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Abstract "Child-bride marriage"—the marriage of prepubescent girls to adult men—has well-known nefarious consequences for females in developing countries where such marriage is often practiced. To improve these outcomes, developing-world governments have adopted several policies aimed at raising female marriage age. This paper investigates the effects of these policies for females in developing countries where parents strongly prefer sons to daughters. I find that raising female marriage age in such countries may have the unintended consequence of increasing the prevalence of female infanticide and sex-selective abortion. Where parents strongly prefer sons to daughters, some parents seek to dispose of their unwanted daughters through child-bride marriage, female infanticide, or sex-selective abortion. By raising the cost of child-bride marriage relative to infanticide or abortion, policies that raise female marriage age induce such parents to substitute the latter disposal methods for the former. I evaluate one such policy in Haryana, India and find empirical support for this prediction. My analysis suggests that from the perspective of female welfare, child-bride marriage may be a second-best institution, or constrained optimum, in developing countries that exhibit strong son preference.

Keywords Child brides · Female welfare · Minimum marriage-age · Conditional-cash transfer · Educational program · Infanticide · Abortion

JEL Classification D10 · 131 · J18

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1 Introduction

720 million women currently alive worldwide were married by age 18. In the developing world, one in three girls is expected to become such a bride, and in South Asia and Sub-Saharan Africa in particular, this figure is closer to one in two (UNICEF 2014: 89).[1] Tens of millions of these brides are not merely young. They are prepubescent—girls whose parents marry them to adult males before menarche. These prepubescent brides, often called "child brides," are most commonly found in developing countries where parents exhibit strong son preference—the preference for male over female offspring.

The poor socio-economic outcomes for females who marry young are well-known. Women who marry as adolescents or younger typically attain less education, are less likely to participate in the labor force, face higher risk of death at childbirth, are more likely to experience domestic violence, and have less autonomy within the household. Likewise, these women's children tend to be less educated and suffer poorer health (see, for instance, Hirschman and Rindfuss 1982; Hirschman 1985; Savitridina 1997; Choe et al. 2001; Jensen and Thornton 2003; Billari and Philipov 2004; UNICEF 2005; Kebede 2007; Field and Ambrus 2008; Roy 2008; Subramanian 2008; Raj et al. 2009; Kamal 2011, 2012; Speizer and Pearson 2011; Bajracharya and Amin 2012; Abalos 2014; Bhanji and Punjani 2014; Borkotoky and Unisa 2015; Chari et al. 2015). To improve these outcomes, at the international community's urging, developing-world governments have adopted three central policies aimed at raising female marriage age: minimum marriage-age laws, conditional-cash transfers, and educational programs.

This paper investigates the effects of these policies for females in developing countries where parents exhibit strong son preference. I find that raising female marriage age in such countries may have the unintended consequence of increasing the prevalence of female infanticide and sex-selective abortion. Where parents strongly prefer sons to daughters, some parents seek to dispose of their unwanted daughters through child-bride marriage, female infanticide, or sex-selective abortion. By raising the cost of child-bride marriage relative to infanticide or abortion, policies that raise female marriage age induce such parents to substitute the latter disposal methods for the former. I evaluate one such policy in Haryana, India and find empirical support for this prediction. As tragic as child-bride marriage may be for girls, for at least some females the relevant alternative is not post-pubescent marriage, but infanticide or abortion. My analysis thus suggests that from the perspective of female welfare, child-bride marriage may be a second-best institution, or constrained optimum, in developing countries that exhibit strong son preference.

My paper contributes to the literature that evaluates the effects of policy efforts to raise female marriage age in developing countries. This literature examines whether these policies successfully raise female marriage age under the presumption that doing so unambiguously improves female welfare (see, for

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[1] Data on the percent of girls who become young brides—females aged 20–24 married by age 18—refer to the most recent year available during the period 2005–2013 (UNICEF 2014).

instance, Erulkar and Muthengi 2009; Sinha and Yoong 2009; Malhotra et al. 2011; Sekher 2012; Kim et al. 2013; Nanda et al. 2014a, b, 2015; Maswikwa et al. 2015). My analysis contributes to this research by demonstrating that successfully raising female marriage age does not unequivocally improve female welfare. In developing countries that exhibit strong son preference, raising female marriage age may result in negative consequences for females, namely infanticide and abortion.

My paper also contributes to the literature that examines the effect of early female marriage on females' socio-economic outcomes. This literature finds that such marriage has a negative effect on numerous such outcomes (in addition to the papers cited above, see, for instance, Singh and Samara 1996; Islam and Ahmed 1998; Bruce 2003; Clark 2004; Garenne 2004; Ikamari 2005; Mensch et al. 2005; Nour 2006, 2009; Buttenheim and Nobles 2009; Gyimah 2009; Sarkar 2009; Santhya et al. 2010; Smith et al. 2012; Sabbe et al. 2013; Sekhri and Debnath 2014; Kamal and Hassan 2015; Kamal et al. 2015). My paper contributes to this research by identifying and examining a hitherto overlooked channel through which older female marriage age may in fact lead to *worse* outcomes for females rather than better: son preference. The results of my analysis thus suggest the importance of caution for policymakers who seek to improve outcomes for females in the developing world by raising female marriage age.

More broadly, my paper contributes to the literature focused on the rational-choice treatment of institutions pertaining to female welfare in developing countries. This literature has examined, for instance, female genital mutilation and dowry killings (see, for example, Coyne and Mathers 2011; Coyne and Coyne 2014; Bloch and Rao 2002). My paper contributes to this research by using rational choice to investigate the consequences of policy efforts to reduce child-bride marriage incidence in the developing world.

2 Child brides in the developing world

A child bride is a prepubescent female whose parents marry her to an adult man and who begins marital cohabitation with her groom before menarche. A child-bride marriage is thus a genuine cohabitational marriage between a prepubescent female and a post-pubescent male.

Child-bride marriage incidence varies substantially throughout the developing world. To measure it across countries, I use data from the Demographic and Health Surveys on the percentage of ever-married females who married by age 12 (DHS 1990–1999).[2] Average age at menarche globally is 13.5 years (see, for instance, Palmert and Boepple 2001). The overwhelming majority of ever-married females

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[2] I use Demographic and Health Surveys for all 50 countries surveyed between 1990 and 1999, relying on the most recent survey for countries surveyed multiple times during this period. These data are also used below to compare women who marry by age 12 with those who marry later, and in Sect. 3 to measure son preference across developing countries. I obtain similar patterns using the countries surveyed between 2000 and 2009 (DHS 2000–2009).

who married by age 12 were therefore likely prepubescent at the time of their marriages.[3]

Figure 1 depicts child-bride marriage incidence across developing countries. This map highlights that incidence's substantial variation, ranging from 0% in Kyrgyz Republic, to 4.9% in Pakistan, and nearly 30% in Bangladesh. Child brides are especially concentrated in South Asia and Sub-Saharan Africa. For instance, in South Asia 6.1% of ever-married females married by age 12, whereas in Latin America only 1.6% of ever-married females did so.

Child brides marry significantly earlier than their postpubescent counterparts, yet both marry adult postpubescent males. Among females in the developing world who marry by age 12, average marriage age is 11.5 years, whereas among females who marry later it is 18.2 years. Despite this difference, however, both females who marry by age 12 and those who marry later marry similarly aged adult males who are well past puberty: males who are, on average, 21.6 and 25 years old, respectively.[4]

Child-bride marriage is vastly more common in more impoverished parts of the developing world. Consider Fig. 2, which depicts the relationship between child-bride marriage incidence and real GDP per capita across countries. The relationship is clearly negative: child-bride marriage incidence tends to be higher where per-capita national income is lower. Furthermore, within countries, child brides are heavily concentrated in the poorest households. Figure 3 depicts child-bride incidence in the poorest and richest households by wealth quintiles in each country. In 80% of countries, child-bride incidence is higher in the poorest quintile, and in 62% of countries, it is at least twice as high in the poorest relative to the richest households.

Child brides tend to be less educated and are more likely to inhabit rural areas than post-pubescent brides. In developing countries, females who marry by age 12 attain on average 1.3 years of education, whereas females who marry later attain on average 4.4 years of education. Similarly, nearly 82% of females who marry by age 12 reside in rural areas, whereas only 63% of females who marry later do so.

In addition to being poorer and less educated, child brides experience a wide range of other inferior socio-economic outcomes. For instance, 26% of females who marry by age 12 show signs of wasting and 43% show signs of stunting. In contrast, less than 17% of females who marry later show signs of wasting, and less than 36% show signs of stunting.[5] Child brides are thus more likely to suffer moderate to severe malnutrition.

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[3] To the best of my knowledge, there exist no data that allow me to precisely identify prepubescent brides—females whose age at menarche strictly exceeds their age at marital cohabitation—for as large a cross-section of countries as this conservative married-by-12 proxy. Data from India's National Family Health Survey 1992–1993, however, where such data are available, results in similar patterns as those discussed below when comparing prepubescent and post-pubescent Indian brides (see NFHS-1 1995; Leeson and Suarez 2016).

[4] The average male reaches puberty at approximately 14 years old (Palmert and Boepple 2001).

[5] The World Health Organization defines wasting as a weight-for-height index that is two or more standard deviations below the reference median population. It similarly defines stunting as a height-for-age index that is two or more standard deviations below the reference median population. For more information, visit: www.who.int/nutrition/topics/moderate_malnutrition/en/
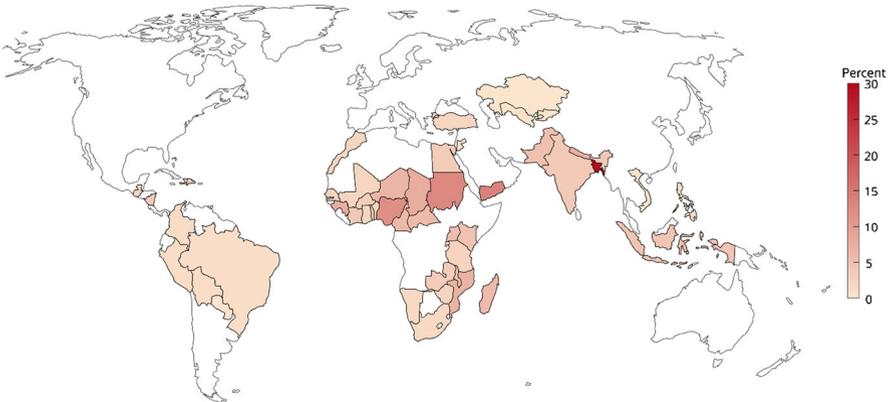
Notes: Data from Demographic and Health Surveys (1990-1999). I use the most recent survey for countries surveyed multiple times during this period. Child-bride marriage incidence is measured as the percentage of ever-married females who married by age 12. The countries surveyed during this period are: Benin, Burkina Faso, Bangladesh, Bolivia, Brazil, Central African Republic, Cote d'Ivoire, Cameroon, Colombia, Comoros, Dominican Republic, Egypt, Ghana, Guinea, Guatemala, Haiti, Indonesia, India, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Morocco, Madagascar, Mali, Mozambique, Malawi, Namibia, Niger, Nigeria, Nicaragua, Nepal, Pakistan, Peru, Philippines, Paraguay, Rwanda, Sudan, Senegal, Chad, Togo, Turkey, Tanzania, Uganda, Uzbekistan, Vietnam, Yemen, South Africa, Zambia, Zimbabwe.

Fig. 1 Child-bride marriage incidence in the developing world
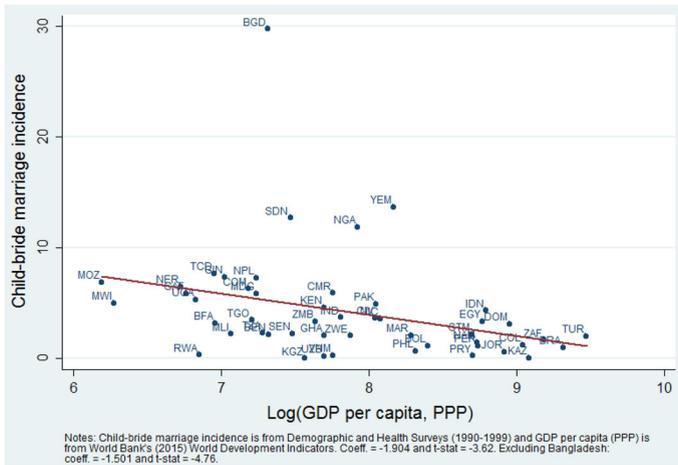
Fig. 2 Child-bride marriage incidence and per capita income

Child brides' children also experience poorer health outcomes. For example, children born to females who marry by age 12 are less likely to be vaccinated against tuberculosis, measles, DTP, and polio, with only 66, 46, 43, and 13% receiving such vaccines, respectively. In contrast, among children born to females who marry later, 77, 58, 57, and 21%, respectively, receive such vaccines. Similarly, 13% of children born to females who marry by age 12 show signs of wasting and
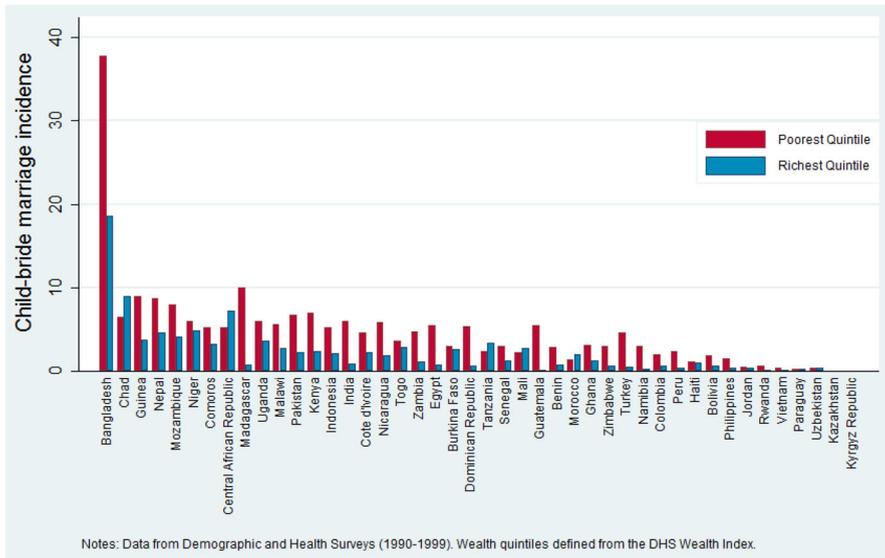
Fig. 3 Child-bride marriage incidence in poorest versus richest quintiles

47% show signs of stunting. Among children born to females who marry later, in contrast, only 8% show signs of wasting and 34% show signs of stunting.

Child brides also exhibit less autonomy in their households. For instance, 10% of females who marry by age 12 have no say over their own health care or how the money that they or their husbands earn is spent. In contrast, only 4% of females who marry later have no say over such matters. Similarly, 10% of females who marry by age 12 have no say in decisions regarding large household purchases, purchases for daily needs, or visits to family or relatives. In contrast, only 4% of females who marry later have no say over such matters.

Additionally, child brides are more likely to experience domestic violence. 35% of females who marry by age 12 report moderate to severe physical abuse by their husbands. Such abuse ranges from being slapped or punched to being attacked with a knife, gun, or other weapon. In contrast, 27% of females who marry later report such physical violence. Child brides are also more likely to experience sexual abuse by their husbands. Among females who marry by age 12, 11% report forced intercourse or other sexual acts by their husbands, compared to 9% of females who marry later.[6]

3 Understanding the reason for child-bride marriage

To investigate the potential effects of policy efforts aimed at raising female marriage age on females in developing countries that exhibit son preference, it is necessary to first understand the cause of child-bride marriage. For this purpose, I

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[6] Questions regarding female autonomy were only available for one country between 1990 and 1999 (Zimbabwe), and those regarding domestic violence were not asked until 2000. Such figures thus correspond to the 2000–2009 period.

draw on Leeson and Suarez (2016), who identify the source of the supply and demand for child brides in developing nations: son preference.

Son preference is the preference for male over female offspring by a child-seeking couple. A son-preferring couple demands a higher quantity of sons than daughters, higher-quality sons than daughters, or some combination of both. In developing countries that exhibit strong son preference, parents' preference for male over female offspring is widespread and deep-rooted. Although the reason for son preference is disputed, the fact that in many developing countries parents are son-preferring is not (see, for instance, Williamson 1976; Cleland et al. 1983; Arnold 1997).[7] For instance, in the developing world the average ever-married female's stated preferences for her ideal number and sex composition of children imply an ideal child bundle that consists of 1.62 sons and 1.46 daughters, or an ideal son/daughter ratio of 1.11.[8]

Son preference in the developing world is also evident in parents' systematic underinvestment in their daughters' care in favor of care for their sons. For example, son-preferring parents underfeed their daughters from infancy through childhood, frequently forgo medical care and treatments for their daughters ranging from prenatal care to vaccinations, and generally devote less time, attention, and resources to their daughters, contributing ultimately to excess female infant and child mortality in the developing world (see, for instance, Das Gupta 1987; Pitt and Rosenzweig 1990; Arnold 1997; Pande and Malhotra 2006; Tarozzi and Mahajan 2007; Oster 2009; Jayachandran and Kuziemko 2011; Barcellos et al. 2012; Bharadwaj and Lakdawala 2013).

Like child-bride marriage incidence, the strength of son preference varies substantially throughout the developing world. Figure 4 depicts the average ever-married female's ideal son/daughter ratio across countries. This ratio ranges from only 0.77 in the Dominican Republic, to 1.22 in Bangladesh, and 1.54 in Nepal. South Asian countries in particular tend to be strongly son preferring. While in Latin America the average ever-married female's ideal son/daughter ratio is only 0.97, in South Asia it is 1.40.

Unsurprisingly given the patterns in Figs. 1 and 4, child-bride marriage incidence is positively related to son preference across countries. Figure 5 depicts this relationship: where son preference is stronger, child-bride incidence is higher. This is consistent with the theory that both a supply and demand for child brides in developing nations arise from son preference.

The logic behind that theory is straightforward. Son-preferring couples seek to produce some ideal number of sons of a given quality. When fetal-sexing technology is available, such couples can attain their ideal sex composition of children and thus their ideal number of sons via sex-selective abortion. Couples who

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[7] Son preference has been attributed to, for example, kinship systems, land holdings, agricultural activity, religion, and ability to care for parents in old age (see, for instance, Rosenzweig and Schultz 1982; Mutharayappa et al. 1997; Das Gupta et al. 2003; Pande and Malhotra 2006; Chung and Das Gupta 2007; Pande and Astone 2007; Chakraborty and Kim 2010; Arokiasami and Goli 2012; Vanneman et al. 2012; Alesina et al. 2013; Gupta 2014; Jain 2014; Mitra 2014; Klaus and Tipandjan 2015; Xue 2015).

[8] This ratio excludes children in ever-married females' ideal child bundle whose sex "does not matter." Nearly 80% of ever-married females' ideal child bundles contain zero such children.
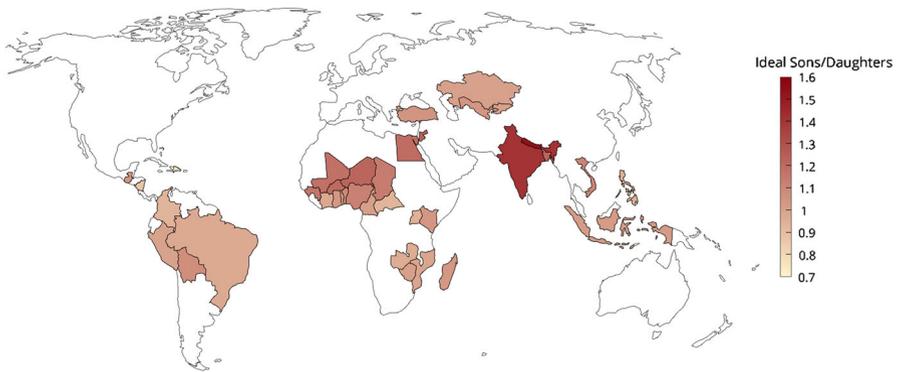
Notes: Data from Demographic and Health Surveys (1990-1999). Son preference is measured as the average ever-married female's ideal son/daughter ratio.

Fig. 4 Son preference in the developing world
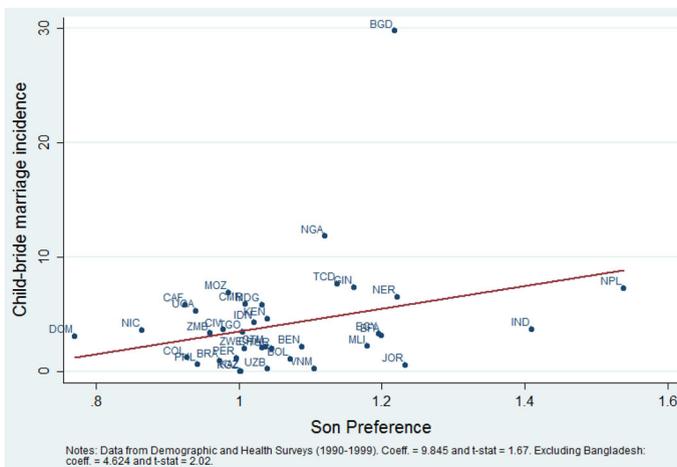
Fig. 5 Child-bride marriage incidence and son preference

are willing to incur the psychic and resource costs associated with sex-selective abortion can dispose of unwanted daughters by preventing those daughters' birth. This allows them to conserve on resources available for investment in sons.[9]

In the absence of such technology, however, or if they are unable or unwilling to incur the costs of sex-selective abortion, son-preferring couples attempting to produce sons will sometimes produce unwanted daughters. To conserve on the resources available for their desired sons, these couples must minimize the cost of maintaining their unwanted daughters in their households by disposing of those daughters after they are born. These couples have two alternative means of such disposal: infanticide or transferring their unwanted daughters to third parties.

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[9] See Becker (1960, 1992) and Becker and Lewis (1973) on the quantity-quality tradeoff faced by parents in their demand for children.

Infanticide avoids the cost of maintaining an unwanted daughter. However, it is also exceptionally psychically costly. At least some couples may therefore seek to dispose of their unwanted daughters by attempting to transfer them to third parties who are willing to accept them. In a son-preferring society where other couples also desire sons and have unwanted daughters they seek to dispose of themselves, finding another couple willing to adopt one's unwanted daughter is unlikely.[10] Finding an adult male who is willing to take one's unwanted daughter as a wife, however, is not.

The reason for this is simple. Son-preferring parents systematically underinvest in their daughters' care in favor of their sons. In doing so, they induce disproportionately greater female infant and child deaths, promoting the survival of relatively more males than females to puberty in son-preferring societies. These differential male–female survival rates produce an imbalanced sex ratio manifesting in a shortage of traditional marriage-aged (i.e. post-pubescent) females. In order to find wives, some adult males are consequently forced to search for brides in younger female cohorts. If the resulting shortage of traditional marriage-aged females is severe enough, these males are willing to take son-preferring couples' unwanted, prepubescent daughters as brides. The more severe this shortage is, the younger the child brides these males are willing to take.

Child-bride marriage therefore serves a simple yet crucial function in developing countries that exhibit strong son preference: it allows son-preferring couples who are unable or unwilling to dispose of their unwanted daughters via infanticide or abortion to do so via the marriage market, and allows adult males who are unable to find brides among traditional marriage-aged (i.e. post-pubescent) females to nevertheless find wives.

4 Analyzing policy efforts to raise female marriage age in developing countries that exhibit son preference

At the urging of the international community, developing-world governments have devoted considerable effort to raising female marriage age with the goal of improving females' poor socio-economic outcomes attendant to child-bride marriage. Those efforts are reflected by three central policies that aim to raise female marriage age in particular: minimum marriage-age laws, conditional-cash transfers, and educational programs. The first sets a minimum age at which someone may legally enter a marital union. The second policy provides a monetary or in-kind reward to a couple if their daughter reaches a pre-determined age as a single female or to a young female herself if she remains unmarried by this age. The third educates parents, young females, and/or young adult males about the poor socio-economic outcomes for females linked to early female marriage.

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[10] Anecdotal evidence from China and India, two of the most son-preferring nations in the world, suggests that girls are more likely to be abandoned in orphanages than boys, and that other couples are unwilling to adopt these daughters as their own (see, for example, Thurston 1996; Johnson 1993; Russell 2007; Hui and Blanchard 2014).

The United Nations (UN), for instance, adopted in 1962 the Convention on Consent to Marriage, Minimum Age for Marriage, and Registration of Marriages (Marriage Convention). The Marriage Convention was the first attempt to address early marriage via international law. It called on states to establish a legal minimum marriage age of 15 years or older. In 1979 the UN adopted the Convention for the Elimination of All Forms of Discrimination Against Women (CEDAW). The CEDAW explicitly classified early female marriage as a women's rights violation, declared all child marriages illegal, and called on states to increase the legal minimum marriage age to at least 18 years.[11]

Prior to the CEDAW, less than 10% of countries globally had a minimum female marriage age of 18 or older (Kim et al. 2013: 4). By 2007, however, nearly half of all countries had adopted this standard, and as of 2013 it extended to over 80% of countries worldwide (Kim et al. 2013: 4; UNSD 2013). Enforcement of such laws by local authorities in developing countries has typically been weak, especially in rural areas. The international community thus continues to call on developing-world governments to encourage stricter enforcement.

In 1994, the government of the Indian state of Haryana launched the first large-scale conditional-cash transfer program, "Our Daughter, Our Wealth" (Apni Beti Apna Dhan) with the purpose of raising female marriage age. This program incentivized the delay of female marriage by compensating parents upon their daughter's eighteenth birthday if she remained unmarried. In Ethiopia the Berhane Hewan project, conducted in 2004–2006, created social support networks for adolescent girls with the aim of promoting female education and reducing early marriage prevalence. And in Bangladesh, the Save the Children's Kishoree Kontha program has since 2007 educated tens of thousands of adolescent girls in basic and financial literacy and reproductive health, and regularly provided them with in-kind incentives as long as they remain unmarried.[12]

Non-profit organizations in India, such as Landesa and the MAMTA Health Institute for Mother and Child, have also conducted educational programs to inform adolescent females of the poor socio-economic outcomes for females who marry young and the benefits of investing in education and labor-market skills (see, for instance, Landesa 2013; MAMTA 2013). And the International Center for Research on Women (ICRW) has embarked on several research and educational projects that target raising female marriage age in numerous developing countries, including Bangladesh, Egypt, Ethiopia, India, Malawi, Mozambique, Nepal, Senegal, Zambia, and Zimbabwe.[13]

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[11] For an excellent account of international law's treatment of early marriage and its evolution, see Kim et al. (2013).

[12] Among more unusual efforts to reduce early female marriage, Central Malawi's Dedza District Senior Chief, Theresa Kachindamoto, annulled over 850 child marriages in the last three years because her sub-chiefs continued to approve marriages involving females younger than the legal minimum marriage-age of 18. She then sent hundreds of these former young brides back to school, often subsidizing their school fees with her personal income or by finding other willing sponsors (see, for example, Grossman 2016; McNeish 2016).

[13] For more information on ICRW's, MAMTA Health Institute for Mother and Child's, and Landesa's projects, visit: http://www.icrw.org/where-we-work?region=All&country=All&work=5&status=All, http://mamta-himc.org/know-us/, and http://www.landesa.org/what-we-do/india/, respectively.

Analyzing the effects of these policies on females in developing countries that exhibit son preference is straightforward in light of the theory of child-bride marriage discussed above. That theory highlights a son-preferring couple's tradeoffs as it seeks to get closer to its ideal child bundle by disposing of unwanted daughters produced in the couple's attempts to produce sons. When fetal-sexing technology is available, a couple that is able and willing to incur the cost of sex-selective abortion may dispose of its unwanted daughters before birth. In the absence of such technology, however, or if the couple is unable or unwilling to incur this cost, it must choose between infanticide—which economizes on unwanted-daughter maintenance costs but inflicts exceptionally high psychic costs—or child-bride marriage—which economizes on the psychic cost of unwanted daughter disposal but involves higher unwanted-daughter maintenance costs.

In view of this, policies that successfully raise female marriage age are notable not only for what they do, but also for what they do not do. What these policies do *not* do is address the underlying cause of child-bride marriage—son preference—and thus the reason some parents resort to marrying their prepubescent daughters in the first place—to dispose of them when they do not want them. What these policies do accomplish is to increase son-preferring couples' cost of disposing of their unwanted daughters via child marriage. As I consider below, however, given what these policies do not do, accomplishing the latter, it turns out, may have unintended and, from the perspective of female welfare, at least not obviously desirable effects.

First, consider the ways in which the foregoing policies aimed at raising female marriage age may raise parents' cost of resorting to child-bride marriage. Minimum marriage-age laws do so by declaring child-bride marriage illegal and punishing parents who resort to it, typically with a fine. Of course the cost of child-bride marriage only rises in this case if there is a positive probability that at least some parents who resort to it will be detected. If this is not true, minimum marriage-age laws are powerless to affect female marriage age and thus useless as a policy for this purpose.

Conditional-cash transfer programs (CCTs) may increase parents' cost of resorting to child-bride marriage through two channels. Which channel operates depends on the identity of the conditional reward's recipient. CCTs that reward young females for remaining unmarried before a stipulated age increase parents' cost of resorting to child-bride marriage via the same channel that educational programs that inform such females do. If young females are the recipients of such reward, or of education about the poor socio-economic outcomes for females who marry young, and this makes them more likely to resist their parents' efforts to marry them off before puberty, it may become more difficult for their parents to do so, raising parents' cost of resorting to child-bride marriage. Even if females cannot prevent being married off before puberty, they may be able to resist their parents' efforts in other ways. For example, females who receive a reward for remaining unmarried, or who are educated about the female outcomes attendant to early marriage, and whose parents marry them off before puberty may attempt to run away from their husbands' households or be less inclined to care for their husbands. This would increase males' cost of accepting prepubescent brides, making it more

difficult for parents seeking to dispose of their unwanted, prepubescent daughters to find men willing to take them as wives.

CCTs that reward young females' parents also raise parents' cost of resorting to child-bride marriage by making it more difficult for them to find adult males willing to take their unwanted, prepubescent daughters as wives. By inducing marginal couples who otherwise expect to marry their daughters slightly earlier than the age stipulated by the CCT to delay their daughters' marriages, these programs raise the "typical" female marriage age, as they are designed to do.[14] In doing so, however, they reduce the demand for prepubescent brides since fewer males are forced to reach into prepubescent female cohorts in search of brides when their search begins among older females and more males can find traditional marriage-aged (i.e., post-pubescent) brides.

Additionally, when the "typical" female marriage age rises, those males who are forced to reach into prepubescent female cohorts in search of brides will only be willing to take relatively older prepubescent females as wives, since the shortage of post-pubescent females is less severe. This, in turn, requires parents who seek to dispose of their unwanted daughters via child-bride marriage to maintain such daughters longer before they are able to dispose of them, thus raising parents' cost of resorting to child-bride marriage. To the extent that minimum marriage-age laws and educational programs also induce marginal couples to delay their daughters' marriage, they also increase parents' cost of resorting to child-bride marriage via the foregoing channel.

Educational programs that inform their participants about the poor socio-economic outcomes for females who marry young may also increase parents' cost of resorting to child-bride marriage through several channels. Here, the operative channel depends on the identity of the person who receives this education. If parents are the recipients of such education, these programs may increase parents' psychic cost of disposing their unwanted daughters via child-bride marriage. If young females are the recipients of such education, these programs may increase parents' cost of resorting to child-bride marriage via the same channel that CCTs that reward young females do, discussed above.

If instead adult males are the recipients of education about the poor socio-economic outcomes for females who marry young, males may become less willing to take young girls as wives. Such may be the case if these outcomes render young brides potentially inferior spouses, as might particularly be the case for the poor outcomes experienced by young brides' children (see, for example, Chari et al. 2015). Wife-seeking males educated about these facts are likely to be less keen to marry young girls, making it more difficult for parents who wish to dispose of their unwanted, prepubescent daughters via child-bride marriage to do so.

Although minimum marriage-age laws, CCTs, and educational programs as those just examined raise parents' cost of disposing of their unwanted daughters via child-bride marriage in the ways considered above, they do not affect parents'

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cost of disposing of unwanted daughters through the other means available to them for this purpose: female infanticide and sex-selective abortion. Policies aimed at raising female marriage age, therefore, raise the cost of child-bride marriage relative to these substitute means of unwanted-daughter disposal. This, of course, is likely to induce substitution of such means: some parents who formerly would have disposed of their unwanted daughters via child-bride marriage will now do so via infanticide or abortion. These policies are consequently likely to have the unintended effect of increasing the prevalence of female infanticide and sex-selective abortion, which would typically be regarded as rather undesirable outcomes for females.

The reason for this unintended effect lies both in what polices that raise female marriage age in son-preferring developing countries do and do not do. As noted above, these policies do not address the underlying cause of child-bride marriage in such countries: son preference, which is ultimately responsible for parents' demand for unwanted-daughter disposal. Given that son preference, and thus the demand for such disposal, is unaffected, what these policies do accomplish is to raise the relative cost of resorting to child-bride marriage as a means of unwanted-daughter disposal, leading parents to satisfy that demand through the now relatively cheaper means of infanticide and abortion.

Among the policies adopted by developing-world governments to raise female marriage age, CCTs come closest to potentially addressing the demand for unwanted daughter-disposal in son-preferring developing countries. In principle, at least, CCTs are capable of raising the cost of such disposal in general rather than through child-bride marriage alone. By offering parents a sufficiently large reward for delaying their daughters' marriage until a certain age, CCTs could potentially incentivize son-preferring parents to not dispose of their unwanted daughters at all, or at least until the cash-transfer is realized. In practice this is unlikely. The cash-transfer sum required to induce such parents to forego unwanted-daughter disposal would need to be at least as large as such parents' cost of maintaining an unwanted daughter until traditional marriage age. Under existing CCT programs, the cash rewards available to parents who delay their daughters' marriage until traditional marriage age are not this large.

India's largest CCT, for example, consisted of the government purchasing a bond of 2500 Indian Rupees upon an eligible girl's birth. Conditional on their daughter remaining unmarried, on her eighteenth birthday her parents could redeem this bond for 25,000 Rupees—the equivalent of approximately 455 USD in 2012, when the first beneficiaries' daughters turned 18 (Nanda et al. 2014a, b: 2). The *Economic Times* (2011) recently estimated the cost of raising a child through age 21 for upper middle-class Indian parents to be 90,000 USD. This of course is a gross overestimate for the typical Indian family: 46% of such costs were estimated to come from education (including college), and about 12% from entertainment. Even excluding such costs, however, and including the remaining costs only through age 16, one arrives at a cost of raising a child in India of 24,000 USD. If the typical Indian family must spend even one-tenth as much to raise a daughter, the largest conditional-cash transfer program in India would not provide son-preferring parents

anywhere near sufficient compensation for the costs of raising an unwanted daughter.[15]

5 Testable predictions and data

The foregoing analysis of the effects of policies aimed at raising female marriage age on females in developing countries that exhibit son preference yields one key testable prediction. By increasing son-preferring parents' cost of disposing of unwanted daughters via child-bride marriage, policies such as minimum marriage-age laws, conditional-cash transfers, and educational programs may induce such parents to substitute alternative means for this purpose, thus potentially increasing the prevalence of female infanticide and sex-selective abortion.

Empirically evaluating the effect of such policies requires some measure of the prevalence of female infanticide and sex-selective abortion. Although reliable data on such outcomes is nearly impossible to obtain, data on the sex ratio at birth is not. The sex ratio at birth captures the extent to which couples practice sex-selective abortion as well as female infanticide—provided that couples who resort to female infanticide do not report the births of infant daughters they have killed—as deviations from the natural sex ratio at birth.

Evaluating the effect of minimum marriage-age laws on the sex ratio at birth requires data not only on such laws' existence, but their enforcement. As discussed above, minimum marriage-age laws potentially increase parents' cost of resorting to child-bride marriage relative to infanticide or abortion only to the extent that they are enforced. To the best of my knowledge such data do not exist, making such an analysis unfeasible.

Evaluating the effect of educational programs on the sex ratio at birth requires data on the extent to which the education provided to recipients is in fact new as well as a reliable way to define and identify those who are treated. The former is not typically or consistently recorded by the organizers of such programs, and the latter is problematic because even if reliable data on attendees of an educational program existed, the extent to which they communicate such education with their households, social networks, and communities does not. This makes it difficult to distinguish between program participants and non-participants, which precludes an evaluation of the effect of an educational program on participants' sex ratio at birth.

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[15] Other smaller-scale programs in India have rewards ranging from 9,000 to 100,000 Indian Rupees (Sekher 2012: 15). The largest of these would still be insufficient to cover the estimated costs above. In other countries, CCTs similarly typically provide insufficiently-large rewards. For example, in Ethiopia, the Berhane Hewan project provided parents with a goat upon their daughter's "graduation" from the program if she had remained unmarried throughout the 2-year period. At the time of graduation, a goat was worth about 20 USD (Erulkar and Muthengi 2009: 8). Additionally, girls who stayed or returned to school received about 4 USD worth of school materials, and those who asked about family planning had the cost of their clinic card (2 USD) covered by the project. In 1994 in Bangladesh, the government launched a scholarship program whereby girls in 7th and 8th grade received a monthly stipend of about 1 to 2 USD if they remained in school and unmarried (Amin and Sedgh 1998: 9; Arends-Kuenning and Amin 2000: 6).

Of the main policies aimed at raising female marriage age in developing countries, therefore, conditional-cash transfer programs are most suitable for evaluating the effect of such policies on the sex ratio at birth and thus the prevalence of female infanticide and sex-selective abortion. To do so, I focus on the first large-scale conditional-cash transfer program in Haryana, India: "Our Daughter, Our Wealth" (Apni Beti Apna Dhan or ABAD). The scheme for this program, discussed above, consisted of providing eligible parents with a monetary reward conditional on their eligible daughter reaching her eighteenth birthday as a single female. Its large coverage permits a greater number of observations in control and treatment groups and its duration allows me to explore ABAD's short and medium-term effects on the sex ratio at birth.

Although data specifically for this purpose were not formally collected, it is possible to explore the effects of ABAD on the sex ratio at birth in Haryana, India by constructing a program-eligibility proxy—that is, an intent-to-treat rather than treatment measure. The National Family Health Survey (NFHS-1 1995; NFHS-2 2000; NFHS-3 2007) is a nationally representative survey which collects all information necessary for this purpose and spans the appropriate time period. Each wave covers females of reproductive age (13–49 for NFHS-1 and 15–49 for NFHS-2 and NFHS-3) and contains information on basic household and demographic characteristics, a complete birth history, and fertility preferences.

6 Empirical analysis

6.1 Variables and empirical strategy

Using all three waves of NFHS, I employ a difference-in-difference approach to examine ABAD's short and medium-term effects on females' sex ratio at birth in Haryana. NFHS-1 was conducted in 1993 in Haryana, and so may be regarded as the baseline survey for the pre-treatment period since ABAD was implemented simultaneously in all districts in October 1994. NFHS-2 was conducted in 1998–1999 and may be regarded as the short-term follow-up survey in the post-treatment period, and NFHS-3, conducted in 2006 in Haryana, as the medium-term follow-up survey in the post-treatment period.

For each female, I define the sex ratio at birth as total male births divided by total female births. I compare the difference between eligible and non-eligible females' sex ratio at birth before ABAD's implementation to the difference between eligible and non-eligible females' sex ratio at birth 4–5 years and 12 years after ABAD's implementation. This approach allows me to control for common additive time trends and permanent differences between eligible and non-eligible females as well as relevant household and individual-level characteristics. The estimated effect of ABAD on females' sex ratio at birth thus serves as a proxy for the effect of ABAD on the prevalence of female infanticide and sex-selective abortion. If son preference, and thus the demand for unwanted daughter disposal, is strong enough in Haryana, ABAD's impact can potentially be positive.

To be eligible for ABAD, a couple had to satisfy poverty and fertility criteria. The former required the couple to be below the poverty line or belong to a disadvantaged caste ("scheduled caste" or "other backward caste"), provided that members of such castes were not government employees or income tax payees—i.e. among the wealthiest 1–4% of the national population (Banerjee and Piketty 2006). The latter required the couple to give birth to a daughter within the first three births in the family after ABAD's implementation date of October 1994.

Based on each of these eligibility criteria, I construct an ABAD-eligibility proxy for all females in the three rounds of NFHS with sufficient information to do so.[16] To approximate the poverty eligibility criterion I use the wealth index constructed by NFHS—a composite measure of a household's cumulative living standard based on household ownership of assets—since no explicit measure of income or poverty is collected. I sort females according to the wealth index within urban and rural sectors and define as poor the population-weighted proportion of the sample that falls below the percentile thresholds indicated by the poverty headcount ratio. I use official poverty headcount ratios for Haryana computed by India's National Planning Commission. These ratios are as follows: 28 and 16.4% for the rural and urban sectors in 1993–1994, 8.3 and 10% for the rural and urban sectors in 1999–2000, and 13.6 and 15.1% for the rural and urban sectors in 2004–2005 (Government of India Planning Commission 2014: 25–27). Additionally, I define as poor all females who belong to a scheduled caste or other backward caste, unless their household wealth index is in the wealthiest 4% of the population-weighted distribution.

To approximate the fertility eligibility criterion I use females' birth histories and define as (potentially) eligible all females with two or fewer live children as of ABAD's implementation date of October 1994, and as non-eligible all females with three or more children as of that date. Thus, I define as (potentially) eligible all females who may still have given birth to a daughter within the first three births in their family after ABAD's implementation—and thus may have subsequently become eligible—and as non-eligible all females who could no longer have given birth to a daughter within the first three births in the family—and thus could not become eligible after ABAD's implementation.

For females interviewed after ABAD's implementation, i.e. all females in NFHS-2 and NFHS-3, this measure is determined by the sum of all births up to October 1994 conditional on the child being alive at the time of the interview or reported as having died after October 1994. For females interviewed before ABAD's implementation, i.e. all females in NFHS-1, I approximate this measure by the sum of all surviving children at the time of the interview in 1993 plus one for females who report a current pregnancy at that time. The ABAD-eligibility proxy is thus equal to one for females who satisfy both the poverty and eligibility criteria approximations, and zero otherwise.

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[16] A similar proxy is constructed by Sinha and Yoong (2009).

Then, for female i in each NFHS wave t, I use ordinary least squares to estimate a linear specification for the sex ratio at birth, SRB_{it}, where

$$SRB_{it} = \alpha_i + \beta_1 ABAD_i T_{t=2} + \beta_2 ABAD_i T_{t=3} + \beta_3 ABAD_i + \beta_4 T_{t=2} + \beta_5 T_{t=3} + X_i'\alpha + \varepsilon_i$$

where $ABAD_i$ is the ABAD-eligibility proxy and T_t are indicators for each survey wave. X is a vector of household and individual level characteristics, including the household wealth index, an indicator for rural residence, years of education, and indicators for scheduled caste/scheduled tribe membership and religious affiliation. With this approach, β_1 and β_2 are the estimates of ABAD's short and medium-term effects, respectively. Table 1 presents summary statistics by survey wave for all the variables used in this analysis.

6.2 Results

Table 2 presents the main results of this empirical analysis. Unless otherwise noted, all regressions include NFHS sample weights. Column 1 contains the most stripped-down specification which includes no controls. Column 2 adds demographic controls for wealth, rural residence, education and birth year fixed effects. Column 3 adds cultural controls for scheduled caste and scheduled tribe membership and religious affiliation.

Consistent with the prediction that policies aimed at raising female marriage age in son-preferring societies may result in higher prevalence of sex-selective abortion and female infanticide, the estimated effect of ABAD on females' sex ratio at birth is positive and significant. Compared to the period before ABAD's implementation, the difference between eligible and non-eligible females' sex ratio at birth increases by 0.227 males per female 4–5 years after ABAD's implementation and by 0.434 males per female 12 years after ABAD's implementation (based on column 3 estimates).[17]

Table 3 presents additional results that contribute to the robustness of the main results. First, to account for permanent differences across districts within Haryana that may be related to ABAD-eligibility and/or implementation, column 1 includes district fixed effects in addition to the demographic and cultural controls from column 3 in Table 2. Unfortunately, this specification does not allow for an estimate of ABAD's medium-term effect on females' sex ratio at birth because confidentiality requirements for HIV testing in NFHS-3 render such information unavailable. Thus, the sample contains only NFHS-1 and NFHS-2 females. Consistent with the

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[17] Using a similar approach, Sinha and Yoong (2009) find a positive and significant impact of ABAD on the ratio of living female children to living male children. By evaluating ABAD's effect on the female/male ratio of living children, Sinha and Yoong's analysis precludes finding ABAD's potential effect on unborn or unreported children killed in infancy (i.e. sex-selective abortion and infanticide). Their results are thus consistent with mine since, conditional on being born, a daughter is more likely to be desired rather than unwanted, especially when ABAD leads son-preferring parents to substitute abortion and infanticide as means of unwanted daughter disposal. Thus, all else equal, we would expect ABAD to promote the survival of living female children relative to living male children while simultaneously inducing a higher prevalence of female infanticide and sex-selective abortion.

Table 1 Summary statistics

Variable	Obs.	Mean	SD	Min.	Max.
NFHS-1					
Sex ratio at birth	2065	1.124	1.023	0	7
ABAD	2846	0.168	0.374	0	1
Ideal son/daughter ratio	2557	1.450	0.596	0	5
Son preference index	2731	1.444	0.509	0	2
Son preference index = 1 (%)	2731	0.451	0.498	0	1
Age	2846	29.827	8.615	13	49
Wealth index	2846	0.336	0.849	−1.266	2.785
Rural (%)	2846	0.737	0.440	0	1
Education	2826	3.017	4.402	0	20
Scheduled caste (%)	2846	0.262	0.440	0	1
Scheduled tribe (%)	2846	0.001	0.028	0	1
Hindu (%)	2846	0.893	0.309	0	1
Muslim (%)	2846	0.038	0.190	0	1
Christian (%)	2846	0.001	0.023	0	1
Sikh (%)	2846	0.066	0.249	0	1
NFHS-2					
Sex ratio at birth	2064	1.112	0.970	0	7
ABAD	2908	0.243	0.429	0	1
Ideal son/daughter ratio	2616	1.355	0.583	0	5
Son preference index	2837	1.370	0.493	0	2
Son preference index = 1 (%)	2837	0.375	0.484	0	1
Age	2908	31.556	8.578	15	49
Wealth index	2908	0.495	0.912	−1.277	2.661
Rural (%)	2908	0.712	0.453	0	1
Education	2907	3.960	4.966	0	19
Scheduled caste (%)	2908	0.422	0.494	0	1
Scheduled tribe (%)	2908	0.001	0.026	0	1
Hindu (%)	2905	0.892	0.311	0	1
Muslim (%)	2905	0.041	0.198	0	1
Christian (%)	2905	0.001	0.038	0	1
Sikh (%)	2905	0.066	0.248	0	1
NFHS-3					
Sex ratio at birth	1593	1.031	0.846	0	6
ABAD	2790	0.285	0.452	0	1
Ideal son/daughter ratio	2296	1.192	0.504	0	8
Son preference index	2454	1.208	0.435	0	2
Son preference index = 1 (%)	2454	0.220	0.414	0	1
Age	2790	28.996	9.439	15	49
Wealth index	2790	0.262	0.893	−1.640	2.181
Rural (%)	2790	0.697	0.460	0	1
Education	2790	5.684	5.161	0	20

Table 1 continued

Variable	Obs.	Mean	SD	Min.	Max.
Scheduled caste (%)	2790	0.468	0.499	0	1
Scheduled tribe (%)	2790	0.002	0.042	0	1
Hindu (%)	2790	0.889	0.314	0	1
Muslim (%)	2790	0.054	0.226	0	1
Christian (%)	2790	0.001	0.026	0	1
Sikh (%)	2790	0.056	0.229	0	1

Data are taken from NFHS-1 (1995), NFHS-2 (2000) and NFHS-3 (2007)

main results, ABAD's impact on females' sex ratio at birth is positive and significant when controlling for time-invariant differences across districts within Haryana. Compared to the period before ABAD's implementation, the difference between eligible and non-eligible females' sex ratio at birth increases by 0.256 males per female 4–5 years after ABAD's implementation.

The extent to which policies aimed at raising female marriage age may result in higher prevalence of female infanticide and sex-selective abortion in son-preferring societies depends on son-preferring parents' demand for unwanted daughter disposal, and, therefore, on the degree of son preference. In particular, the stronger a couple's son preference is, the greater is their demand for unwanted daughter disposal. The effect of such policies on the prevalence of female infanticide and sex-selective abortion, therefore, would be larger among relatively more son-preferring couples.

To explore this empirically, I create a son preference index equal to zero if a female's ideal number of daughters equals or exceeds her ideal number of sons, and equal to one if a female's ideal number of sons strictly exceeds her ideal number of daughters. I evaluate the effect of ABAD on females' sex ratio at birth within each of these subsamples in columns 2–5, where columns 2 and 3 include district fixed effects and columns 4 and 5 do not (but include all waves of NFHS). Column 2 includes only relatively less son-preferring females (son preference index equals zero) and column 3 includes only relatively more son-preferring females (son preference index equals one).

Consistent with the analysis underlying the main results, columns 2 and 3 show that the magnitude of ABAD's positive impact in the short-term on females' sex ratio at birth is over four times larger among relatively more son-preferring females than less son-preferring females. Columns 4 and 5 similarly show that ABAD's impact in the medium-term on females' sex ratio at birth is over twice as large among relatively more son-preferring females than less son-preferring females. This suggests, as predicted by the analysis in this paper, that the extent to which ABAD induces son-preferring couples to substitute female infanticide and sex-selective abortion as means of unwanted daughter disposal increases with the degree of son preference.

Table 2 ABAD's effect on females' sex ratio at birth: main results

Dependent variable: sex ratio at birth	(1)	(2)	(3)
ABAD*NFHS-2	0.277***	0.238***	0.227***
	(0.076)	(0.073)	(0.074)
ABAD*NFHS-3	0.494***	0.457***	0.434***
	(0.075)	(0.074)	(0.075)
ABAD	−0.516***	−0.381***	−0.397***
	(0.061)	(0.061)	(0.062)
NFHS-2	−0.009	0.129***	0.122***
	(0.035)	(0.035)	(0.035)
NFHS-3	−0.140***	0.196***	0.194***
	(0.036)	(0.038)	(0.038)
Wealth index		−0.068***	−0.054**
		(0.021)	(0.021)
Rural		−0.020	−0.008
		(0.033)	(0.033)
Education		−0.020***	−0.018***
		(0.003)	(0.003)
Scheduled caste			0.059*
			(0.034)
Scheduled tribe			−0.113
			(0.363)
Hindu			−0.307
			(0.334)
Muslim			−0.199
			(0.341)
Christian			−0.740*
			(0.425)
Sikh			−0.462
			(0.337)
R^2/Adjusted R^2	0.02	0.10	0.10
N	5722	5705	5705
Birth year fixed effects		X	X

Notes: Data are taken from NFHS-1 (1995), NFHS-2 (2000) and NFHS-3 (2007). OLS with robust standard errors in parentheses. Sex ratio at birth is each female's total male births divided by total female births. ABAD is an indicator variable for program eligibility. NFHS-2 and NFHS-3 are indicator variables for waves 2 and 3 of the survey, respectively. Adjusted-R squared reported whenever birth year fixed effects are included

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table 3 ABAD's effect on females' sex ratio at birth: additional results

Dependent variable: sex ratio at birth	(1)	(2) Less son-preferring	(3) More son-preferring	(4) Less son-preferring	(5) More son-preferring
ABAD*NFHS-2	0.256**	0.084	0.480***	0.099	0.441***
	(0.088)	(0.116)	(0.137)	(0.104)	(0.110)
ABAD*NFHS-3				0.333***	0.700***
				(0.103)	(0.127)
ABAD	−0.342***	−0.366***	−0.349***	−0.436***	−0.388***
	(0.055)	(0.097)	(0.093)	(0.093)	(0.085)
NFHS-2	0.173***	0.212***	0.104***	0.139***	0.103*
	(0.036)	(0.052)	(0.034)	(0.043)	(0.058)
NFHS-3				0.230***	0.171**
				(0.045)	(0.077)
Wealth index	−0.046*	−0.027	−0.046	−0.062**	−0.016
	(0.025)	(0.031)	(0.042)	(0.025)	(0.039)
Rural	0.027	0.029	−0.022	−0.006	−0.067
	(0.028)	(0.035)	(0.060)	(0.038)	(0.063)
Education	−0.020***	−0.024***	0.004	−0.018***	−0.006
	(0.004)	(0.005)	(0.008)	(0.004)	(0.007)
Scheduled caste	0.038	0.178***	−0.105	0.170***	−0.107**
	(0.048)	(0.040)	(0.077)	(0.045)	(0.053)
Scheduled tribe	−0.710***	−0.626***	−1.087***	−0.042	−0.078
	(0.043)	(0.081)	(0.148)	(0.457)	(0.639)
Hindu	−0.268	−0.348	−0.037	−0.363	−0.217*
	(0.282)	(0.304)	(0.154)	(0.362)	(0.124)
Muslim	−0.168	−0.397	0.219	−0.371	0.102
	(0.299)	(0.311)	(0.191)	(0.371)	(0.162)
Christian	−0.675**	−0.728		−0.704	
	(0.309)	(0.295)		(0.457)	
Sikh	−0.397	−0.489*	−0.119	−0.498	−0.410***
	(0.267)	(0.274)	(0.173)	(0.366)	(0.152)
Adjusted R^2	0.11	0.13	0.10	0.11	0.09
N	4112	2394	1718	3607	2098
Birth year fixed effects	X	X	X	X	X
District fixed effects	X	X	X		

Notes: Data are taken from NFHS-1 (1995), NFHS-2 (2000) and NFHS-3 (2007). OLS with robust standard errors in parentheses clustered by district whenever district fixed effects are included. Sex ratio at birth is each female's total male births divided by total female births. ABAD is an indicator variable for program eligibility. NFHS-2 and NFHS-3 are indicator variables for waves 2 and 3 of the survey, respectively. Sample in columns 1–3 contains only females from NFHS-1 and NFHS-2. Christian indicator omitted in samples with no Christians

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

7 Concluding remarks

The marriage of a twelve-year old girl to an adult male is tragic. It is the startling frequency of this tragedy in the developing world that motivates the international community's campaign to "end child marriage".[18] Unfortunately, the unquestionable tragedy of child-bride marriage is not sufficient to declare even successful policy efforts to raise female marriage age in the developing world unambiguously welfare improving for females.

Although such efforts may improve some outcomes for females—such as health and education—in developing countries that exhibit strong son preference, they may worsen others—namely, by increasing the prevalence of female infanticide and sex-selective abortion. To the extent that policymakers are indeed concerned with improving female welfare in the developing world, a more cautious approach to policies aimed at raising female marriage age, or at least one that is cognizant of the underlying cause of child-bride marriage in the first place, is warranted. For this purpose, perhaps the sobering possibility that child-bride marriage may reflect a second-best institution, or constrained optimum, in son-preferring developing countries demands serious consideration.[19] Perhaps in such societies policymakers could devote more effort to addressing son preference itself rather than its symptoms. This, too, however, requires caution. Although the consequences of son preference are well-known, its causes remain disputed.

My investigation of the effect of policies aimed at raising female marriage age on females in the developing world leads to several conclusions. First, my analysis suggests that if the goal is to improve female welfare, policies that may be desirable in a developing country that does not exhibit strong son preference may be considerably less desirable in one that does. In Latin America, for instance, where son preference is weak or non-existent, minimum marriage-age laws, conditional-cash transfers, and educational programs that inform about the negative outcomes for females who marry young may have the desired effect of improving female welfare. In South Asia, in contrast, where son preference is very strong, such policies may have unintended consequences for female welfare by raising the relative cost of child-bride marriage as a means of unwanted-daughter disposal and inducing son-preferring parents to dispose of their unwanted daughters via infanticide or abortion instead.

Second, my analysis highlights the potential difficulty of using policies to independently address any single poor socio-economic outcome for females in countries that exhibit strong son preference. In such countries, studies suggest that son preference is an important determinant of many poor socio-economic outcomes for females (see, for instance, Das Gupta 1987; Miller 1987; Arnold 1997; Das Gupta

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[18] See, for instance, the cover and back photographs of the UNFPA's report *Marrying Too Young: End Child Marriage* (2012), and the photographs exhibited at http://tooyoungtowed.org/. By "child marriage," the international community typically refers to marital unions involving at least one party under the age of 18.

[19] See, for instance, Leeson and Williamson (2009) on the theory of second best. For examples of institutional second-bests, see Coyne (2006), Leeson (2007, 2014), Leeson and Coyne (2012), and Leeson et al. (2014).

and Mari Bhat 1997; Arnold et al. 1998; Sudah and Irudaya Rajan 1999; Sekher and Hatti 2005; Pande and Malhotra 2006; Tarozzi and Mahajan 2007; Arnold and Parasuraman 2009). It is also certainly possible, and indeed likely, that some such outcomes reinforce or give rise to son preference itself.[20] Such may be the case, for instance, when sons rather than daughters are expected to care for parents in old age and females' expected market earnings are lower than that of males (see, for example, Mutharayappa et al. 1997; Das Gupta et al. 2003; Pande and Malhotra 2006; Chung and Das Gupta 2007; Pande and Astone 2007; Mitra 2014; Klaus and Tipandjan 2015). Similarly, where females have few labor market opportunities and are thus unable to independently support themselves, parents may be more likely to view daughters as a greater economic responsibility than sons. Nonetheless, to the extent that son preference remains a significant determinant of poor socio-economic outcomes for females, addressing any one of them without consideration to the rest is likely to result in unintended consequences, as son-preferring parents adjust their efforts to get closer to their ideal child bundles in unforeseen, and perhaps undesirable, ways.

Such parents' substitution of infanticide and abortion for child-bride marriage to dispose of their unwanted daughters is but one example of such a response. To see another, consider, for instance, the tradeoff between prenatal and post-natal investments in children and son-preferring parents' systematic underinvestment in their daughters' care in favor of care for their sons, which results in excess female infant and child mortality.[21] Suppose that in an effort to improve the latter outcomes, policy "balanced" son-preferring parents' post-natal investments in their sons and daughters. A potential unintended consequence of this policy may be even greater prenatal investments in sons versus daughters, as son-preferring parents adjusted their behavior to get closer to their ideal child bundles in light of the new constraints imposed by this policy.

Finally, my analysis illuminates why governments in son-preferring developing countries have been unsuccessful at strictly enforcing minimum marriage-age laws, particularly by local authorities in rural areas. As documented above, child brides are more common in impoverished and rural areas. Given these laws' effect on the relative cost of child-bride marriage and the crucial function such marriage plays in son-preferring societies—both in permitting son-preferring parents to dispose of their unwanted daughters and in enabling adult males, despite the shortage of traditional marriage-aged females, to nevertheless find wives—it is unsurprising that in areas where inhabitants resort to this institution more frequently authorities would be less willing to enforce such laws.

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[20] I thank an anonymous reviewer for highlighting the two-way causal relationship between son preference and female outcomes, particularly labor market outcomes.

[21] On the tradeoff between pre- and post-natal sex-selection, see Lin et al. (2014).

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