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15 February 2012

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MARCH 15, 2011

Abstract

Female bargaining power in rural Haryana, as in much of northern India, is constrained by widespread discrimination against women. In recent years, however, women successfully demand private sanitation facilities from potential husbands as a precondition for marriage. I study this manifestation of bargaining power by modeling latrine adoption as an investment that males can make to improve their desirability on the marriage market, and I show that increasing proportions of females with strong sanitation preferences drive male investment in toilets. Moreover, I demonstrate women's ability to secure latrines increases when they are relatively scarce in a marriage market. I test these predictions empirically by studying a sanitation program in Haryana, India, known colloquially as "No Toilet, No Bride". Using a triple difference empirical strategy based on households with and without marriageable boys, in Haryana and comparison states, before and after program exposure, I provide evidence that male investment in sanitation increased by 15% due to the program. Further, the program effect is four times larger in marriage markets where women are scarce (26%) as compared to marriage markets where women are abundant (6%). These results suggest the relative scarcity of women in Haryana has, conditional on women surviving to marriageable age, improved the ability of the remaining women to secure valuable goods.

JEL Classification: D1, J12, O12, O13

*Affiliation: Yale University. Email: yaniv.stopnitzky@yale.edu. I am grateful to my advisors Dean Karlan, Matthew Kotchen, Sheila Olmstead, and Chris Udry for their guidance and support. I also thank Doug Gollin, Mark Rosenzweig, Paul Schultz, Mushfiq Mobarak, Paul Gertler, Sebastian Galiani, Dan Keniston, Jack Molyneaux, Alexandra Orsola-Vidal, Sumeet Patil, Treb Allen, Melanie Morten, Camilo Dominguez, Snaebjorn Gunnsteinsonn, Namrata Kala, and seminar participants at Yale, Columbia, Pompeu Fabra, Arizona State, Resources for the Future, and the AERE Summer Conference for discussion and valuable comments.

1 Introduction

The economic analysis of public goods often focuses on the suboptimal provision that arises from non-excludability and free-riding. In this framework, costly private efforts to provide public goods generate unremunerated, external positive benefits, and therefore rational agents underprovide public goods relative to the social optimum. Implicit in this analysis is an assumption of unitary decision-makers, whether optimizing individuals or households. If the public good in question is one that households must choose to provide, however, then the validity of the unitary decision-making assumption is critical to understanding provision.

A large and growing body of empirical research casts doubt on the fiction of a unitary household as a model of intrahousehold behavior.[1] A promising alternative for modeling household decision processes is the collective household model, which assumes only that households are Pareto efficient (Browning *et al.* (1994)); individuals within the household are not assumed, in this approach, to have identical preferences, as in the traditional unitary household model. The assumption of collective efficiency generates testable predictions of how "distribution factors" (Browning & Chiappori (1998)), variables that affect the intrahousehold allocation without changing preferences, enter individual demand functions.

This focus on intrahousehold decision-making raises a second, potentially important determinant of public good provision. In particular, if agents inside the household have heterogeneous preferences for a public good (or, equivalently, in their private costs of providing that good), then intrahousehold decisions will also affect the provision of certain public goods. This paper develops this argument by focusing on intrahousehold bargaining over an impure public good and provides strong evidence that intrahousehold bargaining can be shape public good provision.

Women in rural Haryana suffer from discrimination that is widespread and strong enough to generate the most skewed state-level sex ratio in all of India.[2] Due to parental preferences for sons over daughters, parents provide differential post-natal care to boys and girls (Das Gupta (1987)), invest preferentially in male fetuses (Bharadwaj & Nelson (2010)), and/or selectively abort female fetuses (Arnold, Kishor & Roy (2002), Qian (2008)). Each of these factors exacerbates the sex imbalance. Further, if women survive to adulthood, they face numerous gender-specific constraints on their ability to travel or work outside of the household (Eswaran, Ramaswami & Wadhwa (2009)).

In this social context of discrimination, females in rural Haryana have in recent years

[1] For recent examples, see Ashraf (2009), Qian (2008), Bobonis (2009), among others.

[2] Source: Indian Census, 2011. Note that two non-state union territories, Chandigarh and Delhi, both adjacent to Haryana, have slightly worse sex ratios.

demanded from men and obtained a particularly valuable good—toilets—as a precondition for marriage. Women value toilets to a greater extent than males because they suffer disproportionately from male staring and harassment when they defecate, urinate, or attend to menstrual hygiene in public places. For this reason, private latrines generate benefits that are disproportionately enjoyed by females. The change that has allowed women to successfully demand latrines in marriage negotiations is associated with an unusual sanitation campaign commonly known as "No Toilet, No Bride", which Haryana state authorities initiated in 2005. The campaign encouraged families of marriage-age girls to demand that potential suitors' families construct a latrine prior to marriage. Mass media messaging via billboards, posters, and radio advertisements emphasized phrases such as "no toilet, no bride" and "no loo, no I do". These messages were framed by women's concerns about privacy and dignity when they defecate in the open, a behavior that is routine among roughly 70% of rural households in Haryana in 2004. Although the rationale for public investment in sanitation programs is the reduction of fecal pollution and the morbidity associated with widespread open defecation, the emphasis of "No Toilet, No Bride", combined with the fact that private benefits accrue largely to women, provides a unique opportunity to study female bargaining power under widespread discimination.

The "No Toilet, No Bride" program serves as a source of exogenous variation that alters the distribution of female preferences for sanitation. Because women move into the house of their husbands or their husbands' families at the time of marriage, the program's focus on women's preferences indirectly targets male behavior. I study the male response to the program by modeling latrine adoption in a transferable utility model of the marriage market. In the model, men can choose to invest in sanitation in order to raise their returns from marriage, which also depend on marriage market conditions. The model generates two key empirical predictions. First, I show that increasing the proportion of women with strong preferences for sanitation will cause men to increase their investments in latrines. Second, I extend the model to focus on the role of sex ratios, and I demonstrate the marriage market return to male investment increases to a greater extent when females are relatively scarce as compared to when females are abundant. Finally, I analyze the potential role of dowries in altering these empirical predictions, and I establish that the model's predictions on male investment will remain unchanged because dowry is determined in equilibrium as one component of the marital surplus.

I test these predictions using two rounds of the District-Level Household and Facility Survey (2004, 2008/9), a nationally representative, household data set. I employ an empirical strategy based on the intuition that the "No Toilet, No Bride" campaign exerts disproportionate pressure to adopt a latrine on those households with boys active on the marriage market. If the program was successful in linking sanitation with the marriage market, then

households with boys of marriageable age face exogenous pressure to build a latrine, and they should therefore have a higher probability of latrine ownership after exposure to the program. Because such households could differ from households without marriageable age boys in a variety of unobserved ways, my econometric specification controls explicitly for these unobserved characteristics. I implement a difference-in-difference-in-difference approach that compares latrine ownership in households with and without boys of marriageable age, in Haryana and comparison states from northern India, before the program started and three to four years after the program began.

I find an increase of 4.3 percentage points (a 15% increase from a base of 28%) in the latrine ownership differential between households with and without marriage-age boys in Haryana over the period 2004 to 2008 relative to the difference between latrine ownership households with and without marriageable boys in comparison states. In addition, I provide strong, complementary evidence that latrine adoption is driven by whether households have marriageable boys active in a highly competitive marriage market, i.e. one with an undersupply of women due to highly skewed sex ratios. Specifically, I find that Haryana's observed latrine adoption due to "No Toilet, No Bride" is driven largely by marriage markets with a scarcity of women; in these markets I estimate a program effect of 26% over baseline. In marriage markets without this scarcity, however, the "No Toilet, No Bride" treatment effect is one-fourth as large.

These results are robust to competing hypotheses that the program caused changes in male preferences or increased latrine ownership by changing female preferences outside of marriage market channels. Evidence against the former hypothesis comes from a test of program effects among households with boys slightly older than marriage age, and who were thus too old to be affected by the program when they were active on the marriage market. Similarly, I present evidence against the latter alternative hypothesis by analyzing the ability of strictly single marriage-age girls to demand and obtain latrines. Thus, the program appears to operate specifically through the channel of marriage market bargaining.

Finally, I seek evidence on shifts in the intrahousehold sharing rule due to the "No Toilet, No Bride" program. Using a range of household assets and marriage-related variables that women value, I find no evidence the program has caused women to substitute toilets for other goods they value. On the contrary, women's relative position appears to have improved both in terms of age at marriage and the educational quality of their male spouses, while males appear to have been compensated in the form of motorbikes, perhaps in compensation for their sanitation expenditures. I am unable to determine empirically the intrahousehold allocation due to unobservables, but these results provide suggestive evidence that although "No Toilet, No Bride" has altered marital negotiations in various ways, women's status has not worsened along multiple observable dimensions.

Consistent with theoretical predictions from a transferable utility marriage market model with endogenous investment in quality, these findings suggest that (i) the "No Toilet, No Bride" campaign has significantly increased latrine ownership by linking marriage matching to the acquisition of a good that females particularly value, and (ii) biased sex ratios have increased the relative bargaining power of women on the marriage market, thereby improving their ability to demand goods. Thus, in an area with one of the most severely skewed sex ratios on earth, a local scarcity of women appears to have increased women's bargaining power, allowing them to obtain additional goods that they value.

This paper is organized as follows. Section 2 provides a social and economic background to marriage markets in northern India and Haryana, specifically where the "No Toilet, No Bride" program operates. Section 3 presents a model of marriage matching with endogenous investments in quality; a fuller treatment can be found in the theoretical appendix. Section 4 discusses sanitation in rural India and important features of the "No Toilet, No Bride" program. Section 5 explains the empirical strategy, identification issues, and data. Section 6 contains the key empirical results. Robustness to competing hypotheses is discussed in Section 6.3, and Section 7 discusses additional evidence on female bargaining and the intrahousehold allocation. Section 8 concludes.

2 Marriage Markets in Northern India

Marriage markets in northern India are fundamentally shaped by social norms around patrilocality and caste endogamy. Moreover, the marriage negotiation process is structured by the phenomena of arranged marriage and dowry. Marriages are typically arranged by the parents of both families, often with the help of an intermediary matchmaker, who helps identify suitors according to the criteria established by the families. The most important dimensions along which potential spouses are valued include caste, religion, kinship, profession, education, and physical attractiveness; the attractiveness of women is a characteristic particularly important for men (Banerjee *et al.* (2009)). Together, these interlocking institutions play a primary role in shaping the opportunity sets faced by marriage-age individuals and in determining marital outcomes. In this section I provide an overview of these social practices and highlight those characteristics significant for the theory and empirics of this paper.

2.1 Patrilocal Exogamy

The first important aspect of marriage in northern India, of which Haryana is a part, is the practice of patrilocal/virilocal exogamy, i.e. the migration of newlywed brides out of their

households and into the residence of their husbands' family located outside of the brides' home village (Gould (1961)). For example, data from the 1994 PGIRCS survey in the states of Uttar Pradesh and Karnataka suggest that 90% of imported brides originated from villages located within 67 kilometers of the sample villages (Bloch, Rao & Desai (2004)). In their study of how village exogamy serves as a form of insurance against spatially correlated risks, Rosenzweig & Stark (1989) note that the average distance across which two rural Indian households linked through marriage was approximately 30 kilometers. These empirical findings are broadly consistent with other qualitative evidence such as Dutt, Noble & Davgun (1981), which details marriage-generated links for two Punjabi villages and finds that 80% of households had a marriage distance of 40 kilometers. Thus, although households practice strict village exogamy (and appear to seek villages whose incomes do not covary strongly with the home village), households are typically searching for partners within a geographically defined area. This descriptive fact is important for the purposes of this paper because later I adopt an empirical definition of marriage markets in reference to a household's home district.[3]

2.2 Caste Endogamy

A second, crucial feature of Indian marriage matching is caste endogamy, i.e. the practice of marrying a spouse from within one's own caste. For example, Banerjee *et al.* (2009) cite an opinion poll in which 74% of respondents from West Bengal define themselves as opposed to inter-caste marriage, and the authors note the practice of caste endogamy is so widespread that matrimonial classified advertisements, which are common in Indian newspapers, often group listings by caste. In addition, these authors present evidence that individuals are willing to trade substantial benefits in terms of spousal beauty, education, and/or wealth in order to marry within-caste. Later in the empirical section of this paper, I use such widespread and strong preferences for caste endogamy, coupled with the pervasiveness of patrilocal exogamy described above, to justify my empirical definition of a marriage market.

2.3 Sex Ratios in Contemporary India

In India, particularly in the northern states, the phenomenon of "missing women", i.e. women absent from the population due to skewed sex ratios, has a long history. For example, under British rule in the 19th century, census officials documented low ratios of women to men in northern India and British officials suspected the Rajputs, a large northern clan, of female infanticide (Chakraborty & Kim (2008)). Whereas in the past much of the ob-

[3]The full definition I use is the intersection of caste, religion, marriage-age cohort, and district.

served sex imbalance was explained by such infanticide and/or differential neglect of girls (Das Gupta (1987)), the spread of ultrasound, amniocentesis, and doctor-provided abortion technology in recent decades has driven sex ratios among younger cohorts.[4] Estimates using data from the National Family Health Survey (NFHS-2, 1998/9) indicate that more than 100,000 sex-selective abortions of female fetuses were being performed each year in India, many of them by private providers in contravention of (unenforced) government regulations (Arnold, Kishor & Roy (2002)).

The underlying driver of both differential neglect and selective abortion is a strong parental preference for sons. Parents prefer boys over girls for each birth order, but this effect increases dramatically for higher birth order children. In data from the District Level and Household Survey (DLHS 2008/9), 15% of married female respondents *without* children report wanting a boy but only 3% desire a girl, conditional on wanting another child. For birth orders higher than four, nearly 10 times more mothers state a preference for another son as compared to another girl (65% and 6%, respectively). Moreover, these patterns are dominated by preferences among households in northern Indian states.[5]

The consequence of these widespread preferences, coupled with abortion technology and differential neglect/care in the intrahousehold allocation, is a dearth of women relative to men as compared to sex ratios assumed to be natural in countries without discrimination. In this broad regional context, the Punjab region stands out as having the most imbalanced sex ratios. According to the newly released 2011 Census of India, the overall ratio in India is 940 women for every 1000 men. But this aggregate figure masks substantial heterogeneity across Indian states. For example, the Indian state with the most favorable sex ratio for women is Kerala with a female-male ratio of 1084; Kerala is followed by Pondicherry and Tamil Nadu with ratios of 1038 and 995, respectively. The most sex-imbalanced state is Haryana with only 877 females for every 1000 males. Punjab, which has close historical, cultural, and economic ties with Haryana, has a sex ratio of 893 females for every 1000 males. These data are summarized in Figure I, which depicts state-level variation in sex ratios.

Marriage markets are, of course, shaped by the relative proportions of men and women, and the phenomenon of missing women thus increases competition between men for the remaining women. Using this empirical context as motivation, I develop in the next section a conceptual framework for understanding how sex ratios and other marriage market factors affect human capital investments that make people more desirable.

[4]Induced abortion has been legal in India since the Medical Termination of Pregnancy Act (1971) but only under specific conditions that exclude preferences over the child's sex or overall family gender composition.

[5]The largest discrepancies between stated preferences for sons and daughters were found in Bihar, Chattisgarh, Gujarat, Haryana, Jharkhand, Madhya Pradesh, Orissa, Punjab, Rajasthan, Uttarakhand, and Uttar Pradesh. Among households in these states, the average ratio of son to daughter preference was 4.4, conditional on wanting another child. By contrast, among the southern states of Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, and Tamil Nadu the same average was 1.6.

3 Marriage Matching With Endogenous Investment

The decision to marry is one of the most consequential economic decisions in an individual's life. Spouses not only bring qualities to the union that interact to shape household (re)production, with strong implications for intra- and inter-generational welfare, but spousal traits structure the matching process by which marriages form in the first instance. These facets of marriage have occupied a substantial fraction of economists' attention to the causes and consequences of marriages. Much of this research has examined how marriage market conditions and singles' outside options affect outcomes in marriage, with a common result emerging that the fiction of a unitary household inadequately characterizes the complexity of real-world intrahousehold behavior.[6]

Due to the importance of marriage, individuals surely anticipate their marriage prospects and, to the extent feasible, make decisions that maximize their gains from that (future) partnership. Yet only relatively recently has attention been paid to how marriage market conditions affect *pre*-marital behavior (Iyigun & Walsh (2007), Chiappori, Iyigun & Weiss (2009)). Given the widespread importance of traits such as income and education in people's marital decisions, premarital behavior in anticipation of marriage will be critical in determining investments and human capital accumulation. The empirical evidence on these theoretical predictions is sparse, but Lafortune (2010) finds evidence that variation in sex ratios, and thus marriage market prospects, affect individuals' investment decisions in education. Similarly, Arunachalam & Naidu (2006) find that expectations over future fertility bargaining impacts dowry payments before marriage. By showing that men invest in latrines as a response to marriage market conditions, this paper contributes to this small literature.

This section outlines a simple, two-period model that describes how marriage market conditions affect premarital investments. I begin with the benchmark transferable utility model of the marriage market, incorporate useful simplifications drawn from a study by Chiappori, Iyigun & Weiss (2009) on educational attainment and marriage matching, and reinterpret the model to reflect preferences over sanitation. Moreover, I extend the model in two ways to adapt it to important features of the marriage market context in Haryana, as

[6]The theoretical literature on collective household and marriage models suggests that marriage market conditions, such as sex imbalance or divorce laws, should affect the intrahousehold allocation by shifting the resource sharing rule toward the scarcer sex (e.g. Becker (1973), Angrist (2002), Chiappori, Fortin & Lacroix (2002). In this sense, sex ratios are a prototypical distribution factor (Browning & Chiappori (1998)), i.e. a condition that alters the household sharing rule without changing the joint budget set or individual preferences. Evidence for this consistent theoretical result has been found in several developed country contexts. For example, Angrist (2002) studies immigrant populations in U.S. labor markets and finds that sex ratios characterized by many men to women results in lower female labor force participation among married women, and (Abramitzky, Delavande & Vasconcelos (2011)) find supportive evidence that sex imbalance affects the average gap in quality between men and women. Similarly, Chiappori, Fortin & Lacroix (2002) study changes in divorce legislation and find that favorable changes in the legal status of women diminish female labor supply.

discussed in Section 2. First, I devote special attention to the interaction of sex ratios and the distribution of traits in the population. Second, I make the role of dowries explicit in the agents' marriage decisions and I show that investment decisions are unaffected by dowry amounts. In this section, I provide an intuitive discussion of the main assumptions and I focus on predictions that I later test empirically; the theoretical appendix contains additional details.

The conceptual framework is based on a frictionless, transferable utility model of marriage matching, which treats men and women as distinct decision makers with individual preferences, i.e. (potential) households are not assumed to be unitary. An equivalent interpretation is that the parents of men and women act as decision makers (and parental preferences are identical to the preferences of their children); this interpretation is arguably more apt in the context of arranged marriages. Prior to marriage, men choose to invest in their quality in order to maximize the utility they will receive over their two-period lifetimes. In the second period, men either marry or remain single. If they marry, the benefits from marriage are shared between spouses in a manner determined by marriage market constraints as well as the human capital investment decisions made prior to marriage.

The key characteristic of this model is that males and females are divided into *only* two classes, *high* and *low*, which correspond to gender-specific preferences for sanitation (Chiappori, Iyigun & Weiss (2009)). Individual utility for all agents is increasing in sanitation, but due to the gender-specific cost of entering the *high* sanitation class, a positive fraction of men and women have *low* sanitation class when time begins in the model. All payoffs for singles and married couples depend only on the sanitation class to which an individual belongs, i.e. utility is a function only of sanitation class. This implies that the shares of marital surplus, which are determined in equilibrium, also depend only on sanitation class. In particular, since all individuals have a perfect substitute, individuals of the same sanitation class must receive the same share of the marital surplus. In this way, the model assumptions generate specific bounds on the returns for males of being high or low sanitation class, and these bounds will be shown to vary with both the fraction of women with high sanitation preferences and with the sex ratio.

3.1 Basic Features of Transferable Utility

To formalize these arguments, begin by considering the benchmark transferable utility model in which individuals have exogenously determined index of quality. Let x reflect the quality of males and y the quality of females. The union of individuals x and y produces marital output denoted by $f(x, y)$, which is a function only of individual characteristics.[7] In this

[7] In the interest of exposition, I assume heterosexual partnerships for the remainder of this paper.

paper, as is typical in the literature, this marital production function is assumed to be supermodular, i.e. male and female traits are complements in production, which implies positive assortative matching in the marriage market (Becker (1973)).

If individuals do not marry, their utility is simply $f(x,0)$ for males and $f(0,y)$ for females, with $f(\cdot,\cdot)$ assumed to be strictly increasing in both arguments. Given these individual utilities, we can define the *material surplus*, i.e. marital output minus singles' output, as:

$$z_{xy} = f(x,y) - f(x,0) - f(0,y) \tag{1}$$

In addition, men and women have an exogenous, idiosyncratic gain from marriage θ_i, which is assumed to be distributed as $\theta_i \sim F(\theta)$ for $i = x, y$. A natural interpretation for the parameter θ is in terms of the underlying heterogeneity of the individual, emotional gains from marriage. Given this emotional gain from marriage, we can write total marital surplus as equal to $z_{xy} + \theta_x + \theta_y$.

The defining characteristic of the transferable utility framework is that marital surplus is divided and shared between spouses. In this way the TU model provides an attractive interpretation of dowries and brideprices. These payments at the time of marriage help to clear markets because individuals of lower quality have a well-established mechanism for providing their (potential) spouse with a larger share of the marital surplus.

3.2 Specific Model Assumptions

The general transferable utility framework can be simplified in an appealing manner in order to highlight the binary decisions most relevant to premarital investment in sanitation. These simplifications originate from a model presented in Chiappori, Iyigun & Weiss (2009), who focus on educational investments and marriage matching. The key assumption is that males and females can be divided into two classes, *high* and *low*, which in this context correspond to gender-specific preferences for sanitation. This assumes that singles' output and married people's output are functions *only* of sanitation class. Denote these classes by $x \in \{h,l\}$ for males and $y \in \{h,l\}$ for females (where h and l mean *high* and *low*). Finally, assume that the output functions are such that: (i) singles' utility is increasing in sanitation class, i.e. $f(h,0) > f(l,0)$ and $f(0,h) > f(0,l)$, and (ii) sanitation classes are complements, i.e. $f(x,y)$ is supermodular and $z_{hh} + z_{ll} > z_{hl} + z_{lh}$.

Thus, the three key assumptions that characterize this TU set-up are the following: (i) output/utility depend only on sanitation class, (ii) output is an increasing function of only sanitation class, and (iii) sanitation classes are complements in the production of marital output.

3.3 Grounding Model Assumptions in Empirical Context

Although these assumptions on spousal traits reflects a simplification of the decision-making process around marriage, they adhere closely to real-world conditions in general, as well as the particular context of this study. First, note that once an individual is of marriageable age and marriage inquiries begin, the investment options available to improve one's quality in the eyes of potential suitors are extremely constrained. The most important traits for marriage, as discussed in Section 2, are not chosen by individuals active on the marriage market, but are either (i) assigned to them by birth (caste, religion, kinship), (ii) represent the accumulation of multiple years of human capital investments (education, profession, beauty), or (iii) are constrained by external factors (profession and labor markets). By contrast, males' decisions to invest in latrines are endogenously chosen, relatively cheap, and available over even a very short time scales. In this way this model captures effectively the short-term investment decisions men can make over latrine construction in order to attract a bride.

Moreover, it is reasonable to assume that marital output is an increasing function of sanitation class, and that sanitation classes are complements in terms of marital output. Owning a toilet is likely to result in better health outcomes, e.g. reduced illness, and improved non-material welfare benefits, e.g. dignity and social status. This is true both for singles and for married couples. Similar arguments justify the assumption of complementarity in sanitation classes across spouses. Due to health-related externalities, for example, the health benefits an individual obtains from sanitation will enhance the benefits that individual's spouse obtains from sanitation. Further, dignity and social standing will increase to a greater extent not only if a given individual is known as being of high sanitation class but if their spouse is as well. Thus, there is good reason to believe that sanitation classes of men and women will be complements in the marital output function.

3.4 Marriage Decisions

Conditional on sanitation class, individuals in the marriage market choose the class of the potential spouse such that their share of the marital surplus is maximized. If the same conditions are met on the other side of the market, and if males' and females' respective shares are greater than zero, then the marriage forms. Formally,

$$u_x = \max\{U_x + \theta_x, 0\} \quad \text{where} \quad U_x = \max_y \left[z_{xy} - V_y\right] \tag{2}$$

$$v_y = \max\{V_y + \theta_y, 0\} \quad \text{where} \quad V_y = \max_x \left[z_{xy} - U_x\right] \tag{3}$$

Individuals choose the partner of a sanitation class that maximizes their share of marital surplus, which is given by U_x (for men) and V_y (for women). Due to the simplification regarding sanitation classes, there are only four possible pairing: high/high, high/low, low/high, low/low. Further, the set-up implies that all individuals in the same group have an identical substitute and therefore must receive the same share of marital surplus. In particular, observe that if U_h is the share of marital surplus obtained by men in the high sanitation class, and U_l by those in the low sanitation class, then the difference $(U_h - U_l)$ specifies the additional surplus a married man receives from being in the high as compared to low sanitation class.

3.5 Endogenous Investment

Let the marriage market economy be comprised of individuals who live for two periods. In period one, all men are in the low sanitation class, but can choose to invest in sanitation at cost c, which converts them into a high sanitation class individual in period two. All investment decisions occur in the first period and all marriage decisions occur in the second period. Assume lifetime utility is additive across periods. If men never marry and do not invest, their lifetime two-period utility is given by $2f(l,0)$. If they do invest, then in the first period they consume the output associated with a low sanitation person, $f(l,0)$, and in the second period consume $f(h,0)$ if they remain single.

The *unmarried individual's return* to investing is the difference between individual output as a high and low sanitation class person:

$$\phi_x = f(h,0) - f(l,0) \tag{4}$$

Putting this potential single individual's return together with the marriage market return to investment, the investment decision rule of males can be written as:

$$f(h,0) + f(l,0) + \max\left[U_h + \theta_x, 0\right] - c > 2f(l,0) + \max\left[U_l + \theta_x, 0\right] \tag{5}$$

The left hand side of this inequality gives the total output consumed by men of high sanitation class after investing in period one; the right hand side gives total output conditional on not investing.

As discussed above, decisions to marry are determined by the agents' value of θ. In particular, if the individual emotional gain from marriage is sufficiently small ($\theta_x < -U_h$), then even the largest possible share of the marital surplus will be insufficient to entice men to marry. Similarly, if the draw of θ_x is larger than $-U_l$, then the male will *always* marry, irrespective of investment decisions. Finally, there is an intermediate range of θ_x for which

men marry on condition that they invested in the first period, and they remain single if they do not build a latrine ($-U_h < \theta_x < -U_l$).

3.6 Equilibrium

Equilibrium in this model is established by two criteria. First, a clear prerequisite for any stable matching profile is that equal numbers of men and women must marry. Formally,

$$r\left[1 - F(-V_h)\right] = \left[1 - F(-U_l)\right] + \int_{-U_h}^{-U_l} G(\phi_x + U_h + \theta_x)h(\theta)d\theta \tag{6}$$

where the left-hand side is simplified due to the assumption that female cost to being of high sanitation class is sufficiently low as to not impede females developing strong preferences for toilets.[8]

The first term on the right-hand side gives the proportion of men for whom the idiosyncratic gain from marriage, θ_x, is sufficiently large that they always marry. The second term reflects the proportion of men who marry because they made the premarital investment. The sum of these two terms must equal the sum of females, given on the left-hand side, who marry. This quantity is mediated by r, which specifies the sex ratio of females to males. If $r \neq 1$, then incentives must adjust in order to equilibrate the numbers of available women and willing men to marry.

The second criterion for equilibrium characterizes the relative proportions of men and women in high and low sanitation classes. Even if there are equal populations of men and women, it could be the case that, in equilibrium, the number of men or women with high sanitation class differs from the other sex. Therefore, some high sanitation class individuals must marry a low sanitation class partner (if they marry at all). Because of complementarity in types, it must be the case that either (i) there are equal numbers of high sanitation men and women, in which case equilibrium displays perfect positive assortativeness, (ii) some high sanitation men marry low sanitation women, or (iii) some low sanitation men marry high sanitation women. Formal characterization of the equilibrium can be found in the appendix.

3.7 Predictions

The equilibrium conditions generate empirically verifiable predictions, which I test in later sections. In particular, the model delivers two important results on the impact of shifting

[8]More generally, if there is a cost to females of becoming high sanitation class, then they will face an investment decision rule similar to 5. Later, when I discuss the "No Toilet, No Bride" campaign, this case can be modeled as a shock that reduces dramatically the cost of females being high class. For example, if social norms previously made it rare or difficult to negotiate over latrines, then "No Toilet, No Bride" made is less costly for women to express their preferences for sanitation.

women's preferences on male investment in latrines; these model implications are stated in Proposition 1.

Proposition 1. *Given the transferable utility marriage market with endogenous investment discussed above:*

(i) An increase in the fraction of women with strong preferences for sanitation causes males' marriage market return to sanitation investment to increase.

(ii) The marriage market return to males' sanitation investment associated with any given increase in the proportion of women is larger when women are scarce than with equal populations; this return is smallest when women outnumber men.

Proof. See Section A.3 in the appendix.

Intuitively, as the proportion of women with high sanitation class increases so that there are more high sanitation class women than men, then men obtain their largest possible return to latrine investment. This increased return to building a latrine will, on average, raise latrine ownership; this testable prediction will be evaluated against the data in subsequent sections. Further, if women are scarce, then some men must remain unmarried. Due to transferable utility, these men can bid away the entire marital surplus that low sanitation level men would have obtained if there were equal numbers of men and women. Thus, married males with low sanitation level receive no surplus, and so the marital return for sanitation investment is larger than in the case of equal male and female populations. Investing in a latrine will, except in extreme cases of sex imbalance, ensure men marry at least a low sanitation class woman. In contrast, if women are abundant, then some women must remain unmarried and men with a low sanitation level receive the entire surplus associated with marrying a woman of low sanitation level. Their incentives to invest in sanitation are consequently diminished as compared to the equal populations or scarce women cases.

As discussed above, dowries are a common feature of marriage markets in this empirical context. If women (or their families) can simply adjust the dowry amount depending on their sanitation class, how would the predictions from Proposition 1 be affected? The second proposition provides an answer to this question and clarifies that, in the transferable utility framework studied here, dowries have no impact on the predictions from Proposition 1.

Proposition 2. *If dowry amount is independent of spousal characteristics, then premarital investment decisions are fully separable from decisions over dowry amount. If dowry depends on spousal traits, then dowry amount is determined in equilibrium as one component of the marital surplus. Dowry thus has no effect on male premarital investment.*

Proof. See Section A.4 in the appendix.

This result confirms that dowries are fully internalized in the transferable utility framework, and thus do not impact the empirical predictions from the model. Whereas in later sections I confirm the predictions from Proposition 1, I am unable, given data limitations, to test empirically whether dowry adjusts as a response to the "No Toilet, No Bride" campaign.[9] Later in the discussion of my empirical results, I present limited evidence on changes in dowry as a result of the program.

4 Empirical Context

4.1 Overview of the Empirical Argument

To examine the predictions presented in Section 3, I develop an empirical strategy that takes advantage of a natural policy experiment in the Indian state of Haryana. In 2005, Haryana authorities decided to implement a state-level messaging campaign, which was inspired by the work of a local NGO, that linked potential brides' bargaining power over marriage with the state's low levels of sanitation. Women and their families were encouraged to demand from potential suitors a latrine prior to marriage. In this way the campaign created a new link between long-standing customs related to arranged marital negotiations and one particular good that women value.

The empirical argument proceeds in the following steps. I first explain why latrines are much more valuable to women than men, i.e. why they can be considered a type of female good. The second step discusses the sanitation campaign known as "No Toilet, No Bride" (henceforth, NTNB) and explains its primary effects in terms of the theory outlined above. By focusing on women's ability to demand latrines, the program provides a means of studying their bargaining power on the marriage market. Subsequently, I show evidence that the policy has indeed caused an increase in latrine ownership, that this effect is mediated by the marriage market, and that sex ratios appear to be driving the program effect, further supporting the predictions of the marriage market model. Finally, I present complementary evidence that the program appears not to have changed male preferences as opposed to female preferences, and evidence that the program caused an increase in latrine ownership *only* through the marriage market.

[9] In the context of Bangladesh, however, Arunachalam & Naidu (2006) find that dowries adjust to anticipated changes in bargaining over fertility. Although this is a different setting, it does provide some of the only evidence available that expected bargaining can impact premarital behavior.

4.2 Sanitation, Gender, and the "No Toilet, No Bride" Program

4.2.1 Sanitation as a Female Good

In rural India, a large majority of people lack access to sanitation and must defecate in the open. In a recent household survey conducted in Madhya Pradesh, for example, 80% of respondents reported that their primary places of defecation were fields, bushes, rivers/streams, and other public spaces rather than an improved latrine (Patil & Salvatore (2010)). Access to sanitation, and the lack thereof, affects all people but is of particular significance to women. It is, first of all, a matter of convenience to have a private toilet at home, to be used at one's whim with little effort; this value exists for all members of the household. For women, however, private latrines also provide significant benefits in terms of personal dignity and physical security. The impact of sanitation on female dignity is reflected well in the comments of a sixteen-year-old girl, who explained that "the toilet campaign is like a liberation...I would feel so conscious and ashamed [setting off in the mornings toward the open fields]. But just before my brother got married, we got a toilet in the house."[10] To mitigate embarrassment, Indian women often relieve themselves before sunrise or after dark, putting them at greater risk of sexual assault and other attacks from either humans or, in many rural areas, dangerous wild animals.[11]

These strong preferences for privacy result in uncomfortable strategies to minimize exposure. It is common for women to refrain from drinking during the day in order to avoid needing to use a toilet before sunset. Another respondent elaborated on this behavior: "You can spot men all over the hills and in the main town parking themselves on the side of the roads. But when we go down...we keep in mind that we shouldn't consume too much liquids, or else we might have to use the dirty loos. We have got used to holding it forever." These coping mechanisms have psychological and physical consequences. "Women suffer the most [from lack of sanitation] since there are prying eyes everywhere", said Ashok Gera, a doctor who works in a one-room clinic in Haryana. "It's humiliating, harrowing and extremely unhealthy. I see so many young women who have prolonged urinary tract infections and kidney and liver problems because they don't have a safe place to go". Despite these health effects, women rarely report health concerns as a motivation for toilets; their rationales are most frequently framed in terms of privacy and dignity. This is evidence of a strong female preference for privacy in a social context characterized by routine male efforts to view any uncovered women. Finally, menstruation provides another significant reason for why women value private latrines: toilets provide females with the privacy, time, and

[10] Source: Tehelka Magazine (Indian weekly), Vol. 7, Issue 29, July 24, 2010.

[11] One respondent explained: "During the monsoons it is worse. In the dark when we visit the water logged field overgrown with grass and floating with night soil, the danger of getting bitten by snakes and scorpions is also high." Source: Lesley D. Biswas, The Women's International Perspective, October 1, 2010.

comfort necessary to attend to personal hygiene (World Bank (2005)).[12] Thus, because of the high and gender-specific value that women ascribe, latrines can be understood as a type of private female good.

4.2.2 The "No Toilet, No Bride" Program

In Haryana state, local authorities initiated a massive media campaign in 2005 organized around the message of respecting the right of women to use latrines in privacy and security. This campaign is part of India's Total Sanitation Campaign (TSC), a national initiative of the Government of India whose primary objective is to ensure access to and use of sanitation facilities in rural areas. Although a federal initiative, states shoulder a portion of the costs and have substantial flexibility in local design and implementation.

This information campaign encouraged the families of women to demand of boys' families that they construct a latrine prior to the woman marrying and relocating into the boys' family compound (Haryana, like the rest of northern India is predominantly patrilocal). Slogans such as "no loo, no I do" and "no toilet, no bride" were disseminated via radio, banners, and other advertising channels. In particular, village walls were painted with the message: "I won't allow my daughter to marry into a home without toilets." This initiative thus emphasized a novel linkage between social norms around the marriage market and access to sanitation.

Popular media reports suggest widespread exposure to these ideas.[13] In an interview conducted by the Washington Post, a young male, age 22, who was hoping to marry soon, explained: "I will have to work hard to afford a toilet. We won't get any bride if we don't have one now." "I won't be offended when the woman I like asks for a toilet," he added. As part of the information and education campaign, blank building walls were converted into billboards and painted with the slogan (in Hindi): "I won't get my daughter married into a household which does not have a toilet". A recurring radio jingle sang a tune with the lyrics: "no loo, no I do." The founder of Sulabh International, an NGO that designs low-cost improved latrines, states: "The 'No Toilet, No Bride' program is a bloodless coup. When I started, it was a cultural taboo to even talk about toilets. Now it's changing. My mother used to wake up at 4am to find someplace [in the fields or rivers] to go quietly. My wife wakes up at 7am and can go safely in her home." These vignettes help to characterize the social context in which the "No Toilet, No Bride" campaign operates.

[12] Many authors have argued this strong preference might drive absenteeism among girls in secondary school, despite the null findings of Oster & Thornton (2011), who do not report on the presence of sanitation facilities in their sample schools in Nepal and/or whether latrines influence take-up of menstrual cups.

[13] See, e.g., The Times (UK): "Show us your loo before you woo, men are told" (March 26, 2009) and the Washington Post: "In India, more women demand toilets before marriage" (October 12, 2009).

In addition to anecdotal evidence, administrative data from the Haryana health department suggest a large increase in latrine ownership in recent years. According to state officials, 1.42 million toilets were built between 2005 and 2009. Among this total, 950,000 latrines were built by families above the poverty line and 470,000 by households below the poverty line. Further, household survey data provides additional support for the claim of increased latrine coverage. According to data from two rounds of the District-Level and Household Survey (these data will be described in greater detail below), the proportion of households that owned improved latrines increased from 29% in 2004 to 41% in 2008.

Note that latrines are moderately costly capital investments. The average cost of an improved latrine (e.g. a pit latrine with protective slab or a flush toilet to septic tank) typically ranges between 1000 and 2000 rupees (approximately $20–40 USD). For purposes of comparison, Haryana's state-mandated minimum wage for "Scheduled Appointments" of unskilled laborers was 135 rupees in 2004. According to the Indian NSS, Haryana has the second highest daily wage rate for agricultural labor (195 rupees). Therefore, the cost of typical latrine will range from five to 14 days of paid labor for these two unskilled groups. However, the Government of India provides through the Total Sanitation Campaign subsidies that reimburse households for up to 80% of latrine costs if they possess a Below Poverty Line (BPL) card. Given this incentive scheme, households below the poverty line (BPL) are able to construct an improved latrine at an actual cost of approximately Rs. 200–300 (roughly $4.50–6.75 USD). This amount would be only two days labor for an unskilled worker at Haryana's public position minimum wage or for an agricultural daily wage laborers with BPL card (NSS 2010).

5 Empirical Strategy

Haryana's "No Toilet, No Bride" campaign can be understood as generating exogenous variation in the proportion of women with strong preferences for sanitation. Thus, by studying how latrine adoption responds to the program, it is possible to test empirically the predictions from the theoretical model.

I identify program effects by exploiting the following intuition. The program is targeted to girls and their families in the sense that the female side of the marriage market must accept the campaign's message and decide to take action. The female side of the market is the first step in the sequence of behavioral change related to latrine ownership. However, if the program is effective and women either express their preference or demand a latrine from potential suitors, then the program will exert disproportionate pressure, which is plausibly exogenous, specifically on those households that have boys of marriage age, i.e. households with boys active or nearly active on the marriage market. To study whether women are able

to demand and obtain latrines, therefore, I explore changes in latrine ownership among these particular households with marriageable boys, who comprise the actual treatment group in which the relevant outcome can be measured. After exposure to the program, households with boys of marriageable age can be expected to have a higher probability of latrine adoption as compared with households without marriageable boys.

Since the campaign began in 2005, households are unable to choose the number of marriageable boys as a response to program incentives.[14] In this sense, program exposure in Haryana is plausibly exogenous to the presence of a marriageable boy. Still, households with marriageable boys might differ systematically from non-marriageable boy households, which raises concerns about endogeneity in any simple comparison of these two groups over time.

To address these econometric concerns, I propose two complementary analyses. Estimation begins with a difference-in-difference (DD) specification, which controls explicitly for potential differences in marriageable boy and non-marriageable boy households. I lay out the identifying assumptions required for this analysis, discuss unresolved issues, and propose an additional method based on significantly weaker assumptions. In particular, I use a difference-in-difference-in-difference (DDD) specification, which captures the change in the difference between households with and without marriageable boys on ownership of a latrine after the program was implemented, using northern Indian states other than Haryana as a comparison group. As discussed in Section 2, these states are an appropriate choice for comparison with Haryana because of their relative similarity on matters of son preference and sex ratios as compared to southern Indian or the easternmost Indian states. For these reasons, the factors that mediate women's bargaining power and marriage market processes are likely to be comparable across treatment and comparison households. Estimates of the NTNB program effect are shown to be consistent and similar in magnitude across the DD and DDD specifications, despite being based on different assumptions.

5.1 Data

This paper uses two rounds of household microdata from the District Level Household and Facility Survey (DLHS), a nationwide survey implemented by the Government of India to track the national Reproductive and Child Health Program.[15] The primary survey module interviews a representative sample of ever-married women and gathers household infor-

[14] Households could choose, of course, how and when to become *active* on the marriage market. The manner in which I construct my marriageable boy variable, explained in greater detail in Section 5.2, addresses this concern explicitly.

[15] DLHS is an initiative of India's Ministry of Health and Family Welfare and is implemented by the International Institute for Population Sciences in Mumbai.

mation on maternal and child health outcomes, family planning and reproductive health, utilization of health care services, access to health facilities, and health knowledge. Additional modules focus on household, village, and health facility characteristics, but I do not use them in my analysis. The data form a repeated cross-section that is representative at the district level for 601 districts in 34 Indian states and territories. I use the two latest survey rounds, DLHS-2 (2004) and DLHS-3 (2008/9), which provide data immediately preceding the project period as well as after three/four years of program exposure.[16]

I restrict the sample to focus on rural households from northern states, which are those states characterized by the strongest cultural preference for sons, as discussed in Section 2.3.[17] Using these restrictions, my 2004 data contains information on roughly 220,000 households, including 12,500 in Haryana; the 2008 sample contains data on approximately 370,000 households, including about 16,000 Haryana households.

5.2 Variable Construction

In my empirical analysis, I construct the following variables. *Latrine* is a binary indicator that assumes the value of one if household i owns a private latrine that prevents contact between humans and excreta, as per the standard definition of the Joint Monitoring Programme of WHO and UNICEF; note that shared latrines and pit latrines without slabs do not meet these criteria. I use this definition due to its operational relevance to governmental and non-governmental sanitation programs, including the Total Sanitation Campaign and "No Toilet, No Bride". Moreover, the requirement that toilets be private to a household is closely related to women's concerns around privacy and dignity, and is thus important in the context of the "No Toilet, No Bride" program.

The marriageable boy and girl variables, *mboy* and *girl*, are based on the gender-specific mean age of marriage $+/-$ one standard deviation (and rounded to the nearest integer). This variable adopts a value of one for any household that has a boy/girl of marriageable age, irrespective of marital status. Given my empirical strategy, I am implicitly defining the "No Toilet, No Bride" treatment group as those households with boys of marriageable age, the vast majority of which have been active on the marriage market during the pro-

[16] For the remainder of the paper, I will simply refer the DLHS-3 survey year as 2008.

[17] The 16 states included in my sample are: Jammu and Kashmir, Himachal Pradesh, Punjab, Chandigarh, Uttaranchal, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar, West Bengal, Jharkhand, Orissa, Chhatisgarh, Madhya Pradesh, and Gujarat. My empirical results are robust to alternative sample selection that includes only Haryana and adjacent states as well as a regional criterion that includes all states in the northwest quadrant of the country. However, the policy that I examine in my empirical section is at the state-level. Therefore, due to matters of inference using clustered data, it is desirable to include the largest number of states that could serve as plausible controls. Given the close relationship between son preference and women's outcomes in society, the most appropriate control group is comprised by those states with similar levels of stated son preference.

gram. I considered alternative definitions of the marriageable criterion, including one based exclusively on single, unmarried children, one based on strictly married men, as well as one using different intervals around the gender-specific mean. Increasing the interval size around mean age at marriage is undesirable because it includes larger numbers of households who might not be affected by treatment. Observe that the definition using singles excludes by construction any households with marriageable boy(s) who married after the program began, thereby eliminating from treatment sample exactly those households most likely to have responded to the program. At the same time, the use of strictly married young men as *mboys* would exclude households with marriageable boys who purchased a toilet in anticipation of marriage.[18] My preferred definition, therefore, is the gender-specific mean age at marriage $+/-$ one standard deviation because it best balances these concerns.

To account for unobserved household fertility preferences, I also construct another *mboy*-oriented variable that is the total number of *mboys* in the household divided by the total number of living children. This variable provides a more robust test of the effect of *mboys* even if there are unobserved changes in household fertility in Haryana, which are potentially correlated with presence of an *mboy*. While I report the results from regressions that use this *fraction of mboys* variable instead of simply the presence or absence of *mboys*, it will be seen that this modified use of *mboys* does not alter in either a qualitative or quantitative manner the central findings.

My empirical definition of *marriage market* builds on the discussion in Section 2, where I reviewed evidence that (i) nearly all women marry within their caste group, and (ii) nearly all women move, upon marriage, to villages that are between 30 and 70 kilometers away from their home villages. Taken together, these facts provide a natural means of defining a given household's marriage market. Unfortunately, the DLHS data does not contain geocoded data on households, nor does it identify previous residences, so I am unable to define marriage markets in this explicitly spatial way. Instead, I assume marriage occurs predominantly within one's administrative district. Districts in India are heterogeneous in terms of area, but their size ranges are comparable to the ranges reported in the studies of marriage migration. For example, the largest district in Haryana is roughly 70 kilometers across from the western to eastern administrative boundary, while the smallest district is roughly 17 kilometers in diameter. Thus, districts provide a reasonable approximation to the distance across which marriages typically form.

The second descriptive fact from Section 2 used when defining marriage markets is caste endogamy, which refers to practice of marrying within one's own caste group. For the purposes of this marriage institution, the relevant grouping is the *jati*, which is sometimes re-

[18]Numerous popular media accounts contain interviews in which young men report they are building a latrine *in preparation* for the marriage market, even if a potential spouse is not yet identified.

ferred to, imprecisely, as sub-caste. The *jati* is a community that plays the principal role in providing one's social identity, including providing potential marital partners, providing some forms of insurance against consumption risk, and serving as a professional network across labor markets (Munshi & Rosenzweig (2006)). In the absence of this detailed, *jati*-specific data, I use the DLHS question on broad caste grouping. This variable represents an aggregation of finer social categories, but it still divides the sample population into four categories (scheduled caste, scheduled tribe, other "backward", and other).[19] Finally, because the relatively large caste category of "other" might include more than one religion (and marriages almost never happen across religions), I also include religion in my marriage market definition. Thus, a *marriage market* for the purposes of this paper will be those households in household i's home district with marriageable boys/girls of the same caste grouping and religion.

Finally, the variable for *sex ratio* is the ratio of women to men in a particular marriage market. I exclude households in marriage markets where either the number of marriageable boys or girls is less than twenty individuals; this omits unusual and pathological (e.g. missing) values for the sex ratio. There exists substantial variation in the sex ratios across marriage markets, despite the overall sex imbalance in the population.

Table I presents summary statistics on key variables for Haryana and comparison states in each round of the survey. These two groups are comparable across a wide range of relevant observables, including household size, the fraction of households with and without *mboys*, male age at marriage, age of the household head, etc. Given the severity of sex imbalance in the Punjab region, which includes Haryana, there is a few percentage point difference in the ratio of women to men, although the trend in similarly declining (i.e. becoming more skewed against women) over time in both Haryana and control states. Note that the sex ratio is greater than one in Haryana in 2004 and in control states in both 2004 and 2008. There are two reasons why this is the case. First, the marriage market definition internalizes the average age gap between men and women at the time of marriage. On average, men marry girls that are 3.5 years younger than them. With population growth, each successive, younger cohort is larger than its predecessor. Thus, by defining marriageable boys and girls in this way, the fact of sex imbalance due to son preference is countervailed by the impact of population growth. The second reason is that the variance of the distribution of female age at marriage is lower than that for males. Hence, when I define the marriage market in respect to male and female mean ages at marriage $+/-$ one standard deviation, the age range for males is two years larger for males than females. This additionally causes more males to be included in a marriage market, thereby increasing the sex ratio.

Latrines are also substantially different across Haryana and comparison states. In data

[19] These categories encompass 19.4%, 13.3%, 39.9%, and 27% of my sample, respectively.

from both survey rounds, control states have mean latrine ownership that is nearly 10 percentage points lower than in Haryana. One reason for this is that Haryana is wealthier than most of the states in the comparison group, and wealth is correlated with latrine ownership. Moreover, the overall trends in latrine ownership in Haryana and control states differ as well. Observe that in the comparison states sample latrine ownership has actually declined between 2004 and 2008. For this reason a difference-in-difference analysis that simply compares Haryana and controls over time would be inappropriate. But when I disaggregate latrine ownership by *mboy* status, it can be seen the decline in the control group is actually driven by the non-*mboy* households; *mboy* households in this group have increased their latrine ownership, on average, but to a lesser degree than in Haryana. In other words, there is a two percentage point increase in latrines among *mboy* households in comparison states, but this increase is much greater in Haryana due to the incentives established by NTNB. Note that in the DDD framework, which is explained in more detail below, these differential trends across *mboy*/non-*mboy* households are explicitly controlled for, and so pose no threat to identification.[20]

5.3 Empirical Specification

To estimate the impact of Haryana's "No Toilet, No Bride" campaign on improved latrine ownership, I begin with a difference-in-difference specification that compares latrine ownership between Haryana households with and without *mboys* before and after program exposure. This analysis highlights the core intuition driving the empirical strategy, namely that NTNB targeted the behavior of *mboy* households in particular. I run a regression of the following form:

$$\text{Latrine}_{it} = \alpha + \beta_1(\text{mboy}_i \times \text{post}_t) + \beta_2(\text{mboy}_i) + \beta_3(\text{post}_i) + \epsilon_{it} \tag{7}$$

where *mboy* is an indicator variable that adopts the value of one if household i has a male household member between the ages of 19–27 (males' mean age at marriage $+/-$ one standard deviation) and ϵ_{it} is a household-specific iid error term that satisfies $\text{E}(\epsilon_{it}|\mathbf{X}) = 0$. Standard errors are clustered at the village-level.

In addition to the primary definition of *mboys*, I use an alternative *mboy* variable that is the fraction of *mboys* in the household divided by the total number of children. This alternate definition addresses potential concerns that unobserved household fertility could be correlated with women's status. This DD specification controls for unobserved time-invariant traits of *mboy* and non-*mboy* households, as well as secular trends in Haryana. The coef-

[20] As an extra robustness check, I run the entire analysis on a sample of households that excludes any states that have declining latrine coverage. All estimates remain unchanged.

ficient of interest β_1 is therefore identified from changes in latrine ownership among *mboy* households over time. Consistent identification in this case depends on the common trends assumption for *mboy* and non-*mboy* households, i.e. observed changes in latrine ownership between these two groups of households would have been identical in the absence of the program.

One concern with this approach, which would invalidate the identifying assumption, is that an unobserved shock in Haryana is positively correlated with latrine ownership in *mboy* households or negatively correlated with latrine ownership in non-*mboy* households. For example, since *mboy* are on average slightly wealthier than non-*mboy* households, any economic shock that differentially affects wealthier households could affect latrine ownership as well.

I address this concern about potential endogeneity by using a triple difference (DDD) regression specification, where the three differences are households with and without marriageable boys, in Haryana and comparison states, before and after (three to four years of) program exposure. I regress a binary variable for latrine in household i in state j at time t on a set of interactions and fixed effects:

$$\begin{aligned}\text{Latrine}_{ijt} = \alpha &+ \beta_1(\text{mboy}_i \times \text{state}_j \times \text{post}_t) + \beta_2(\text{mboy}_i \times \text{post}_t) + \beta_3(\text{mboy}_i \times \text{state}_j) \\ &+ \beta_4(\text{state}_j \times \text{post}_t) + \beta_5(\text{mboy}_i) + \beta_6(\text{haryana}_i) + \beta_7(\text{post}_i) + \epsilon_{ijt} \qquad (8)\end{aligned}$$

where *mboy* is defined as both an indicator and a fraction, as explained above, and ϵ_{ijt} is a household-specific iid error term with $\mathrm{E}(\epsilon_{ijt}|\mathbf{X})$ assumed $= 0$ given the full set of fixed effects and interactions $\mathbf{X}$. The fixed effects control for unobserved time-invariant factors at the state level and time-varying factors across both states. The double interaction terms allow the relationship between marriageable boys and improved latrines to vary across states and across time, in addition to capturing state-specific linear time trends.

In this formulation, the primary coefficient of interest is β_1 on the triple interaction, which captures the change in the effect of marriageable boys on latrine adoption in Haryana between 2004 and 2008 relative to the change in effect of marriageable boys on latrine adoption in control states between 2004 and 2008. This is the period during which the "No Toilet, No Bride" campaign likely generated additional social pressure on these households. Because I condition on state-year fixed effects, *mboy*-state, and *mboy*-year interactions, β_1 is identified through Haryana-specific changes over time in differential rates of latrine ownership between households with and without marriageable boys.

Consistent estimation of this saturated linear probability model requires that $\mathrm{E}(\epsilon_{ijt}|\mathbf{X}, \delta_{jt}) = 0$, where $\mathbf{X}$ is a vector comprised of the *mboy* variable interacted with state and year dum-

mies, and δ_{jt} reflects state-year fixed effects.[21] This assumes that changes in this differential across states and time are orthogonal to unobserved determinants of latrine ownership.

Standard errors in the DDD regressions are clustered at the state-year level (yielding a total of 32 clusters). Because I use only two cross-sections, there is no concern about the serial correlation raised by Bertrand, Duflo & Mullainathan (2004).

6 Empirical Results

The empirical analysis presented in this section tests the two implications derived from the model of marriage matching with endogenous investment.

6.1 Marriageable Boys and Household Latrine Adoption

I focus first on the main program effect of "No Toilet, No Bride" on latrine ownership; this analysis corresponds to the first theoretical prediction from Proposition 1. Recall that because the program generates plausibly exogenous variation that increases the proportion of women with a strong preference in toilets, the model predicts that latrine adoption should rise.

The first test of this prediction uses the DD specification given by (7); estimates are presented in Table III. The DD estimates suggest that NTNB has increased *mboy*'s investment in latrines by between 0.057 and 0.061 percentage points over a baseline mean of 0.27, i.e. NTNB increased latrine ownership by approximately 22%. When using the *mboy* fraction variable that controls for household fertility, which is reported in columns (3) and (4), results are similar, although the point estimates when including controls is somewhat smaller.

As suggested earlier, however, any changes in *mboy* households, e.g. wealth shocks, would violate the identifying assumption in this DD framework and yield inconsistent estimates. Therefore, I turn to the DDD analysis, which relies on significantly weaker assumptions than the DD framework. Table II provides an intuitive preview of my main findings regarding the treatment effect of "No Toilet, No Bride" on households with marriageable boys. This table contains mean latrine ownership among the eight possible groupings implied by the DDD strategy. For exposition, I compare Haryana only with Punjab, which is the state most similar in terms of culture and economy. Punjab is, in fact, the ideal control for Haryana due to their long and common history as part of the greater Punjab region. This evidence must be considered suggestive; statistical inference is complicated by the fact that

[21] The linear probability model is particularly appropriate in this context because the fully saturated specification implies the conditional expectation function of latrine ownership is linear. Still, I run similar regressions using probit and logit specifications, which yields nearly identical results.

policy variation occurs at the state-year level.

For this reason, the preferred DDD analysis includes a much larger sample of states, which have similar son preferences to Haryana. Table IV presents DDD estimates of the NTNB campaign on latrine adoption. The primary coefficient of interest is the first triple interaction, which is positive and statistically significant ($\beta = 0.043$). The program increases latrine ownership by 4.3 percentage points above a baseline mean of 0.28 for Haryana's *mboy* households, i.e. a 15% increase among those households likely to be affected by females demanding/desiring improved sanitation.

These results support the argument that the more simple difference-in-difference specifications (instead of the full DDD implemented here) would provide inconsistent estimates of the program effect. For example, Haryana increased state-level latrine ownership at a faster rate than control states, violating the common trends assumption in a DD framework. Moreover, *mboy* households in Haryana have, on average, a 3% lower probability of latrine ownership, which again suggests a DD analysis at the Haryana/control level is problematic. These changes are explicitly controlled for as part of my identification strategy, as discussed above.

The key result from this specification is the marked shift in the effect of marriageable boys on improved latrines, specific to Haryana after the NTNB campaign. Specifically, there was a 4.3 percentage point change in the differential over time between Haryana and control households with and without marriageable boys. Because the program targeted specifically those households whose boys are on the marriage market, and having a marriageable boy is plausibly exogenous to household decisions regarding improved latrines, conditional on the full set of interactions and fixed effects, these results provide evidence that either (i) a positive fraction of marriageable women in Haryana have shifted their preferences *and* pressured men into sanitation investments, or (ii) men have anticipated this pressure and responded by increasing their premarital investment in latrines. There is an additional possibility, outside of the bargaining interpretation, which suggests that new couples invest in latrines as a form of health-seeking behavior and health investment in children.[22] While the DDD specification cannot rule out this possibility, the following sections present evidence on each of these channels and confirm that the marriage market hypothesis is driving these results.

[22]This hypothesis of unitary household preferences for investment in children is ruled out by the analysis of sex ratios below. If women favor child investments more than men, however, then Haryana women demanding toilets, and therefore program effects, could be explained more by child health than private female benefits. This interpretation is fully consistent with the bargaining interpretation of the empirical results.

6.2 Marriage Markets, Female Preferences and Latrine Adoption

The second testable prediction from the model states that the impact of rising proportions of women with a preference for toilets on premarital investment will be mediated by the sex ratio. To study this cross-partial effect of how sex imbalance in the marriage market mediates male investment responses to changing female preferences, I use regression specification (8) in two subsamples, where one is comprised of households in marriage markets with an oversupply of women and one with an undersupply of women. This formulation is desirable for expositional purposes, but it is equivalent to interacting the sex ratio indicator (for r greater or less than unity) with the set of interactions and fixed effects from (8). As before, I first present estimates from the DD (using *mboy*/non-*mboy* and pre/post treatment) and then turn to the preferred DDD analysis.

Tables V and VI report estimates from these analyses. When women are abundant, the estimated average treatment effect of NTNB is statistically indistinguishable from zero. By contrast, when woman are scarce and the marriage market is highly competitive for men, the treatment effect is nearly double the estimate from the entire sample; this point estimate is large and highly statistically significant (at the 99 percent level). The difference in magnitude is nearly double the estimated effect from Table IV, which is consistent with the relative sizes of the subsamples, these results, and the earlier estimate that ignored the sex ratio.

These results provide strong evidence that skewed sex ratios mediate the impact of women's ability to demand latrines on the marriage market. When women are scarce, they are able to negotiate successfully for latrines, but when they are abundant, men have less incentive to invest and women are unable to obtain latrines to the same degree. In this sense, the phenomenon of missing women in a marriage market appears to have increased female bargaining power, conditional on survival to marriage age. Finally, these results lend additional support to the marriage market hypothesis because evidence of marriage market-driven latrine adoption bolsters the case that NTNB exerted disproportionate pressure on marriageable boys.

One issue that arises when interpreting these results is the role of migration. Perhaps males elect to move out of tight marriage markets with dim prospects, or alternatively, they import brides from other marriage markets. Similarly, males could seek brides from younger cohorts, which will be larger than older cohorts, on average, because of population growth. There are in fact a wide variety of possible means by which men could relax the constraints imposed on them in a particular marriage market. Unfortunately, the DLHS data do not contain information that allows me to identify such migration. To the extent men are able to alleviate the pressure they experience on the marriage market, however, my estimates of the program effect will underestimate the program effect in the absence of migration across

marriage markets.

6.3 Investigating Competing Hypotheses

The previous sections provided a series of results that together provide compelling evidence that male premarital investments respond to both changing distributions of preferences in the female populations and constraints generated by local sex imbalances.

6.3.1 Identification

In assessing the validity of this identification strategy, note that the most likely explanations for a positive effect of marriageable boys on latrine ownership can be ruled out by this empirical specification. For example, ifhouseholds with young male adults typically enjoy higher income, which allows them to purchase latrines, we would expect to see a positive correlation between marriageable boy households and latrine ownership across both states, but we would not expect a Haryana-specific change over time. Another rationale for an observed positive correlation between marriageable boy households and latrine ownership is that transfers associated with marriage, such as dowry and gift-giving, could also facilitate latrine ownership. A similar counterargument, however, can also rule out this hypothesis: we would expect this story to affect households with marriageable boys equally in Haryana and control states.

For the identifying assumption to be invalid, an unobserved factor must cause the trend in the difference in latrine ownership between households with and without marriageable boys to diverge across Haryana and control states. In such a case, this factor would cause the common trends assumption to be violated, i.e. the trend in the differential between *mboy*/non-*mboy* households would inaccurately reflect the counterfactual scenario in Haryana in the absence of the program. This identifying assumption would be violated if there are unobserved Haryana-specific shocks that covary with latrine adoption *and* the presence of a marriage age boy. This assumption is impossible to accept with certainty, but it is difficult to generate hypotheses on the types of shocks on Haryana's marriageable boy households that would undermine identification.

In this section I consider three competing interpretations of my main results. The first two hypotheses explore distinct mechanisms by which the observed changes in latrine ownership might arise, which are outside the marriage market considerations reflected in the theoretical framework. The third hypothesis is a placebo test that examines whether any unobserved factors related to household size and/or fertility are driving my results. Given the tests conducted here, I can strongly reject each of these competing hypotheses regarding the NTNB effect.

6.3.2 Does the Program Change Male Preferences?

Depending on how NTNB messages are received by men, the main empirical result from Section 6.1 could arise not because women are exerting pressure via the marriage market on male investments, but because men's preferences have changed in response to the program. Consider a scenario whereby NTNB changed young adult male preferences for sanitation among both households with boys active on the marriage market as well as those with relatively recent experience on the marriage market. Perhaps the program raised the salience of sanitation in Haryana, changed men's preferences, and thereby caused an increase in latrine adoption. In this way households with young men, which are relatively wealthy, became convinced about the value of sanitation and made the sanitation investment.[23] Then even in my triple difference empirical framework it might be possible to observe a program effect, yet this hypothesized shift would operate entirely outside of the marriage market.

I test this hypothesis directly by studying whether NTNB has caused any change in latrine adoption among households with men slightly older than marriageable age. Recall that my definition of marriageable boy is $+/-$ one standard deviation from males' mean age at marriage; this yields an age range of 19 to 27. Here I create a new indicator that takes the value of one if a household has anyone in the age range 27 to 34 years. This age group is young and close enough in age to serve as a reasonable comparison group to very late teens and twenty-something year olds, but due to their age are almost certainly married already and therefore immune from marriage market pressures generated by the program. I run a regression using the same DDD specification as above, but substitute the *oldboy* variable for the *mboy* variable in all interactions and fixed effects.

As can be seen in Table VIII, the main coefficient of interest is statistically zero. These households, like *mboy* households, are more wealthy on average than households without these *oldboys*. Given the focus on a cohort of men who are otherwise likely to be very similar to younger men active on the marriage market (if anything, they should have more income/wealth, on average, which they could use to purchase a latrine), the null result suggests that male preferences have not changed as a result of the NTNB program. This provides additional evidence that the mechanism through which the program operates is the marriage market hypothesis.

6.3.3 Do Changing Female Preferences Drive Latrine Adoption Outside of Marriage?

A second possibility regarding the behavioral mechanism driving latrine adoption is that female preferences are indeed changing as a result of NTNB, but that these preferences affect latrine ownership *outside* of marriage market channels. For example, girls might learn

[23] Wealth and *mboys* are correlated in my sample ($\rho = 0.11$).

from the NTNB emphasis that latrines are valuable and subsequently push their parents or husbands into buying them. Under this hypothesis, women still push for latrines as a result of the program but they obtain the goods for reasons that have nothing to do with marriage *per se*.

To study this issue, I use a DDD regression that focuses on *mgirls* in place of *mboys*. Yet many households with both *mboys* and *mgirls* will be married, so running this analysis on the entire sample will include all those households in which men built a latrine in order to marry. In this case it would be impossible to distinguish between the effects of premarital bargaining and investment on the one hand and changes in female preferences outside of the marriage market. Instead, I focus on a subsample that excludes households with both marriageable boys and marriageable girls. Some of these households will have both *mboys* and *mgirls* because they are siblings; it is unfortunate that they are excluded but the data does not allow me to differentiate perfectly between sibling pairs and married pairs. The benefit of analyzing this subsample, however, is that it excludes with near certainty those couples who married since NTNB began, thereby focusing the analysis on single *mgirls*.

Table IX reports the results from this analysis. In this case, the coefficient of interest is again statistically indistinguishable from zero. This suggests that among girls who are active on the marriage market, and who are thus a primary target of the NTNB message, there is no program-induced ability to obtain latrines. These results provides an instructive counterpoint to the results from Table IV. In that case, women are able to obtain latrines through marriage, in accordance with their preferences. But when these marriages are excluded from the sample, we observe no program effect at all. Therefore, the evidence indicates that NTNB causes women's preferences to shift, but that this causes a shift in male premarital investments *only* through marriage market pressures.

6.3.4 Omitted Variables Correlated With Household Size

Earlier I noted that the key identifying assumption underlying my econometric specification could be violated if there exists an unobserved, differential trend that affected only marriageable boy households in Haryana. For example, if Haryana instituted an anti-poverty program between 2005 and 2008, which raised incomes of marriageable boy households, then increased toilet coverage could be explained by an income rather than marriage market effect associated with the program. If this were the case, $\mathrm{E}(\epsilon_{ijt}|\mathbf{X}, \delta_{jt}) \neq 0$ and estimates of β_1 from eq. (8) would be biased.

Household structure might play a particularly important role in this context because of the strong son preference in the greater Punjab region. One form this son preference can take is fertility behavior that follows a stopping rule, i.e. when families have children until

they have a boy, who will continue to live in the family compound and care for the parents in old age (girls will typically marry and move away from the village). If households practice a stopping rule, then households with any girl children will be, on average, larger and slightly older than households without girls. This reasoning suggests that the demographic and age structure of the household might vary systematically with the gender composition of the children. Additionally, because household size is correlated with poverty, any Haryana-specific anti-poverty program after 2005, such as (hypothetically) workfare or low-income educational stipends, could also cause a spurious correlation between marriageable boy households in Haryana in 2008 and latrine ownership.

My alternative definition of *mboy* as the fraction of *mboy*s among total children in the household provides on strong test of the influence of unobserved fertility on latrine adoption. In addition, I test the validity of this hypothesis by modifying eq. (8) by adding the full suite of interactions and fixed effects for two different categories of household size. Specifically, I create a dummy variable for *small households* that indicates whether the household is smaller than the mean household size in the sample; *large households* are those larger than mean household size. My main empirical specification, modified in this manner, tests simultaneously for both potentially confounding stories just outlined.

As can be seen in Table VII, the primary coefficients of interest are, as before, only the triple interaction terms that reflect the DDD for marriageable boys, small households, and large households in Haryana in the post-treatment period. I find small and statistically insignificant effects for both small and large households, and the estimate of the NTNB treatment effect, captured in the *mboy* triple interaction, remains positive and significant at the five percent level. These robustness results provide evidence rebutting the notion that factors related to the age or demographic structure of households are confounding my estimates of the program effect.

7 Bargaining Power and the Intrahousehold Allocation

The theoretical literature on collective household and marriage models suggests that marriage market conditions, such as sex imbalance or divorce laws, should affect the intrahousehold allocation by shifting the resource sharing rule toward the scarcer sex. Thus, theoretical investigations predict that female scarcity should result in greater bargaining power among the remaining women. In this sense, sex ratios are a prototypical distribution factor (Browning & Chiappori (1998)), i.e. a condition that alters the household sharing rule without changing the joint budget set or individual preferences.

Until now, this paper has focused on how marriage market conditions affect male investments in a good women value highly. I presented evidence that the program appears to

operate by changing female preferences in conjunction with marriage market pressures related to sex imbalance. But these results are consistent with two possible mechanisms, both of which operate *through* the marriage market. Does the program indeed cause a shift in female preferences for sanitation, making them stronger than before? Or does the program's emphasis on female bargaining power on the marriage market actually increase that power directly? In other words, the program might shift the distribution of female types and, by so doing, drive male premarital investment, or it might act as a sort of distribution factor that itself shifts the intrahousehold sharing rule.

It is less plausible that an information campaign can act in a distribution factor than serve to shift preferences. Yet these two mechanisms carry strong implications for how household behavior responds to the program. In particular, the former interpretation suggests the program taps into the relative bargaining power held by women when they are scarce, changes women's preferences over the bundle of assets and qualities of marriage that they bargain over, and so causes women to negotiate more readily over latrines as compared to other desired goods. If this interpretation is correct, then we would expect to see that the observed treatment effect on latrines results in a form of compensating differential with respect to other goods, i.e. women must trade off some good(s) in order to obtain a toilet at the time of marriage. And the second interpretation is that by highlighting women's right to demand certain goods, particularly if not only in the context of female scarcity, the program provides an exogenous, positive shock directly to women's bargaining power rather than to female preferences. In this case, we would expect to see an unconditional increase in latrines as a net gain for women, i.e. without any tradeoffs.

I examine the first interpretation that the program changed female preferences, redistributing relatively more weight to latrines and less weight to other items in the bundle of goods that women value. Greater latrine ownership in response to the program should occur when women have sufficient bargaining power to obtain goods they particularly desire. Moreover, if the program causes an alteration of the woman's weighting scheme over her preferred goods, then the program effect should also cause a decline in ownership of some other favored good. We should therefore find evidence that women must trade off some goods they prefer in order to secure latrines during the marriage bargaining process.

Note that if one is prepared to assume that women would never agree to a trade (of a latrine for some other good or bundle thereof) that lowered her utility, then one can immediately conclude that the increase in latrine adoption reflects a shift in the intrahousehold allocation toward women that has unambiguously improved female welfare. Absent this assumption, it is possible to explore a range of household goods and characteristics for which we have reason to believe women have a strong preference. Given the cultural context of Haryana, such marriage qualities might include the educational levels of one's spouse (con-

ditional on own education), the age gap between husband and wife (younger brides relative to men are associated with lower status of women in the household; see, e.g., Desai & Andrist (2010)), influence over fertility, and/or increased access to household assets such as improved cooking fuels, sewing machines, washing machines, etc.

I test for program effects for each of these outcomes using the DDD approach, when there is data on the particular asset or outcome for both survey rounds, or using DD (with the differences being *mboy*/non-*mboy* households in Haryana and control states), when there exists data only from the 2008 round. Table X summarizes the findings from these regressions. The unifying result is that along a range of numerous possible goods and desirable traits, there is no evidence that women have been forced to tradeoff other desirable goods in order to secure a latrine.

In contrast, these results provide suggestive evidence that the relative position of women has improved, in addition to latrines, along two key dimensions: the education level of the husband, conditional on women's education, and the age at marriage/living with husband. With respect to the education difference between husband and wife, a simple analysis of the DDD estimates does not yield statistically significant differences. Disaggregating the data into those households with and without latrines, however, indicates an increase in 0.1 years in the differential between male and female schooling specifically among *mboy* households in Haryana post-treatment; in these same households without latrines, there appears to have been a 0.03 year decline in the gap but this is not statistically significant; the statistically significant difference between these estimates is 0.13 years. The evidence therefore suggests a slight improvement in the average quality of males for a given female only in those treatment households with latrines.

With respect to female age at marriage, a trait which is positively associated with female status, a pattern similar to the education gap emerges. That is, the DD estimate of changes in age at marriage that arise among *mboy* households in Haryana is not statistically significant, but it appears to mask heterogeneity across households with and without latrines. In particular, there appears to be an increase of 0.16 years in the mean age at marriage, which is specific to households that have latrines who are therefore likely to have responded to the program. In *mboy* households without latrines, however, no such evidence emerges. Hence, women in *mboy* households in Haryana after treatment appear to get married slightly later (0.24 years) in those households that have latrines as compared to Haryana *mboy* households without latrines. A similar result was found with respect to the age at which the female first cohabits with the husband.

One interesting result to emerge is that there has been an increase in motorbike ownership. Motorbikes are a good that males value and that form a common part of dowry among wealthier families. The observed increase among *mboy* households in Haryana after

program exposure occurs for both *mboy* households that have latrines as well as those that do not, but those with latrines have a (statistically significant) two percentage point higher probability of motorbike ownership than households without latrines after the program. This quantity reflects a 7% increase in motorbike ownership associated with being a treatment household *and* having a latrine. This result provides suggestive evidence that marriage negotiations over toilets have been associated with men being compensated in other ways for the expense.

Taken together, these suggestive results indicate that NTNB and bargaining over latrines might have caused a number of shifts in dowry outcomes, but there is no evidence that females were forced to substitute items they care about in favor of toilets. On the contrary, it appears that women have improved their relative position in the household on account of marrying older and marrying better educated men, while Haryana's *mboys* have increased their ownership of motorbikes, especially if they built a latrine. Dowries, which are unobserved, could play a fundamental role in driving these findings. It seems likely that several items commonly involved in dowry and marriage negotiations might have shifted in response to the program, but without additional data and assumptions on the household's behavior it is impossible to empirically determine a shift in the intrahousehold allocation.

8 Conclusion

This paper focuses on an innovative natural policy experiment known as "No Toilet, No Bride", which highlighted the link between latrines, for which women have a strong preference due to concerns about privacy and security, and marriage markets in Haryana state in the historical Punjab region. Because the program encouraged girls' families to demand from boys' families a latrine prior to marriage, it generated disproportionate pressure to construct a latrine specifically among those households whose boys were of marriageable age and seeking a bride. I demonstrate that marriageable boy households were indeed affected disproportionately by the program, and I estimate the "No Toilet, No Bride" treatment effect to have increased latrine ownership by 15% over the baseline mean of Haryana households with marriageable boys in 2004. In addition, estimates of latrine adoption in Haryana post-treatment are four times larger in marriage markets characterized by a scarcity of women as compared to marriage markets with more women than men.

These results are shown to be invulnerable to competing hypotheses that challenge this marriageable boy effect of the program. In particular, I have shown (i) there is no evidence that unobserved factors correlated with household size are driving my estimates and (ii) the program does not appear to have changed male preferences for latrines. The "No Toilet, No Bride" program thus appears to have caused a significant increase in latrine own-

ership in Haryana specifically through the channel of female preferences in the context of bargaining power. Moreover, I provide substantial evidence that women are not trading toilets for other goods in the context of marriage bargaining toilets. Indeed, the program is associated with an increase along two fundamental dimension for women's status: the mean age at marriage and educational quality of the husband. These findings are consistent with a theoretical framework in which sex imbalance alters marriage market conditions and causes males to increase their premarital investments in their own quality. The underlying mechanism that drives latrine adoption among households with marriageable boys is thus competition on the marriage market and a household's desire to marry successfully its boys. In exploring the impact of skewed sex ratios on women's bargaining power, as reflected in female demand for latrines under "No Toilet, No Bride", this paper provides evidence that, despite widespread and persistent discrimination, the female bargaining position has improved through heightened competition on the male side of the market.

In addition to the literature on female bargaining power and marriage, this paper also makes an important contribution to the limited evidence that exists on the effectiveness of sanitation campaigns at large scale. In India, nearly 70% of the rural population lacks access to sanitation, and this situation is associated with severe morbidity and mortality. An estimated 1.2 million children under five die each year in the country; most of these deaths are attributed to diarrheal disease and acute respiratory infections, which are both exacerbated by inadequate sanitary behavior and sanitation infrastructure (Black, Morris & Bryce (2003)). In this critical policy context, a low-intensity information campaign, "No Toilet, No Bride", cleverly exploited deeply rooted social norms and marriage market conditions in order to increase sanitation. As a result, there are approximately 500,000 more toilets among Haryana's four million households in 2008 than in 2004.[24] By studying this large shift, this paper is informative not only about female bargaining power, but also regarding the design of sanitation policy and behavior change programs more generally.

Finally, this paper provides, to the best of my knowledge, the first empirical evidence on how intrahousehold decision-making affects public good provision. By showing that female bargaining power determines women's ability to obtain goods (with public good characterictics), this paper highlights a new and important mechanism that impairs socially optimal provision of certain key goods.

[24]This number reflects the increase in toilets in Haryana that can be attributed to the "No Toilet, No Bride" campaign based on estimates in this paper.

A Theoretical Appendix

A.1 Additional Features of Transferable Utility

The assumption underlying the transferable utility framework is that this marital surplus is divided and shared between spouses. In particular, the surplus is divided according to a sharing rule that is determined not by the individual characteristics of partners in a match, but by the requirements imposed by stable matching. A matching assignment profile is considered *stable* if no two married or unmarried people prefer to be together and no married individual prefers to be single (Gale & Shapley (1962)). This profile will display either positive or negative assortativeness depending on the super- or sub-modularity of the marital output function $f(x, y)$, i.e. whether traits x and y are complements or substitutes.[25] Then the key feature of transferable utility is that a man (woman) with a given level of quality can "bid away" higher quality men (women) by offering the potential spouse on the other side of the market a greater share of the marital surplus. The well-known consequence is that the equilibrium, i.e. the stable assignment profile, must maximize aggregate marital surplus across all men and women (Shapley & Shubik (1972) and Becker (1973)). Moreover, the sharing rule that specifies the division of the marital surplus is determined in equilibrium through the requirements of stable matching. In this way, changes in the relative proportions of men and women, or in the distribution of quality in the male or female populations, alter the sharing rule over marital surplus.

A.2 Further Characterization of Equilibrium

To characterize equilibrium formally, let α denote the fraction of women of high sanitation class; $(1-\alpha)$ is therefore the fraction of women with low sanitation preferences. Similarly, define β as the fraction of men who have invested in a latrine and so are of high sanitation class; $(1-\beta)$ gives the complementary set of men who did not invest. The second criterion for equilibrium can then be expressed for each possible scenario outlined above, i.e. $\alpha = \beta$, $\alpha > \beta$, and $\alpha < \beta$.

The first case, when equal numbers of high sanitation class people get married, is the following:

$$\alpha = \underbrace{[1 - F(-U_l)]\, G(\phi_x + U_h - U_l)}_{\text{Always marry and invest}} + \underbrace{\int_{-U_h}^{-U_l} G(\phi_x + U_h + \theta) h(\theta) d\theta}_{\text{Married b/c invested}} = \beta \tag{9}$$

[25] This paper assumes throughout that positive assortativeness holds.

The second and third cases involve the possibility that, in equilibrium, more men or women belong to the high sanitation class and thus some individual(s) in the high grouping marry individual(s) from the low grouping. Formally, these cases are:

$$\alpha > [1 - F(-U_l)]\, G(\phi_x + U_h - U_l) + \int_{-U_h}^{-U_l} G(\phi_x + U_h + \theta) h(\theta) d\theta \tag{10}$$

$$\alpha < [1 - F(-U_l)]\, G(\phi_x + U_h - U_l) + \int_{-U_h}^{-U_l} G(\phi_x + U_h + \theta) h(\theta) d\theta \tag{11}$$

Eq. (10) states there are more women with high preferences for sanitation than men who invested in latrines. Eq. (11) considers the opposite case when more men invested than there are women with high preferences for sanitation. Note that the assumption of complementarity of types implies that only one of these inequalities can hold at once. These expressions combined with equation (9) specify the equilibrium. See Chiappori, Iyigun & Weiss (2009) for a proof of existence and uniqueness of this marriage market equilibrium.

A.3 Division of the Marital Surplus

The equilibrium conditions have strong implications for the sharing rule that divides marital surplus. Consider each of the three cases in turn. In the first case, when $\alpha = \beta$, there is perfect positive assortativeness. Thus, the surplus from marriage of same types, z_{hh} or z_{ll}, must equal the sum of shares from two same-class individuals marrying, that is:

$$z_{hh} = U_h + V_h \tag{12}$$

$$z_{ll} = U_l + V_l \tag{13}$$

Male and female shares need not be equal if the outside options to marriage differ across spouses.

When $\alpha \neq \beta$, then surplus shares must satisfy:

$$U_h + V_l \geq z_{hl} \tag{14}$$

$$U_l + V_h \geq z_{lh} \tag{15}$$

In particular, when $\alpha < \beta$, there are more men who invested than there are women with strong preferences for sanitation, and eq. (14) will hold with equality while eq. (15) will hold as a strict inequality. An immediate consequence of these equilibrium shares is that high sanitation men must relinquish some of the marital return from their investment. In particular, they must receive their lower-bound marital return to investment; otherwise, an equivalent man could bid away any surplus until the minimum bound is restored. Plugging

eq. (14) into (12) and using (13) yields:

$$V_h - V_l = z_{hh} - z_{hl} \tag{16}$$

$$U_h - U_l = z_{hl} - z_{ll} \tag{17}$$

Eq. (17) specifies the marriage market return to investment by males, and men get only their marginal contribution to a marriage with a low sanitation class woman, i.e. the lower bound on their investment return. By contrast, women with high sanitation preferences get their entire contribution to the marital surplus of a marriage with a man with a high sanitation class. By contrast, when $\alpha > \beta$, men receive the entire marginal contribution to marital surplus from their investment ($= z_{hh} - z_{lh}$), and women receive the remainder ($= z_{lh} - z_{ll}$).

These bounds on the marriage market returns yield testable results. I gather the key predictions from this discussion into Proposition 1, which is presented in Section 3.7 above.

Proof. I consider each of the two main testable predictions in turn.

Observe that eq. (9) implicitly defines males' marriage market return to investment ($U_h - U_l$) as a function of α. As α increases, it immediately follows that either U_h must increase and/or U_l decrease in order for there to be sufficient men willing to marry (conditional on investing). Thus, an increase in α drives male premarital investment by increasing males' marriage market return.

For the second implication, consider eq. (6) when $\theta_y > -V_h$ and all women want to marry someone.[26] Assume $r < 1$ and women are scarce. This implies that some men must remain unmarried. As r decreases, V_h and U_l must decline and/or U_h must increase, which implies that the marriage market return to male premarital investment increases (and women's marriage market return to being of high sanitation class must decline) to maintain equality in the numbers of men and women who want to marry.

In the case of equal populations, i.e. $r = 1$, an increase in the fraction of females with strong preferences for sanitation causes men to receive their upper bound return on sanitation investment. Now consider a situation of female scarcity. Some proportion $(1 - r)$ men will fail to marry, even if they want to, because of an insufficient number of brides. These potentially unmarried men, who will all be of a low sanitation class, will bid away the entire surplus obtained by the married low sanitation class men, i.e. U_l decreases. The immediate consequence is that $U_h - U_l$ is larger than in the case of equal populations. Conversely, when $r > 1$ and women outsupply men, then low sanitation level men receive the entire surplus in a marriage with a low sanitation type female, i.e. U_l increases as compared to the case of

[26] This situation in which the idiosyncratic gain from marriage for females is sufficiently large to cause all women to prefer marriage is easily justified given the particularly low status ascribed to older single women in Haryana.

equal populations. Therefore, $U_h - U_l$ must be smaller when $r > 1$ than when $r = 1$, which is in turn smaller than when $r < 1$. In this way, the second part of Proposition 1 follows directly from transferable utility and the requirements of pairwise stable matching. □

A.4 Dowries

In a transferable utility (TU) framework, dowries form a part of the transfers that divide the surplus. Thus, a natural way to incorporate dowry is to assume that marital output is comprised of two portions: non-dowry and dowry output, i.e. the marital output $= f(x, y) + d_{xy}$ and d can depend in any way on x and y. A union generates additional output over singles' status both because of complementary traits in household production (from $f(x, y)$ and because it brings in "additional" resources from the bride's family. From the perspective of the bride's family, dowry enters as a cost that diminishes the total gain of marriage; if dowries d are greater than the material and emotional gain from marriage, then the marriage does not occur. The only relevant criterion for males' investment decision is the marriage market return to investment and not how that return is constituted by dowry and other non-dowry marital output. I summarize this argument as Proposition 2, presented in the main body of this paper.

Proof. Consider two cases: when dowry is independent of spousal traits and when dowry depends on spousal traits in an undefined manner.

Note first that if dowry amount is independent of spousal traits, investment decisions are fully separable from dowry considerations. We can rewrite the respective problems as: $U_X = \max_Y [z_{XY} - V_Y + d]$ and $V_Y = \max_X [z_{XY} - U_X - d]$. Thus, the share of male surplus U_X is comprised of two parts: a dowry d and non-dowry amount equal to $\max_Y [z_{XY} - V_Y]$, and males' decisions are simply over the latter (and, of course, whether to marry at all, i.e. $\max\{U_X + \theta_x + d, 0\}$).

Now consider the case when dowry payments are determined by spousal traits. Let d_{XY} denote the dowry given by woman of type Y to man of type X. Ignore considerations of wealth/income or credit constraints. Then we can rewrite eqs. (2) and (3) to explicitly incorporate dowry:

$$u_x = \max\{U_x + \theta_x, 0\} \text{ where } U_x = \max_y \left[\gamma_{xy} - V_y\right] \tag{18}$$

$$v_y = \max\{V_y + \theta_y - d_{xy}, 0\} \text{ where } V_y = \max_x \left[\gamma_{xy} - U_x\right] \tag{19}$$

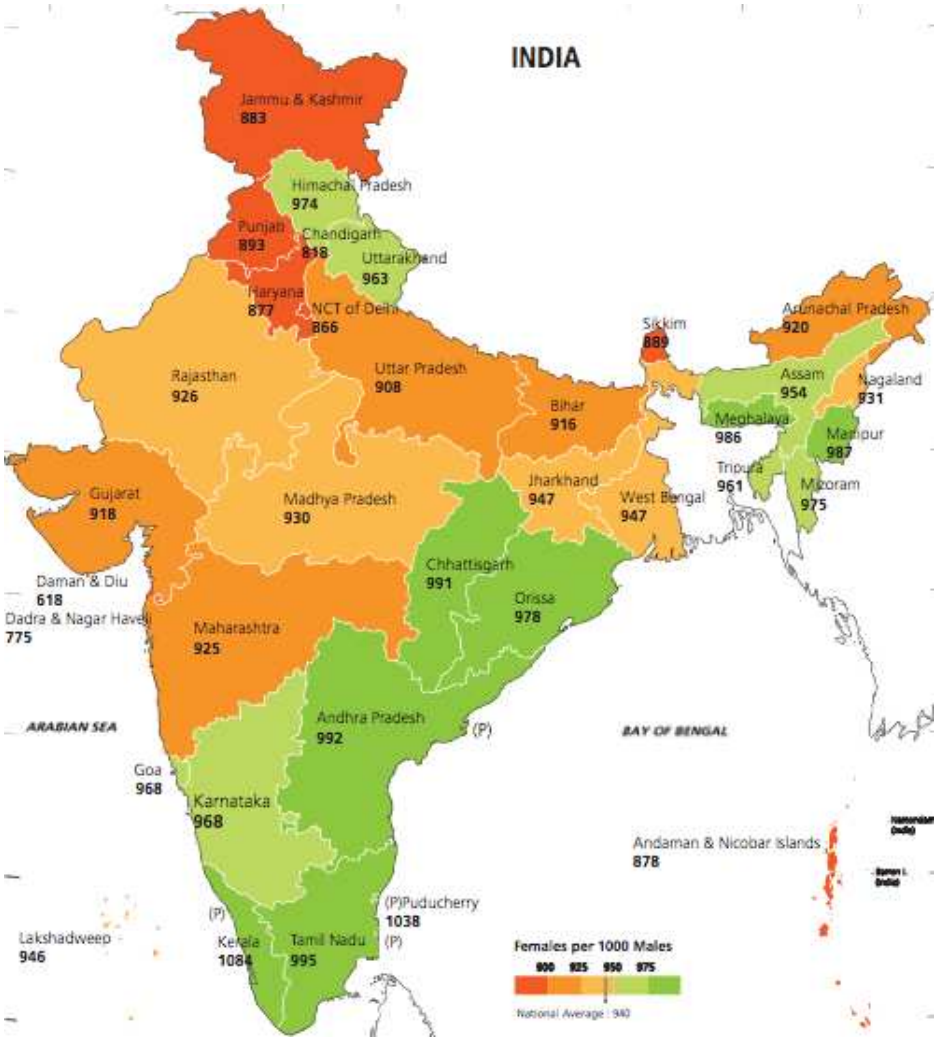
where $\gamma_{xy} = f(x, y) + d_{xy} - f(x, 0) - f(0, y) = z_{xy} + d_{xy}$, and z_{xy} on the right-hand side of the last equality is the same surplus object from the non-dowry analysis. Although the

dowry and non-dowry portions of marital output are simply added up and shared, consistent with TU, the dowry also enters as an additional term in the decision by the female about whether to marry at all.

Irrespective of how dowry depends on spousal traits x and y, the surplus shares from Section A.3 are easily modified to account for the constraints imposed here. In other words, the sharing rule that divides the marital surplus is still determined in equilibrium, and the bounds on the sum of marital output plus dowry must hold in the same way as before. Thus, from the perspective of male incentives to invest, the inclusion of dowry in this modeling framework is irrelevant. □

B Figures and Tables

FIGURE I: SEX RATIOS ACROSS INDIAN STATES, 2011



Source: Census of India, 2011.

TABLE I: SUMMARY STATISTICS

VARIABLE	Haryana		Control States	
	2004	2008	2004	2008
Latrine	0.285	0.395	0.198	0.185
	(0.451)	(0.489)	(0.398)	(0.388)
Latrine (*w/ mboy*)	0.276	0.419	0.196	0.202
	(0.447)	(0.493)	(0.397)	(0.401)
Latrine (*w/o mboy*)	0.293	0.368	0.199	0.173
	(0.455)	(0.484)	(0.399)	(0.378)
Marriageable boy	0.456	0.465	0.415	0.415
	(0.498)	(0.499)	(0.493)	(0.493)
Marriageable girl	0.450	0.432	0.442	0.419
	(0.498)	(0.495)	(0.497)	(0.493)
HH size	6.263	5.984	6.415	6.041
	(2.656)	(2.527)	(2.942)	(2.626)
Number of males	3.265	3.102	3.260	3.067
	(1.563)	(1.477)	(1.730)	(1.577)
Number of female	2.996	2.883	3.154	2.974
	(1.606)	(1.567)	(1.768)	(1.617)
Age of HH head	43.631	44.452	43.444	43.787
	(13.681)	(13.480)	(13.221)	(13.289)
Male age at marriage	22.975	22.507	22.741	22.397
	(3.608)	(3.485)	(4.625)	(4.306)
Female age at marriage	19.310	19.330	18.368	18.545
	(2.674)	(2.335)	(3.666)	(3.147)
Sex ratio	1.016	0.962	1.087	1.048
	(0.091)	(0.094)	(0.138)	(0.144)
Observations	15220	14108	263079	319449

Standard errors in parentheses. Marriageable boys are household members 18–26 in age; marriageable girls are members aged 15–24. Haryana has the "No Toilet, No Bride" campaign, which started in 2005 and has been ongoing since then.

TABLE II: MEAN LATRINE OWNERSHIP BY TREATMENT-STATE-YEAR

	Before	After	Time Trend
	TREATMENT HHS		
Haryana	0.270	0.320	0.050
Punjab	0.522	0.670	0.148
Within Year Diff.	−0.152	−0.250	
Diff-in-Diff	−0.098		
	NON-TREATMENT HHS		
Haryana	0.276	0.276	0.000
Punjab	0.502	0.633	0.131
Within Year Diff.	−0.126	−0.257	
Diff-in-Diff	−0.131		
DDD ESTIMATE	$-0.098 + 0.131 = 0.033$		

This table summarizes the triple difference strategy (in Haryand and Punjab only) by looking at group means of latrine ownership using the interaction of treatment group, state, and time. Treatment households are those with at least one child of marriageable age, defined as $+/-$ one standard deviation from the gender-specific mean age at marriage, which are those who should be affected by the NTNB program. Punjab is the state most similar to Punjab in terms of wealth, culture, and politics.

TABLE III: LATRINE ADOPTION (DIFF-IN-DIFF ESTIMATES)

Latrine	(1)	(2)	(3)	(4)
Mboy x Post	0.061***	0.057***	0.070***	0.038***
	(0.014)	(0.011)	(0.015)	(0.012)
Mboy	-0.017	-0.041***	0.011	-0.039***
	(0.011)	(0.007)	(0.010)	(0.010)
Post	0.082***	0.065	0.015	0.039**
	(0.026)	(0.017)	(0.033)	(0.019)
Constant	0.276***	-0.239***	0.362***	-0.277***
	(0.026)	(0.015)	(0.034)	(0.019)
Controls	N	Y	N	Y
R^2	0.014	0.251	0.021	0.249
N	29345	27815	29328	27815

The dependent variable is a dummy variable for whether household *i* has a latrine. Column (1) reports the basic DD regression using the *mboy* variable. Column (2) adds the following control variables: age and education of the household head, wife/mother's education, household size, and four proxies for wealth (house type, fan, TV, phone, and motorcycle). Column (3) using the *fraction of mboys* variable, which uses total number of *mboys* in the household as a fraction of total children in order to account for household fertility. Column (4) adds the same control variables to the regression from Column (3). The primary coefficient of interest in all cases is the double interaction. All standard errors are clustered at the village-year level. Significance levels: ***p< .01 **p< .05 *p< .1.

TABLE IV: LATRINE ADOPTION (DDD ESTIMATES)

Latrine	(1)	(2)	(3)	(4)
Mboy x Haryana x Post	0.036***	0.043***	0.047***	0.040***
	(0.011)	(0.007)	(0.010)	(0.008)
Mboy x Haryana	-0.011	-0.018***	-0.009	-0.021***
	(0.008)	(0.004)	(0.006)	(0.005)
Mboy x Post	0.019*	0.001	0.023**	0.003
	(0.010)	(0.006)	(0.009)	(0.008)
Haryana x Post	0.110**	0.051*	0.114**	0.060**
	(0.046)	(0.026)	(0.045)	(0.025)
Mboy	0.009	-0.013***	0.020***	-0.023***
	(0.008)	(0.004)	(0.006)	(0.004)
Haryana	0.088***	-0.064***	0.079***	-0.066***
	(0.026)	(0.013)	(0.024)	(0.025)
Post	-0.102**	-0.016	-0.101**	-0.016
	(0.046)	(0.026)	(0.045)	(0.025)
Constant	0.281***	-0.147***	0.282***	-0.150***
	(0.026)	(0.025)	(0.024)	(0.025)
Controls	N	Y	N	Y
R^2	0.019	0.330	0.020	0.333
N	445584	445583	393885	393884

The dependent variable is a dummy variable for whether household *i* has a latrine. Column (1) reports the basic DDD regression using the *mboy* variable. Column (2) adds the following control variables: age and education of the household head, wife/mother's education, household size, and four proxies for wealth (house type, fan, TV, phone, and motorcycle). Column (3) using the *fraction of mboys* variable, which uses total number of *mboys* in the household as a fraction of total children in order to account for household fertility. Column (4) adds the same control variables to the regression from Column (3). The primary coefficient of interest in all cases is the triple interaction. All standard errors are clustered at the state-year level. Significance levels: $^{***}p< .01$ $^{**}p< .05$ $^{*}p< .1$.

TABLE V: SEX RATIOS & MARRIAGE MARKET COMPETITION (DD ESTIMATES)

	LOW SEX RATIO		HIGH SEX RATIO	
Latrine Ownership	Coef.	p-value	Coef.	p-value
Mboy x Post	0.075***	0.000	0.020	0.308
	(0.014)		(0.019)	
Mboy	-0.022*	0.050	0.001	0.906
	(0.011)		(0.012)	
Post	0.133***	0.000	0.034***	0.009
	(0.020)		(0.013)	
Constant	0.241***	0.000	0.348***	0.000
	(0.000)		(0.008)	
R^2	0.034		0.002	
N	18399		10568	

The dependent variable is a dummy for whether household *i* owns a latrine. I run this specification separately for households in a competitive marriage market (from the marriageable boy's perspective), which is defined as having more marriageable boys than marriageable girls, and for households in a less competitive marriage market. These are the low and high sex ratio columns, respectively. The coefficients of interest (the double interactions) are statistically different from each other at the 99% level. Standard errors, clustered at the village-year level, are reported in parentheses. Significance levels: ***p< .01 **p< .05 *p< .1

TABLE VI: SEX RATIOS & MARRIAGE MARKET COMPETITION (DDD ESTIMATES)

	LOW SEX RATIO		HIGH SEX RATIO	
Latrine Ownership	Coef.	p-value	Coef.	p-value
Mboy x Haryana x Post	0.065***	0.007	0.018*	0.061
	(0.024)		(0.009)	
Mboy x Haryana	-0.044**	0.038	-0.018	0.199
	(0.021)		(0.014)	
Mboy x Post	0.005*	0.443	0.036**	0.028
	(0.006)		(0.015)	
Haryana x Post	0.099*	0.056	-0.110***	0.007
	(0.042)		(0.036)	
Mboy	0.016***	0.002	0.007	0.611
	(0.004)		(0.012)	
Haryana	0.056	0.226	0.090**	0.018
	(0.046)		(0.034)	
Post	0.110***	0.000	-0.170***	0.000
	(0.021)		(0.037)	
Constant	0.136***	0.000	0.291***	0.000
	(0.010)		(0.012)	
R^2	0.028		0.028	
N	249100		270938	

The dependent variable is a dummy for whether household *i* owns a latrine. I run this specification separately for households in a competitive marriage market (from the marriageable boy's perspective), which is defined as having more marriageable boys than marriageable girls, and for households in a less competitive marriage market. These are the low and high sex ratio columns, respectively. The coefficients of interest (the triple interactions) are statistically different from each other at the 99% level. Standard errors, clustered at the state-year level, are reported in parentheses. Significance levels: ***p< .01 **p< .05 *p< .1

TABLE VII: HOUSEHOLD STRUCTURE

Improved Latrine	Coef.	SE	p-value
Mboy x Haryana x Post	0.037**	0.016	0.019
Mboy x Haryana	-0.024**	0.011	0.035
Mboy x Post	0.007	0.011	0.499
Mboy	0.023***	0.007	0.003
Small HH x Haryana x Post	0.024	0.018	0.176
Small HH x Haryana	-0.045***	0.016	0.004
Small HH x Post	-0.072***	0.020	0.000
Large HH x Haryana x Post	-0.002	0.030	0.958
Large HH x Haryana	-0.042***	0.016	0.008
Large HH x Post	-0.003	0.020	0.888
State-Year FE	Yes		
R^2			0.0645
N			442824

The dependent variable is household latrine ownership. *Small HH* indicates that household *i* had four or less children; *large HH* indicates household *i* had more than four children. Standard errors are clustered at the state-year level. Significance levels: ***p< .01 **p< .05 *p< .1.

TABLE VIII: "NO TOILET, NO BRIDE" AND MALE PREFERENCES

Latrine Ownership	Coef.	SE	p-value
Oldboy x Haryana x Post	0.003	0.009	0.705
Oldboy x Haryana	-0.002	0.010	0.724
Oldboy x Post	-0.082***	0.014	0.000
Haryana x Post	0.136***	0.045	0.006
Oldboy	0.100***	0.006	0.000
Haryana	0.075***	0.016	0.000
Post	0.000	0.045	0.996
Constant	0.184***	0.018	0.000
R^2			0.010
N			461730

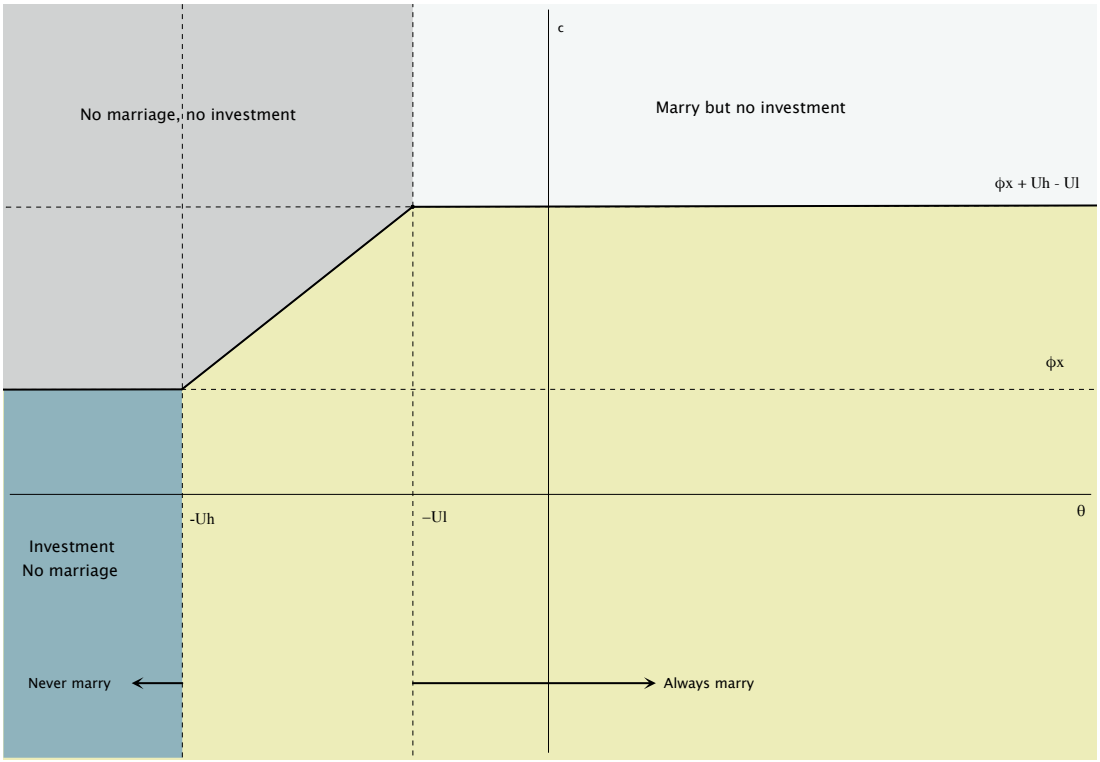
The dependent variable is latrine ownership at the household level. *Oldboy* is an indicator variable for whether the household has a male slighter older than being of marriageable age (i.e. between 28 and 36 years of age). All standard errors clustered at the state-year level. Significance levels: ***p< .01 **p< .05 *p< .1.

TABLE IX: FEMALE PREFERENCES OUTSIDE OF MARRIAGE

Latrine Ownership	Coef.	SE	p-value
Mgirl x Haryana x Post	0.005	0.011	0.669
Mgirl x Haryana	0.020***	0.006	0.003
Mgirl x Post	-0.003	0.111	0.798
Haryana x Post	0.115**	0.042	0.010
Mgirl	0.022***	0.006	0.001
Haryana	0.079***	0.018	0.000
Post	-0.015	0.042	0.724
Constant	0.192***	0.018	0.000
R^2			0.007
N			455113

Sample focuses on single *mgirls* only by excluding households with both mboys and mgirls. All standard errors clustered at the state-year level. Significance levels: ***p< .01 **p< .05 *p< .1.

FIGURE II: MARRIAGE AND INVESTMENT INCENTIVES



The idiosyncratic gain to marriage, θ, is along the x-axis. Individual costs of investment are along the y-axis. The yellow region indicates those men who will invest. Graph is adapted from Chiappori, Iyigun, and Weiss (2009).

TABLE X: FURTHER EVIDENCE ON INTRAHOUSEHOLD ALLOCATION

Dep. Var.	Full	Latrine	No Latrine	Diff.
Education gap	0.016	0.099*	-0.032	0.131***
	(0.031)	(0.050)	(0.032)	
Age gap	-0.012	0.026	-0.003	0.029
	(0.053)	(0.113)	(0.956)	
Age at first birth	0.208**	0.105	0.188*	-0.083
	(0.091)	(0.078)	(0.098)	
Pregnant	-0.013**	-0.013*	-0.007	-0.006
	(0.006)	(0.006)	(0.007)	
Contraceptive use	-0.027*	-0.002	-0.022	-0.020
	(0.014)	(0.013)	(0.170)	
Marriage age	-0.042	0.163***	-0.079	0.242***
	(0.064)	(0.051)	(0.073)	
Living with husband	0.145*	0.291***	0.013	0.278***
	(0.069)	(0.049)	(0.077)	
Sewing machine	0.035***	0.029**	0.021**	0.008
	(0.008)	(0.012)	(0.008)	
Washing machine	0.022***	0.011**	0.017***	-0.006
	(0.002)	(0.004)	(0.001)	
Cooker	-0.005	-0.003	0.003	0.006
	(0.005)	(0.006)	(0.007)	
Fan	0.012	0.003	0.031	-0.028***
	(0.006)	(0.008)	(0.007)	
Television	-0.014**	-0.019	-0.023***	-0.004
	(0.005)	(0.016)	(0.007)	
Motorcycle	0.052***	0.049***	0.027***	0.022**
	(0.008)	(0.018)	(0.008)	

Reported coefficients are from the triple interaction of *mboy*-haryana-post. The coefficients for marriage age, age at which first living with husband, washing machine, and cooker are all based on the difference-in-difference using *mboy* status and Haryana/control (i.e. with no time dimension) due to variables being missing from the 2004 round. The first column reports the basic DDD or DD estimates. Column "Diff" reports the statistical significance of the difference between the coefficients from columns (2) and (3) based on $p > \chi^2$. All standard errors are clustered at the state-year level. Significance levels: ***p< .01 **p< .05 *p< .1.

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