are robust to the inclusion of all households.

marriage expenses across castes is higher for households in the bottom 25 percentiles of the income distribution. Table 12 reveals that the difference between a girl's marriage expenses and a boy's marriage expenses are higher for the forward castes at comparable levels of income.

Table 13 provides estimates of equation (2). A comparison of columns (1) and (2) indicate that holding the number of persons in the household fixed, the presence of an additional unmarried female aged 18 or less is associated with a 7.7% decrease in monthly consumption expenditure per capita while the corresponding decline associated with the presence of an additional male aged 18 or less is only 4.85%. Column (3) controls for both the number of unmarried females aged 18 or less and the number of males aged 18 or less. We notice that all else equal, one more unmarried girl aged 18 or less is associated with a 9.09% decline in consumption per capita while the corresponding decline associated with a male aged 18 or less is only 6.82%. These results are consistent with households with more daughters saving up for their daughters' marriages and the presence of an additional son imposing no such burden on the household.

Tables 14 and 15 provide estimates of different variants of equations (8) and (10) respectively and contain the main results of this paper. In each case the sample has been restricted to households belonging to the bottom 25 percentiles of the income distribution.[12] Table 14 shows that for children aged 5 years or less the presence of an additional unmarried girl aged 18 or less in the household is associated with a 0.33 standard deviation higher reduction in height-for-age z-scores in Forward Caste households as compared to the base category. However, this does not hold for children over 5 years of age. Table 15 shows that the differential worsening of height-for-age across castes does not vary by gender of the child. Table 16, which presents estimates of equation (9), shows that the result in Table 14 is robust to the introduction of household fixed effects. As a robustness check, I present the results of a placebo test

[12]It is reasonable that the need to save forces only the very poor households to cut down on food. For households above the 25th percentile of the income distribution I do not find any effects on the nutritional outcome of children.(These results are not shown but are available upon request.)

in Table 17, the “placebo” being the number of males in the household aged 18 or less. Notice that the presence of additional males in the household places a lower financial burden on the household because sons’ marriages are far less expensive than daughters’ marriages. We note that the coefficients on the interaction terms are positive and insignificant.

6 Conclusion

Using data from the two rounds of the India Human Development Survey which is a rich panel dataset from India, I document that daughters’ marriages are more expensive than sons’ marriages. Moreover, daughters’ marriages are customarily more expensive in the Forward Caste households as compared to the other castes. I find evidence that after controlling for a rich set of covariates including the total number of people in the household and order of birth of the child, children in households that have more girls are shorter in height (by age-appropriate measures) than their peers in households that have less girls. It seems that children aged five years or lower are the most adversely affected. Furthermore, the evidence suggests that the differential worsening of nutritional outcomes across caste does not vary by sex of the child but does vary by age. Children appear most susceptible to the reduction in height in early childhood. As one would expect the result holds only for households with incomes below the 25th percentile of the income distribution. These findings, to the best of my knowledge, are the first to suggest that marriage expenses might lead to a deterioration in nutritional outcomes in early childhood, and that all children exposed to the shock in the early years of their lives are vulnerable to it regardless of their sex. In view of the well-established fact that outcomes in early life predict earnings potential in adult life, high marriage expenses appear to be a serious cause for concern.

References

Anderson, Siwan. 2003. Why dowry payments declined with modernization in Europe but are rising in India. *Journal of Political Economy*, **111**(2), 269–310.

Anderson, Siwan. 2007. The economics of dowry and brideprice. *The Journal of Economic Perspectives*, **21**(4), 151–174.

Arnold, Fred, Choe, Minja Kim, & Roy, Tarun K. 1998. Son preference, the family-building process and child mortality in India. *Population studies*, **52**(3), 301–315.

Ashraf, Nava, Bau, Natalie, Nunn, Nathan, & Voena, Alessandra. 2016. *Bride price and female education*. Tech. rept. National Bureau of Economic Research.

Behrman, Jere R, & Deolalikar, Anil B. 1990. The intrahousehold demand for nutrients in rural south India: Individual estimates, fixed effects, and permanent income. *Journal of human resources*, 665–696.

Bhalotra, Sonia, Chakravarty, Abhishek, & Gulesci, Selim. 2016. The Price of Gold: Dowry and Death in India. *IZA Discussion Paper 9679*.

Bharadwaj, Prashant, & Lakdawala, Leah K. 2013. Discrimination begins in the womb: evidence of sex-selective prenatal investments. *Journal of Human Resources*, **48**(1), 71–113.

Brown, Philip H. 2009. Dowry and intrahousehold bargaining evidence from China. *Journal of Human Resources*, **44**(1), 25–46.

Case, Anne, & Paxson, Christina. 2008. Stature and status: Height, ability, and labor market outcomes. *Journal of Political Economy*, **116**(3), 499–532.

Chakravarty, Abhishek, *et al.* 2010. Supply shocks and gender bias in child health investments: evidence from the ICDS programme in India. *BE Journal of Economic Analysis and Policy (Topics). doi*, **10**(2202), 1935–1682.

Clark, Shelley. 2000. Son preference and sex composition of children: Evidence from India. *Demography*, **37**(1), 95–108.

Corno, Lucia, Hildebrandt, Nicole, & Voena, Alessandra. 2016. Weather Shocks, Age of Marriage and the Direction of Marriage Payments. *Unpublished Manuscript*.

Das Gupta, Monica, Zhenghua, Jiang, Bohua, Li, Zhenming, Xie, Chung, Woojin, & Hwa-Ok, Bae. 2003. Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea. *The Journal of Development Studies*, **40**(2), 153–187.

Desai, Sonalde, Vanneman, Reeve, & National Council of Applied Economic Research, New Delhi. 2005. India Human Development SurveyIHDS-1. *ICPSR22626-v8. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2010-06-29. http://doi.org/10.3886/ICPSR22626.v8.*

Desai, Sonalde, Vanneman, Reeve, & National Council of Applied Economic Research, New Delhi. 2015. India Human Development Survey-II (IHDS-II), 2011-12. *ICPSR36151-v2. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], http://doi.org/10.3886/ICPSR36151.v2.*

Glewwe, Paul, & Miguel, Edward A. 2007. The impact of child health and nutrition on education in less developed countries. *Handbook of development economics*, **4**, 3561–3606.

Gupta, Jayoti. 2002. Women second in the land agenda. *Economic and Political Weekly*, 1746–1754.

Guven, Cahit, & Lee, Wang-Sheng. 2015. Height, aging and cognitive abilities across Europe. *Economics & Human Biology*, **16**, 16–29.

Harris, Marvin. 1993. The evolution of human gender hierarchies: A trial formulation. *Sex and gender hierarchies*, 57–79.

Hoddinott, John, Behrman, Jere R, Maluccio, John A, Melgar, Paul, Quisumbing, Agnes R, Ramirez-Zea, Manuel, Stein, Aryeh D, Yount, Kathryn M, & Martorell, Reynaldo. 2013. Adult consequences of growth failure in early childhood. *The American journal of Clinical Nutrition*, ajcn–064584.

Jayachandran, Seema, & Kuziemko, Ilyana. 2011. Why do mothers breastfeed girls less than boys? Evidence and implications for child health in India. *The Quarterly Journal of Economics*, **126**(3), 1485–1538.

Jayachandran, Seema, & Pande, Rohini. 2017. Why Are Indian Children So Short? The Role of Birth Order and Son Preference. *American Economic Review*, **107**(9), 2600–2629.

Jensen, Robert. 2002. Fertility Preferences and Female Disadvantage: Equal Treatment, Unequal Outcomes?

Kodoth, Praveena. 2005. Fostering insecure livelihoods: dowry and female seclusion in left developmental contexts in West Bengal and Kerala. *Economic and Political Weekly*, 2543–2554.

Logan, Trevon D, & Arunachalam, Raj. 2014. Is there dowry inflation in south asia? an assessment of the evidence. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, **47**(2), 81–94.

Miller, Barbara D. 1981. *The endangered sex.*

Oster, Emily. 2009. Does increased access increase equality? Gender and child health investments in India. *Journal of development Economics*, **89**(1), 62–76.

Rao, Vijayendra. 1993. The rising price of husbands: a hedonic analysis of dowry increases in rural India. *Journal of Political Economy*, **101**(4), 666–677.

Rose, Elaina. 1999. Consumption smoothing and excess female mortality in rural India. *Review of Economics and statistics*, **81**(1), 41–49.

Sekhri, Sheetal, & Storeygard, Adam. 2014. Dowry deaths: Response to weather variability in India. *Journal of development economics*, **111**, 212–223.

Strauss, John, & Thomas, Duncan. 1998. Health, nutrition, and economic development. *Journal of economic literature*, **36**(2), 766–817.

Tanner, James M, Healy, MJR, Lockhart, RD, Mackenzie, JD, & Whitehouse, RH. 1956. Aberdeen growth study: I. The prediction of adult body measurements from measurements taken each year from birth to 5 years. *Archives of Disease in Childhood*, **31**(159), 372.

Figure 1: Age at Marriage for ever-married woman: IHDS-2

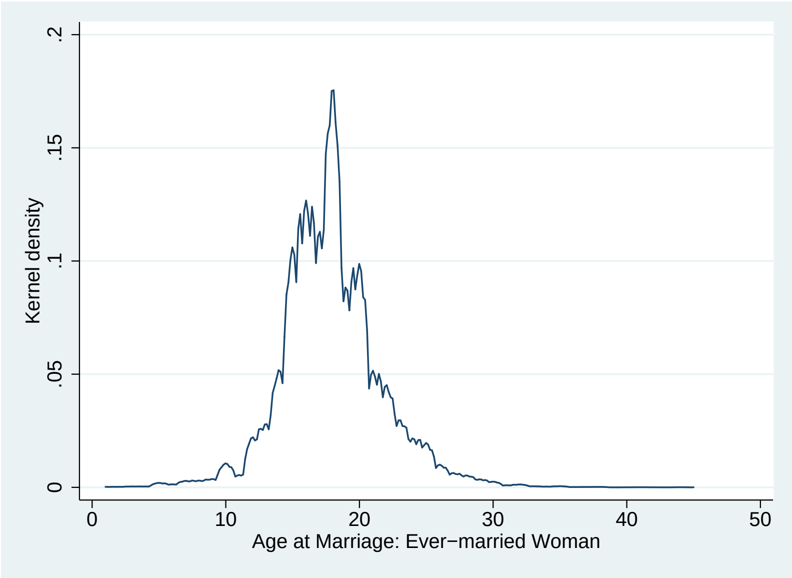

Figure 2: Minimum daughter's marriage expenses / Annual income: 1st Quartile

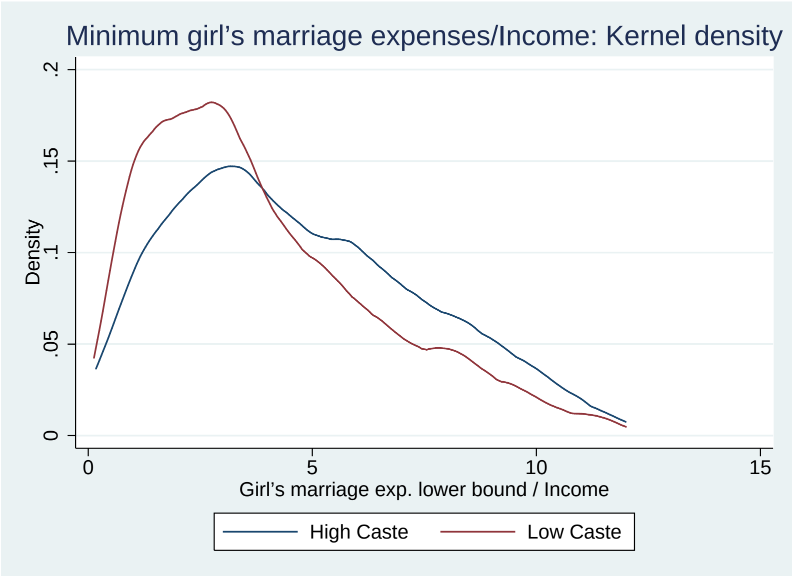

Figure 3: Maximum daughter's marriage expenses / Annual income: 1st Quartile

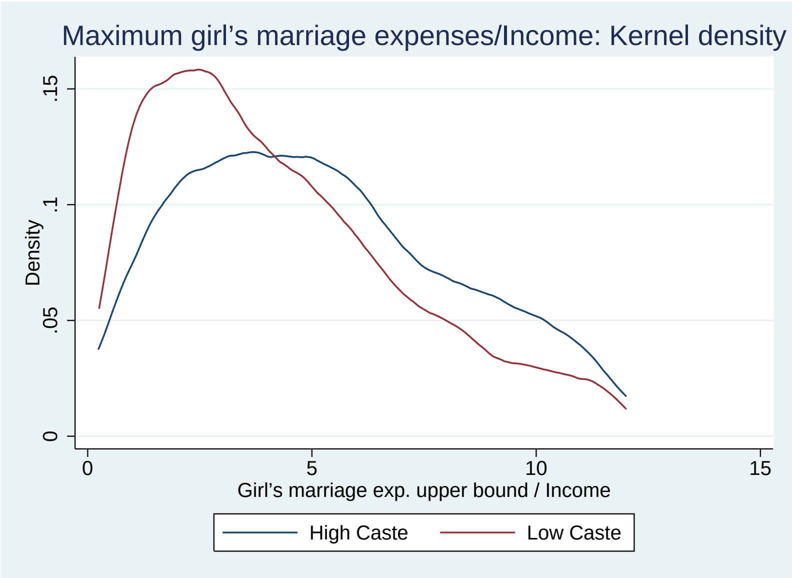

Table 1: Summary statistics for Individual Characteristics

	IHDS-1 & 2 Mean (se) [N]	IHDS-1 Mean (se) [N]	IHDS-2 Mean (se) [N]
Height-for-age z-score (children $\leq$ 60 months)	-1.9332 (2.075) [16224]	-1.9785 (2.1417) [7209]	-1.8970 (2.0212) [9015]
$\mathbf{1}$(Female)	0.4897 (0.499) [386635]	0.4775 (0.499) [191830]	0.5017 (0.4999) [194805]
Order of birth	2.559 (1.662) [140816]	2.557 (1.6217) [64994]	2.5604 (1.6972) [75822]
Woman's age at marriage for women $\leq$ 30	17.29 (3.59) [199353]	17.19 (3.622) [103897]	18.24 (3.139) [12557]

Note: Individuals are not weighted

Table 2: Summary statistics for Household Characteristics

	(IHDS-1 & 2) Mean (se)	(IHDS-1) Mean (se)	(IHDS-2) Mean (se)
Monthly consumption per capita	904.1409	767.9647	1109.409
	(8.763989)	(7.804252)	(11.96952)
Monthly consumption per capita	365.6012	337.3083	408.1693
(Essential Foods)	(2.017636)	(2.115036)	(2.568238)
Annual Household Income	54873.86	48058.1	64919.26
(2004 Rupees)	(710.2223)	(650.6629)	(953.1056)
1(Urban)	.2775596	.2586581	.3345829
	(.0104789)	(.0102679)	(.0119086)
No. of persons	5.514119	5.817751	5.055944
	(.0333894)	(.0437789)	(.0251666)
No. unmarried females aged 11-18	.4002826	.4227386	.3685873
	(.0052229)	(.0074843)	(.0059347)
No. unmarried females aged 0-18	.9671253	1.059109	.8332281
	(.011922)	(.0147401)	(.0102105)
No. of males aged 0-18	1.114638	1.235478	.9374558
	(.0138677)	(.017248)	(.0116327)
Asset Index	12.39582	11.2621	14.09752
	(.1140392)	(.1135238)	(.1211405)
1(Forward Caste)	.22636	.2292197	.2393939
	(.0077589)	(.00825)	(.008576)
1(Hhd has bank a/c)	.5166	.3603	.6937
	(.00605)	(.00700)	(.00700)

Summary statistics for Household Characteristics (contd...)

	(IHDS-1 & 2) Mean (se)	(IHDS-1) Mean (se)	(IHDS-2) Mean (se)
Yrs. of schooling	7.316014	6.923944	7.874019
(highest educated female 21+)	(.0772921)	(.0775272)	(.0786082)
Yrs. of schooling	4.757283	4.135875	5.713579
(highest educated male 21+)	(.0756611)	(.0765499)	(.0840007)
Max. amt. spent in a girl's wedding	108037.9	89912.86	134672.5
(2004 Rupees)	(1336.02)	(1257.701)	(1853.995)
Min. amt. spent in a girl's wedding	82775.83	71137.45	99944.61
(2004 Rupees)	(1025.207)	(1007.943)	(1350.619)
Max. amt. spent in a son's wedding	68727.6	57236.06	85249.38
(2004 Rupees)	(834.8296)	(782.2985)	(1136.022)
Min. amt. spent in a son's wedding	52879.06	46026.23	62758.05
(2004 Rupees)	(645.4496)	(641.3276)	(833.1912)
Girl's wedding expenses(Upper)/Income	2.868359	2.68912	3.105968
	(.0265025)	(.0341037)	(.0361254)
Son's wedding expenses(Upper)/Income	1.865776	1.752968	2.008978
	(.0180114)	(.0221232)	(.0253983)
Girl's wedding expenses(Lower)/Income	2.225048	2.152064	2.316402
	(.0206958)	(.0279075)	(.0285838)
Son's wedding expenses(Lower)/Income	1.448779	1.408414	1.494071
	(.0140944)	(.0182454)	(.0192191)
N	52537	29484	23053

Note: Household weights used

Table 3: **Customary Marriage Expenses (2004 Rupees) for a Daughter by Caste Category (1st quartile of Income distribution)**

Caste category	Upper bound Mean (se)	Lower bound Mean (se)
Forward Castes(IHDS-1)	93978.5	74784.3
	(3933.288)	(3409.098)
Other Castes(IHDS-1)	62713	49675
	(1269.25)	(983.769)
Forward Castes(IHDS-2)	120487	92565
	(4429.89)	(3750.29)
Other Castes(IHDS-2)	91356.47	66918.28
	(2395.34)	(1416.767)
Forward Castes(IHDS-1 & 2)	105222	83295
	(3406.48)	(2836.12)
Other Castes(IHDS- 1 & 2)	74541	56747
	(1450.38)	(926.2953)

Source: IHDS 1 & 2

*Note:*Household weights used

Table 4: **Mean of Ratio of Marriage Expenses for a daughter to Annual Household Income by Caste Category (1st quartile of Income distribution)**

Caste category	Upper bound	Lower bound
IHDS-1:		
Forward castes	5.13	4.26
Other Castes	4.32	3.52
IHDS-2:		
Forward castes	6.96	5.30
Other Castes	5.83	4.54

Source: IHDS 1 & 2

*Note:*Household weights used

Table 5: Caste Categories (IHDS-1 households): Weighted Percentage

Item	Number cent
Brahmin	4.71
Forward/General (except Brahmin)	22.07
Other Backward Castes (OBC)	42
Scheduled Castes (SC)	23
Scheduled Tribes (ST)	7.84
Others	1
Total	100

Source: Sample restricted to panel households

Table 6: Number of Unmarried Females aged 0-18 in a household: Weighted Percentage

Number	Per cent
0	33.8
1	32.8
2	18.8
3	3.5
4	1.3
≥ 5	9.8
Total	100

Note: Sample restricted to panel households
Panel household weights used

Table 7: **Marital Status (Age > 20)**

Item	Number	Per cent
Married, spouse absent	4,550	2
Married	183,527	77
Unmarried	26,485	11
Widowed	22,299	9
Separated/Divorced	1,672	1
Married no gauna	123	0
Total	238,656	100

Source: IHDS 1 & 2

Note: Gauna is the consummation of marriage.

Table 8: Determinants of **Girls'** Marriage Expenses (Customary Minimum and Maximum in 2004 Rupees)

	(1) Min. expenses	(2) Max. expenses	(3) Min. expenses	(4) Max. expenses
1(Forward Caste)	27606.0***	36256.0***	21809.4***	29387.2***
	(2244.0)	(2859.6)	(2767.9)	(3539.6)
1(Wave2)	13596.4***	26217.8***	13114.1***	23879.1***
	(1254.9)	(1820.5)	(1395.2)	(2388.2)
1(Forward Caste)***1**(Wave2)	-4604.2*	-8078.9**	-3978.3	-9771.9*
	(2605.4)	(3423.1)	(4096.9)	(5254.0)
Annual household Income	0.165***	0.214***	-0.311***	-0.270*
	(0.01168)	(0.01513)	(0.1138)	(0.1406)
Asset Index	4512.3***	5918.9***	3880.4***	5378.5***
	(122.78)	(160.59)	(170.20)	(256.81)
1(Urban)	-2486.4	-4666.4**	-1224.0	-2429.3
	(1771.0)	(2318.3)	(2023.5)	(3108.5)
N	65955	65946	17622	17610
R^2	0.351	0.368	0.268	0.289
Sample:				
Income distribution	All	All	0-25th %ile	0-25th %ile

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions are weighted using household weights.

All regressions control for state fixed effects and have a constant.

Table 9: Determinants of **Boys'** Marriage Expenses (Customary Minimum and Maximum in 2004 Rupees)

	(1) Min. expenses	(2) Max. expenses	(3) Min. expenses	(4) Max. expenses
1(Forward Caste)	15072.4***	20661.5***	12291.5***	17434.8***
	(1317.4)	(1881.0)	(1432.8)	(2485.8)
1(Wave 2)	9059.7***	18496.6***	8407.2***	16418.3***
	(816.90)	(1224.6)	(888.47)	(1557.1)
1(Forward Caste)***1**(Wave2)	166.2	-1603.7	1478.5	450.5
	(1540.5)	(2156.1)	(2525.1)	(4069.5)
Annual household Income	0.102***	0.136***	-0.234***	-0.217
	(0.007679)	(0.01083)	(0.07571)	(0.1394)
Asset Index	2494.4***	3319.3***	2142.7***	2973.5***
	(68.486)	(101.78)	(106.56)	(191.91)
1(Urban)	-1273.4	-2129.9	-1303.9	-2258.9
	(956.61)	(1491.4)	(1250.6)	(2130.0)
N	65977	65947	17660	17604
R^2	0.323	0.312	0.242	0.227
Sample:				
Income distribution	All	All	0-25th %ile	0-25th %ile

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions are weighted using household weights.

All regressions control for state fixed effects and have a constant.

Table 10: Determinants of Ratio of **Girls'** Marriage Expenses to Annual household Income

	(1) Min. exp. ÷Income	(2) Max. exp. ÷Income	(3) Min. exp. ÷Income	(4) Max exp. ÷Income
1(Forward Caste)	0.657***	0.773***	0.881***	1.030***
	(0.06526)	(0.06364)	(0.1127)	(0.1364)
1(Wave 2)	0.466***	0.807***	0.854***	1.339***
	(0.04126)	(0.04870)	(0.07421)	(0.09347)
1(Forward Caste)*__1__(Wave2)	-0.177**	-0.161**	-0.384**	-0.244
	(0.07013)	(0.07849)	(0.1919)	(0.2271)
Annual household Income	-0.0000201***	-0.0000252***	-0.000259***	-0.000305***
	(3.980e-07)	(4.716e-07)	(0.000007859)	(0.000009310)
Asset Index	0.0481***	0.0637***	0.157***	0.207***
	(0.003883)	(0.004663)	(0.008156)	(0.01060)
1(Urban)	-0.186***	-0.268***	-0.126	-0.236*
	(0.03971)	(0.05154)	(0.1005)	(0.1244)
N	62784	62372	14669	14404
R^2	0.230	0.239	0.339	0.339
Sample:				
Income distribution	All	All	0-25th %ile	0-25th %ile

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions are weighted using household weights.

All regressions control for state fixed effects and have a constant.

Table 11: Determinants of Ratio of **Boys'** Marriage Expenses to Annual Income

	(1) Min. exp. ÷Income	(2) Max. exp. ÷Income	(3) Min. exp. ÷Income	(4) Max exp. ÷Income
1(Forward Caste)	0.337***	0.440***	0.430***	0.531***
	(0.03273)	(0.04048)	(0.07114)	(0.09045)
1(Wave 2)	0.324***	0.554***	0.580***	0.901***
	(0.02662)	(0.03356)	(0.04877)	(0.06523)
1(Forward Caste)***1**(Wave2)	-0.0769*	-0.0506	-0.125	-0.0103
	(0.03963)	(0.05035)	(0.1307)	(0.1640)
Annual household Income	-0.0000125***	-0.0000167***	-0.000157***	-0.000212***
	(2.444e-07)	(3.302e-07)	(0.000004807)	(0.000005899)
Asset Index	0.0209***	0.0285***	0.0901***	0.119***
	(0.002386)	(0.003173)	(0.005293)	(0.007166)
1(Urban)	-0.116***	-0.141***	-0.112*	-0.0941
	(0.02448)	(0.03395)	(0.06294)	(0.08579)
N	62665	62611	14591	14569
R^2	0.246	0.249	0.333	0.354
Sample:				
Income distribution	All	All	0-25th %ile	0-25th %ile

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions are weighted using household weights.

All regressions control for state fixed effects and have a constant.

Table 12: Determinants of **difference** in a girl's and boy's customary marriage expenses (in 2004 Rupees)

	(1) Min. girl -Min. boy	(2) Max. girl -Max. boy	(3) Min. girl -Min. boy	(4) Max girl -Max. boy
1(Forward Caste)	11138.4***	16511.5***	9378.1***	13574.0***
	(1871.6)	(2675.3)	(2181.3)	(3327.3)
1(Wave 2)	4472.4***	7461.2***	2762.4**	7097.8***
	(1108.0)	(1593.4)	(1389.6)	(2170.3)
1(Forward Caste)***1**(Wave2)	-1568.6	-6829.7**	-3063.0	-8209.8
	(2445.6)	(3385.6)	(3328.3)	(5668.5)
Annual household Income	0.0746***	0.103***	-0.147	-0.116
	(0.01689)	(0.02156)	(0.1218)	(0.1700)
Asset Index	2162.4***	2747.4***	1937.0***	2776.1***
	(130.21)	(184.33)	(174.73)	(287.30)
1(Urban)	-3159.5*	-5042.8**	1140.9	456.2
	(1771.8)	(2271.3)	(2111.0)	(3604.2)
N	67314	67298	17959	17957
R^2	0.119	0.112	0.109	0.0866
Sample:				
Income distribution	All	All	0-25th %ile	0-25th %ile

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions are weighted using household weights.

All regressions control for state fixed effects and have a constant.

Table 13: Variation of Log Monthly Per Capita Consumption Expenditure with Number of Unmarried Daughters aged 0-18, Household Fixed Effects Model

	(1) ln(COPC)	(2) ln(COPC)	(3) ln(COPC)
No. unmarried females 0-18	-0.0771***		-0.0909***
	(0.01396)		(0.01493)
No. males 0-18		-0.0485***	-0.0682***
		(0.01527)	(0.01623)
Annual hhd. Income	0.00000185	0.00000216	0.00000161
	(0.000001679)	(0.000001694)	(0.000001681)
No. of Persons	-0.0601***	-0.0693***	-0.0394***
	(0.006933)	(0.007266)	(0.009934)
Wave of Survey	0.241***	0.240***	0.239***
	(0.01414)	(0.01409)	(0.01407)
N	23938	23922	23894
F	178.1	174.4	159.3
R^2	0.297	0.288	0.299
Sample:			
Income distribution:	1-35th %ile	1-35th %ile	1-35th %ile

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All regressions are estimated using household fixed effects.

Table 14: Variation of Height-for-age Z scores of children with Number of Unmarried Daughters aged 0-18, Sample restricted to very poor households

	(1) Height-for-age Z Score	(2) Height-for-age Z Score	(3) Height-for-age Z Score
No. of unmarried girls 0-18	0.0784	0.0456	-0.0406
	(0.06745)	(0.06479)	(0.04429)
1(Forward Caste)	0.597***	0.217	0.222
	(0.1817)	(0.1934)	(0.1366)
No. of unmarried girls 0-18***1**(Forward Caste)	-0.329***	-0.0756	-0.0666
	(0.09336)	(0.1000)	(0.08295)
1(Female)	-0.0545	-0.0181	-0.0461
	(0.1122)	(0.1006)	(0.06646)
N	3289	2458	2749
R^2	0.0457	0.0911	0.0934
Sample:			
Age in months	≤ 60	$61 - 110$	$111 - 228$

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: All regressions are weighted using panel household weights. All regressions control for order of birth, age in months, no. of persons in the household, household income, asset index, rural or urban location, religion, type of toilet dummies, dummy for having a bank account, education of highest educated male and female aged 21 or more and state fixed effects. Model(1) controls for wave of survey. All regressions have a constant. Standard errors clustered at the PSU level. In all cases sample restricted to households with annual income between 3500 and 18500 (2004) Indian Rupees.

Table 15: Checking for discrimination against girls (DDD Model)

	(1) Height-for-age Z Score	(2) Height-for-age Z Score	(3) Height-for-age Z Score
No. of unmarried girls 0-18	0.0764	0.0223	0.0443
	(0.08609)	(0.08242)	(0.06410)
1(Forward Caste)	0.588***	0.217	0.264*
	(0.2198)	(0.2060)	(0.1439)
1(Female)	-0.0397	0.0611	0.251**
	(0.1936)	(0.1753)	(0.1245)
No. of unmarried girls 0-18***1**(Forward Caste)	-0.278**	0.0921	0.00191
	(0.1373)	(0.1487)	(0.1204)
1(Forward Caste)***1**(Female)	-0.00194	-0.203	-0.275
	(0.4146)	(0.3301)	(0.2544)
No. of unmarried girls 0-18***1**(Female)	0.000509	0.0119	-0.173**
	(0.1072)	(0.09247)	(0.08049)
No. of unmarried girls 0-18***1**(Female)	-0.0717	-0.188	-0.00505
***1**(Forward Caste)	(0.2123)	(0.1975)	(0.1628)
N	3289	2458	2763
R^2	0.0458	0.0945	0.0984
Sample:			
Age in months	≤ 60	$61 - 110$	$111 - 228$

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: All regressions are weighted using panel household weights. All regressions control for order of birth, age in months, no. of persons in the household, household income, asset index, rural or urban location, religion, type of toilet dummies, dummy for having a bank account, education of highest educated male and female aged 21 or more and state fixed effects. Model(1) controls for wave of survey. All regressions have a constant. Standard errors clustered at the PSU level. In all cases sample restricted to households with annual income between 3500 and 18500 (2004) Indian Rupees.

Table 16: Variation of Height-for-age Z scores (of children 10 years or less) with Number of Unmarried Daughters aged 0-18 (Household Fixed Effects), Sample restricted to very poor households

	(1) Height-for-age Z-score	(2) Height-for-age Z-score
No. of Unmarried Females 0-18	0.490	
	(0.3243)	
No. of Males 0-18		-0.902***
		(0.2303)
No. of Unmarried Females 0-18 *$\mathbf{1}$(Forward Caste)	-1.023*	
	(0.5904)	
No. of Males 0-18 *$\mathbf{1}$(Forward Caste)		1.035
		(0.9110)
Hhd. Fixed Effects	Yes	Yes
N	5074	5074
F	5.152	6.529
R^2	0.0703	0.0768

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Both regressions control for gender, order of birth, age in months, no. of persons in the household, household income, asset index, dummy for having a bank account, education of highest educated male and female aged 21 or more. In both cases sample is restricted to households with annual income between 6000 and 18000 (2004) Indian Rupees. Standard errors clustered at the PSU level. Both regressions are weighted using household weights.

Table 17: **Placebo Specification**: Variation of Height-for-age Z scores of children with Number of Males aged 0-18

	(1) Height-for-age Z Score	(2) Height-for-age Z Score	(3) Height-for-age Z Score
No. of males aged 0-18	0.0152	-0.0686	-0.0713
	(0.06779)	(0.07046)	(0.05632)
1(Forward Caste)	-0.0607	-0.119	0.0393
	(0.2095)	(0.2093)	(0.1567)
No. of males aged 0-18 ***1**(Forward Caste)	0.144	0.130	0.0632
	(0.1209)	(0.1157)	(0.08562)
1(Female)	0.0158	-0.0222	-0.147**
	(0.1069)	(0.09925)	(0.07323)
N	3289	2458	2749
R^2	0.0425	0.0918	0.0935

Standard errors in parentheses

Source: IHDS-1 & 2

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: All regressions are weighted using panel household weights. All regressions control for order of birth, age in months, no. of persons in the household, household income, asset index, rural or urban location, religion, type of toilet dummies, dummy for having a bank account, education of highest educated male and female aged 21 or more and state fixed effects. Model(1) controls for wave of survey. All regressions have a constant. Standard errors clustered at the PSU level. In all cases sample restricted to households with annual income between 3500 and 18500 (2004) Indian Rupees.