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The Causal Effect of Maternal Age at Marriage on Child Wellbeing: Evidence from India

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Abstract

We use nationally representative household data from India to establish the intergenerational effect of early marriage on a broad set of health and educational investments and outcomes, and to explicate the underlying mechanisms. The empirical strategy utilizes variation in age at menarche to obtain exogenous variation in the age at marriage. We find that delayed marriage results in significantly better child health and educational outcomes. We further analyze a subsample of uneducated child brides to show that the age at marriage matters by itself, independently of its effects via the woman's educational attainment and her marriage market outcome. From a household-decision-making perspective, the effects appear to be due (at least in part) to a reduction in desired and actual fertility as a result of later marriage, which may be associated with a quantity/quality tradeoff.

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1 Introduction

Early marriage of women is a common practice in many parts of the developing world, with significant numbers of women being married before the age of 18.[1] A number of studies have confirmed a negative correlation between early marriage and the health and educational outcomes of women and their children (Bruce 2003, Clark 2004, Nour 2006, Raj et al. 2009, Santhya et al. 2010). Some recent studies confirm that this observed relation has a causal component: Field and Ambrus (2008) show that delaying marriage has a causal effect on the woman's educational attainment and her prenatal investments in rural Bangladesh. Sekhri and Debnath (2014) find that, in India, children of women who get married later perform significantly better on arithmetic and reading tasks.

We make two contributions to this literature. We utilize nationally representative data from India to establish, for the first time, the intergenerational effects of early marriage on a broad set of indicators of child well-being, including health and educational attainment. To isolate the causal influence of marriage age, we employ the empirical strategy proposed by Field and Ambrus (2008), who instrument the woman's age at marriage by her age at menarche. This instrument is motivated by the observation that has been made by sociologists and anthropologists that parents become extremely anxious to marry off their daughter once she has reached menarche, partly to avert any unwanted pregnancies (Caldwell et al. 1983; Srinivas 1984).[2] Using this instrumental variable strategy, we find that early marriage results in lower health and educational investments and worsens the health and educational outcomes of the woman's children. We find, for instance, that a one-year delay in marriage would increase the probability of the child completing its required vaccinations by 4.6 percent, and increases its probability of school enrolment by 3.1 percent, while increasing the child's weight-for-height z-score by 0.08 and his/her reading and math test scores by 2.3 and 3 percent respectively.[3]

[1] For instance, in India 27.1% of women between the ages of 15 and 19 are married (the legal minimum age is 18 years). Corresponding figures for other selected countries are: 46.1% in Bangladesh, 42% in Chad, 32.9% in Malawi, 50.4% in Mali, 38.2% in Mozambique and 31.7% in Nigeria (data from Demographic and Health surveys between 2003 and 2005). For an overview on the practice of early marriage, see among others, Bloom and Reddy (1986), Althaus (1991), Singh & Samara (1996), and Jensen and Thornton (2003).

[2] According to Caldwell et al. (1983), "...a major control over the age at marriage of women is provided by the fact that many families feel deep disquiet and guilt over the presence of an unmarried menstruating daughter in the household..."

[3] These effects are all statistically significant when we apply a multiple testing correction to the p-values (Benjamini et al 2006).

Our second contribution is to unpack the channels which mediate the effect of early marriage on child outcomes. The age at which a woman gets married may matter for a number of reasons: First, early marriage curtails a woman's education, with many women dropping out of school around the time of marriage. Field and Ambrus (2008) find that each additional year that marriage is delayed results in 0.22 additional years of schooling (see also Maertens 2013). This can then affect household outcomes by affecting the woman's knowledge, preferences, and bargaining power (see, among others, Glewwe 1999; Christiaensen and Alderman 2004; Gakidou et al. 2010; Banerji et al 2013). Second, women who marry early might marry into households that are systematically different (perhaps worse) than the average household (see Sivasankaran 2014), with attendant implications for post-marital outcomes. Finally, the age at which the woman enters the spousal household may matter directly e.g. younger women may be less able to advocate for their preferences in the spousal household[4], which matters to the extent that women and men have different preferences for investment in children's health and education (Beegle et al 2001, Maitra 2004, Allendorf 2007, Atkin 2009, Majlesi 2014). Field and Ambrus (2008) refer to this channel as representing an "age effect".

We attempt to empirically isolate the mediating channels by means of two successive sample restrictions. First, following Field and Ambrus (2008), we restrict the sample to women who have never attended school (the uneducated sample). In this sample, variations in the age at marriage are not associated with variation in educational attainment, thereby allowing us to exclude the education channel. Next, we further restrict the sample to a set of "child brides" - women who were engaged to be married before they attained menarche.[5] This sample restriction is based on the observation that for many child brides, marriage is entered into at a very early age, but cohabitation tends to be postponed until after the girl has reached puberty. In this final subsample, therefore, the timing of menarche plays a role in determining the age at cohabitation, but does not correlate with spousal characteristics, which are predetermined (this is a testable assumption that we are able to verify in the data), or with educational attainment (because the girl was not attending school to begin with). Thus, by restricting the sample to non-educated child brides, we

[4]Indeed, some have argued that this may help explain why certain men might demand young brides (Caldwell et al. 1983).

[5]We recognise that there might be women in the general sample who might have informally arranged a match during childhood, but due to lack of information on this informal process, cannot include these women in our analysis.

are able to exclude the channels of education and spousal choice, and to examine whether the age at cohabitation matters directly for intergenerational outcomes.[6]

We find first that the effects of early marriage on child educational and health outcomes persist even after excluding education and spousal selection effects, i.e. there appear to be beneficial "age effects" in the child bride sample. In general, the beneficial effects of delaying marriage are largest in the child bride sample and smallest in the uneducated sample, indicating that the education channel reinforces the age channel, but that these effects are partially counteracted by sorting in the marriage market.

We further unpack the effect of early marriage by examining its impacts on the household decision-making process. To do so, we investigate the effect of early marriage on the woman's fertility, and her status in the household as evidenced by her participation in household decisions and freedom of mobility. We find that delayed marriage is associated with delayed childbearing (as measured by the age at first birth) as well as lower completed fertility. At the same time, we find a reduction in contraceptive usage, suggestive of an attempt to "catch up" to the household's desired fertility. Consistent with this interpretation, the reduction in completed fertility appears to be greater than the reduction in (stated) desired fertility. However the fact that desired fertility also declines indicates that the effect of delaying marriage is not entirely due to a "mechanical effect" of delaying fertility.

Our results on the household status outcomes are mixed: While there is some evidence that later marriage increases a woman's ability to go places without permission, it also seems to decrease her ability to go to these same places alone and her say in household decisions. Field and Ambrus (2008) examine a more limited set of women's empowerment outcomes and find some evidence of increased decision-making and mobility as a result of delaying marriage. Inasmuch as the fundamental relationship between age at marriage and women's latent bargaining power is similar, these varying results suggest challenges in measuring bargaining power.

Overall our results confirm that the age of marriage has important implications for the well-being of the next generation. Our finding that these implications are not solely mediated by education or by spousal choice implies that the age of marriage matters by itself. In conjunction with

[6]The distinction between marriage and cohabitation is only relevant for the sample of child brides. We refer to marriage throughout the paper, except where the distinction is important.

our finding that the beneficial effects of later marriage are not entirely undone by marriage market sorting (as evidenced by the fact that the effects of child outcomes persist even in the full sample), this provides a rationale for direct policy interventions to increase the age of marriage, over and above policies that target educational attainment. [7] In India the legal minimum age of marriage is 18 years for women, despite which more than 50% of women in our data report being married before the age of 18, indicating the weakness of enforcement. In recent years, economic incentives have also been attempted, most notably in the state of Haryana, which provided cash incentives for delaying marriage.[8] Such programs may provide a promising alternative to legal enforcement of age minimums in an environment in which social norms play a large constraining role on the choices of women.

The rest of the paper is structured as follows. Section 2 introduces the dataset used and provides some summary statistics. Section 3 outlines the empirical strategy and Section 4 reports the results. Section 5 concludes with a discussion.

2 Data

The analysis uses data from the India Human Development Survey 2005 (IHDS). The IHDS is a nationally representative survey of 41,554 rural and urban Indian households in all twenty-eight states and five union territories.[9] The IHDS sampled ever-married women between the ages of 15 and 49 (one was randomly chosen from each surveyed household), who were then administered a separate health and education questionnaire that included questions on marriage and reproductive history, as well as questions on health investments. For the analysis, we restrict ourself to women who are married only once, and exclude the women who marry above the age of 40 years, leaving us with 32,741 women. We will refer to this sample as the "full sample". We will also analyze two subsamples: A subsample of women who never attended school (i.e. have zero years of education), and a subsample of women who were married before they attained

[7] Economic opportunities for women are another policy that can lead to delayed marriage. Jensen (2012), for instance, using a Randomized Controlled Trial design, shows that young unmarried women exposed to recruiting services of local business process outsourcing firms were significantly less likely to get married or have children. See also Maitra and Gangadharan (2003), Kirdar et al. (2009) and Heath and Mobarak (2015).

[8] While to our knowledge there is no evidence yet on the effects of this program on girls' age at marriage – likely due to the fact that recent data are not yet available – there is evidence that this program increased the human capital investments in girls (Sinha and Yoong 2009).

[9] Lakshwadeep and the Andaman and Nicobar islands were excluded.

menarche ("child brides") and who never went to school. These subsamples consist of 18,795 and 2,487 women, respectively.

Table 1 provides descriptive statistics on the three analysis samples. The uneducated sample and the sample of uneducated child brides are clearly quite different from the full sample on a number of dimensions, including household size, wealth and consumption, and fertility. As expected, the age at marriage declines as we go from the full sample to the child bride sample. Figure 1 graphs the distribution of the age at marriage for each of the three samples. It can also be seen from Table 1 that on average there is a difference of 2.44 years between marriage and cohabitation for the child bride sample, whereas cohabitation closely follows marriage in the other two samples.

The analysis focuses on a number of groups of outcomes. We describe these below:

1. Health investments: These include pre- and post-natal health investments for the woman's last two births since 2000, specifically, (a) A binary indicator for any antenatal care (b) A binary indicator for home birth, (c) Duration of breastfeeding (in weeks), and (d) An indicator for whether the child completed the full WHO-recommended set of vaccinations.

2. Child health outcomes: These include (a) Size at birth (as reported by the mother for each of her last two births since 2000) - this is a categorical variable that takes values 1 through 4, with 4 indicating the largest size, (b) Weight-for-height of the women's children under the age of 5 (converted to z-scores), (c) An indicator for incidents of major morbidity of children under the age of 18, and (d) An indicator for mortality in the first year of life for all the children the woman gave birth to.

3. Educational investments: These include current school enrolment and number of completed years of schooling for all children.

4. Educational outcomes: These include scores on reading, writing and math tests that the survey administered to all children between the ages of 8 and 11. The reading score is a number between 0 and 4: A reading score of 1 corresponds to ability to read letters, 2 corresponds to ability to read words, 3 corresponds to ability to read paragraphs and 4 corresponds to ability to read stories. The mathematics score is a number between 0 and 3: A mathematics score of 1 corresponds to ability to do recognize numbers, 2 to ability to do subtraction and 3 to ability to do division. The writing score is a binary indicator for whether the child is able to write a simple

sentence with 2 or fewer mistakes.

5. Women's status in the household: This set includes subjective assessments of the woman's decision-making power in the household. We create indices that summarize the following groups of outcomes: (a) Self-reported say in household decision-making: Whether the respondent reports participating in decisions about expensive household purchases, what to cook, how many children to have, what to do when children are ill and whom the children should marry, (b) Ability to go alone to the local health center, the local store or visit relatives and friends, (c) Ability to go to these same places without asking permission from her husband or a senior family member[10], and (d) Discussion: Whether the respondent and her husband talk about business matters, household expenditure and local politics never, sometimes, or often[11]. In addition, we look at: (e) Whether men usually eat first when the household takes its main meal, (f) Whether she goes out with her husband (either by themselves or with the children), and (g) Employment outside the home: Whether the woman reports having worked for cash in the previous year[12], and how many hours she worked for cash last year.

6. Health knowledge: The woman was asked questions to test her knowledge of nutrition, fertility, hygiene and HIV/AIDS (these questions range from breast-feeding practices, diarrhea treatment to HIV transmission). We create two indices by summing the number of correct answers to questions about (a) general health practices, and (b) AIDS.

7. Fertility: We examine the onset of fertility, in terms of the mother's age at first birth, as well as her desired number of children, and her completed fertility (for women who state that they do no desire any more children). We also examine whether women are currently using any contraceptive methods.

[10]While these variables may seem to overlap considerably with her reports of whether she can go alone, this is far from complete. For instance, of the 74 percent of respondents needing to ask permission to go to the health clinic, 65 percent can go alone.

[11]Each response is converted into two binary variables: at least sometimes, or often, and then normalized to have standard deviation one and summed.

[12]That is, this variable does not reflect all the work the respondent may do, such as self employment or employment on another member's farm. However, there is evidence that working outside of the home for cash is more likely to empower a woman within the home (Anderson and Eswaran 2009) and also is more likely to respond to exogenous empowerment within the home (Heath and Tan 2015b).

3 Analytical strategy

3.1 Conceptual framework

We conceptualize the link between age at marriage and intergenerational outcomes as arising in two stages. In the first stage, the age at marriage implies a set of decisions: (i) The age at cohabitation, (ii) Educational attainment, and (iii) Spousal choice.[13] In the next stage, each of these decisions has implications for the primitives in a model of household decision-making, namely the preferences and bargaining power of the woman and her spouse, as well as the choice set that they face. For instance, if marriage curtails the woman's education, this may affect her earning ability and thereby affect the choice set of the household, in addition to affecting her bargaining power in the spousal household. Similarly, the age at which the woman enters the spousal household may have a bearing on the relations she develops with her spouse and his parents, and hence her status and bargaining power in the household. Her age at cohabitation may also impose a constraint on the choice set of the household, in terms of fertility choices. In particular, it may mechanically affect the age at which the woman begins to bear children, which is important because early childbearing is known to have significant health risks for both mother as well as child.

Broadly speaking, our objective is first to establish the overall causal effect of the age at marriage, and then to disentangle the causal effects of the various decisions embodied in the marriage decision. A related objective is to understand how the marriage decision affects the fundamentals of the decision-making process in the spousal household, i.e., its effects on the choice set, preferences and bargaining power.

3.2 Empirical strategy

3.2.1 Identifying the effect of age at marriage

We consider the following regression model where y_{ij} denotes an outcome for child i of woman j :

$$y_{ij} = \alpha + \beta AgeMarriage_j + \boldsymbol{\gamma}\mathbf{X}_j + \boldsymbol{\theta}\mathbf{Y}_{ij} + e_{ij} \tag{1}$$

[13] One can think of other decisions that are embodied in the marriage decision, but the ones identified here are those that we think plausibly matter for the outcomes we are interested in.

where $AgeMarriage_j$ denotes the woman's age at marriage, $\mathbf{X}_j$ denotes a vector of individual and household-level controls, including the woman's age and district and caste fixed effects, $\mathbf{Y}_{ij}$ is a vector of child-level controls, including gender and age (and the interaction between child age and child gender, to capture the fact that gender differences cumulate over time) and ε_{ij} is an error term.[14]

A major concern is that age at marriage is plausibly correlated with the error terms in equation (1) (children of women who choose to marry early might, for instance, be predisposed to worse later-life outcomes). To address this concern, we follow Field and Ambrus (2008) and Sekhri and Debnath (2014) by instrumenting age at marriage by the age at menarche of the woman. This strategy is motivated by the observation that has been made by sociologists and anthropologists that parents in India become anxious to marry off their daughter once she has reached menarche. We discuss the underlying assumptions of this strategy in detail in Section 3.2.3.

The child-level dependent variables of interest are health and educational investments and outcomes (the full set of variables is described in Section 2). We apply the False Discovery Rate (FDR) correction procedure of Benjamini et al. (2006) within each group of variables in order to account for multiple testing in a group of potentially correlated outcomes.

3.2.2 Identifying mechanisms

We start by attempting to examine the channels that mediate the effect of the age at marriage. First, we follow Field and Ambrus (2008) to abstract away from education effects by restricting the sample to women who were no longer in school by the time they reached marriageable age. To do so, we focus on women who never attended school (i.e. they have zero years of education), and repeat the previous set of estimations for this sample.[15] In this subsample, the age at marriage affects outcomes via its effect on spousal characteristics and/or directly, via "age effects".

Next, we attempt to test for "age effects", i.e. whether age at cohabitation matters for child outcomes. To do so, we further restrict the sample to include only child brides, i.e. women who married before they reached puberty - in such marriages, cohabitation is often postponed until

[14] Note that we cannot include mother fixed-effects as this would sweep out the effect of *AgeMarriage*.

[15] Differently from Field and Ambrus(2008) who restrict the sample to women who dropped out of school prior to menarche, we restrict the sample to women who have zero education. This is because although the IHDS data indicate the number of educational grades the woman has completed, it is not possible to infer exactly when (i.e. at what age) a woman dropped out of school, as the starting age and whether or not grades were repeated are not known.

the woman reaches menarche. Within this sample, therefore, the timing of menarche affects the age at cohabitation, but cannot affect spousal choice since the latter is pre-determined. This assumption is testable, by regressing observed characteristics of the spousal household on the age at menarche. We carry out this exercise for four spousal household characteristics that we can identify in the data: (i) The education of the mother-in-law, (ii) The education of the father-in-law, (iii) Whether or not the spousal household is in the same village as the woman's natal household, and (iv) The distance of the spousal household from the natal household.[16] Appendix Table 1 presents the results of this exercise separately for all three samples. In line with our intuition, these characteristics of the spousal household are indeed affected by the age at menarche in the full sample and the uneducated sample, but not in the child bride sample. This provides reassurance that age at menarche is indeed a credible instrument for age at cohabitation in the (non-educated) child bride sample.

Thus, we are now estimating:

$$y_{ij} = \alpha + \beta AgeCohabitation_j + \boldsymbol{\gamma}\mathbf{X}_j + \boldsymbol{\theta}\mathbf{Y}_{ij} + u_j \tag{2}$$

where the error u_j absorbs maternal education as well as spousal characteristics, and where age at cohabitation is instrumented for by the age at menarche.

Comparing effect sizes across the three samples will help shed light on the size and direction of age effects, education effects and marriage market sorting effects. One caveat that we should note at the outset is that there is a clear gradient in socio-economic status across the three subsamples (see Table 1) that may result in heterogeneous effects. For example, if the effects of early cohabitation mainly work through a bargaining channel and if this is especially significant for younger women, then we would expect age effects to be larger in the child bride sample. Or alternatively, one may speculate that by having entered into marriage well before cohabitation, the child brides may have already developed a particular relationship with their future in-laws prior to cohabitation, so that the actual age at which they enter the spousal household does not have a strong effect on their status in the new household. The potential heterogeneity of effect sizes across samples

[16] Other observable household characteristics such as husband's education, household size, income, consumption and wealth are however outcomes of the marriage and cohabitation decisions, and therefore cannot be used to test the exclusion restriction.

should therefore be borne in mind when interpreting the results.

Lastly, we attempt to shed light on which elements of the household decision making process are affected by the age at marriage/cohabitation. We utilize the same regression specifications as before, but this time the outcome variables are (i) Female employment, income and survey measures of bargaining power, and (ii) Fertility preferences and knowledge of health practices. The specific outcome variables are described in Section 2.

In addition to examining the effects on these measures, we also consider the hypothesis that the woman's bargaining power may be reflected in gender differential investments in her children, e.g., women who have greater say in household decisions may tend to equalize investments in sons and daughters.[17] We test this hypothesis by estimating the separate effects of the age at marriage on boys and girls.

3.2.3 Validity of the instrumental variable strategy

Field and Ambrus (2008) argue that a significant portion of the variation in timing of menarche is random, rendering it a good instrument for the age at marriage. While studies of twins have found that random genetic variation is the single largest source of variations in menarche (Kaprio et al. 1995),[18] some studies have reported an association between environmental factors and the age at menarche. Specifically, poor childhood nutrition (Karlberg 2002) and hard physical labor (Pellerin-Massicotte et al 1987) have been shown to delay menarche. At the same time, exposure to environmental toxins has also been shown to increase hormonal levels, leading to earlier menarche (Blanck et al. 2000; Windham et al. 2004). Thus, women who end up delaying marriage may also be undernourished and/or been less exposed to environmental toxins, and this could have a direct effect on some of the outcomes we are considering.

We undertake two strategies to minimize the potential endogeneity of menarche. First, we control for district fixed effects to account for spatial variation in exposure to environmental factors that affect menarche.[19] Second, to account for any remaining within-district variation in environmental conditions and health investments, we follow the approach of Field and Ambrus (2008)

[17] On average, daughters have significantly less years of schooling, are less likely to be enrolled, and have worse test scores than sons - this is true for children in all three samples.

[18] See also Treloar and Martin (1990) on the importance of genetic variation.

[19] Most marriages occur within the same district (see Fulford 2015), so that the district of residence of the married woman is most likely also her natal district.

and Debnath and Sekhri (2014) in including mother's height in the vector of controls, **X**. If height is a sufficient statistic for health investments and under-nutrition that is severe enough to affect menarche also results in stunting, then conditioning on height will eliminate any confounding from health investments that affect both menarche and marriage conditions. Since height is clearly closely related to health even if it is not a sufficient statistic for health (Strauss and Thomas 1998), the fact that controlling for health has very small effects on our results suggests that they are not driven by unobserved health inputs that also affect age at menarche.

In Figure 2, we graphically examine the relationship between height and the age at menarche in the data: Although the relationship is flat over the range 10-15 years (which accounts for 90% of the sample), there is a small but significant positive relation between the two variables at higher ages. This positive relation is inconsistent with the nutritional channel above, but is in line with the hypothesis that menarche ends the growth spurt which takes place during puberty, resulting in a positive correlation between adult height and menarche (see Onland-Moret et al. 2005). In this case, maternal height is an important control because it rules out a direct channel by which the age at menarche may affect children's health outcomes, e.g. maternal height has been linked to pre-term birth and low birth-weight (see Han et al 2012 for a review of the literature).

In Table 2 we test the strength of the instrument by regressing the age at marriage/cohabitation on the age at menarche separately for each of the three samples; these are our first-stage regressions. Menarche is a strong predictor of the age at marriage/cohabitation: A one-year delay in menarche delays marriage by 0.45 and 0.50 years, respectively in the full sample and the uneducated sample, and delays cohabitation by 0.59 years in the child bride sample.

A remaining consideration is measurement error in the age at menarche. While this is possible given that it was self-reported by respondents at the time of the survey, menarche is a major event for girls in India, and girls of both low and high caste report knowing little or nothing about menstruation before it began, but afterwards learning of taboos about eating and mobility during menstrual periods (Garg et al. 2001, Sharma et al 2006).[20] These lifestyle changes imply that respondents are likely to recall its timing fairly accurately. Furthermore, the distribution of reported age at menarche (Figure 3) does not show any heaping at key ages (such as round numbers

[20]Field and Ambrus (2008) make a similar argument that life events accompanying menarche increase the likelihood that respondents remember it accurately.

or school leaving ages) that would suggest significant recall error. Of course, this evidence does not definitively prove that there is no recall error in menarche. Inasmuch as any recall error is imperfectly correlated with recall error in the age of cohabitation, however, our instrumental variables estimates reduce the downward bias due to measurement error in OLS estimates. Indeed, in section 4.2 we propose that this might help explain why the OLS estimates of the effect of age at cohabitation on child health and education are smaller than the IV estimates. To the extent that there may still be correlation in the measurement errors in age at menarche and age at cohabitation, the IV estimates still represent a lower bound on the true causal effect of age at cohabitation.

4 Results

We start by examining the effect of age at marriage on child investments and outcomes in the full sample. The top panel in Tables 3-6 present the results using the regression specification in (1). For comparison, we present the OLS estimates alongside the IV estimates, but focus our discussion on the IV estimates. The tables also report the baseline mean of each of the dependent variables, as well as the Kleibergen-Paap F-statistic that tests the strength of the instrumental variable without assuming iid standard errors.

Table 3 shows that a one-year delay in marriage reduces the probability of home birth by 1.2 percentage points (2.2 percent), increases the duration of breastfeeding by 0.85 weeks (5.1 percent) and the probability that the child completes his/her full set of WHO-recommended vaccinations by 1.9 percentage points (4.6 percent). These are economically and statistically significant effects. Next, we examine whether these effects on health investments are manifested in child health outcomes. Table 4 shows that a one-year delay in marriage increases size at birth by 0.025 units (recall that this is a categorical variable that takes values from 1 through 4), and the weight-for-height z-score by 0.084. We do not however find any significant effects on mortality, although statistical power is an issue given that mortality is a relatively rare outcome. Overall, Tables 3 and 4 establish that the age at marriage has a strong causal effect on health investments and outcomes.

We now look at educational investments (Table 5) and outcomes (Table 6). Increasing the age at marriage by one year increases the number of years of education of the woman's children by, on average, 0.11 years (1.9 percent) and the probability that her children are currently enrolled in

school by 2.5 percentage points (3.1 percent). These estimates are highly statistically significant. Table 6 shows that a one-year delay in marriage improves the children's scores in reading and math by 0.061 (2.3 percent) and 0.048 (3 percent) respectively.

Next, we attempt to understand the mediating channels by repeating the estimations for the two subsamples. The results are reported in the middle and lower panels of Tables 3-6.

In terms of pre- and post-natal health investments, we do not find statistically significant effects of age at marriage in the uneducated sample (Panel B), although the coefficients are in the right direction and of comparable magnitude to those in the full sample. In the child bride sample (Panel C), we find a significant effect of age at cohabitation on the probability of obtaining antenatal care in the child bride sample. In this sample, we also estimate a large effect (1.45 months) on the duration of breastfeeding, although this is not statistically significant. The effects on measured health outcomes (Table 4) are more striking: In the child bride sample, there is clear evidence that delaying cohabitation improves birth size and weight-for-height and reduces the incidence of major morbidity.[21] The estimated effects are large compared to those in the full sample, probably due to the fact that the child bride sample is starting from an unusually disadvantaged position. In the uneducated sample (Panel B), the estimates are similar to those for the full sample (although only the coefficient on size at birth is statistically significant), indicating that the effect of early marriage is not entirely mediated by its effect on educational attainment.

Our conclusions are reinforced by the results in Tables 5 and 6 on educational investments and outcomes. Age at marriage has a strong causal effect on school enrolment and attendance (Table 5) even after we restrict the sample to uneducated women (Panel B), and subsequently, the child brides (Panel C). These effects on investments are manifested in learning outcomes, as measured by test scores (Table 6). In particular, we find that delayed cohabitation significantly improves reading and math scores in the child bride sample (Panel C). As before, the estimated effects are much larger for the child bride sample than in the full sample. In the uneducated sample, the coefficients are again comparable to those in the full sample, but lack precision.

[21]Child age is controlled for in all regressions that examine outcomes of surviving children. Implicitly, this also controls for the mother's age at birth. Mother's age at birth can be included in the regressions for birth size and infant mortality, but this results in a reduction in sample size because of missing data on birth dates for some non-surviving births. However, the results in Table 4 are robust to this inclusion, suggesting that the positive relationship between marriage age and birth size is not entirely due to the biological effect of maternal age on pregnancy outcomes. These results are available on request.

One common thread across Tables 3 through 6 is that the instrumental variable coefficients are in general larger in magnitude than the OLS coefficients, i.e. the OLS estimates of age at marriage and cohabitation are biased in a direction that suggests that later marriage and cohabitation are associated with characteristics that predict adverse outcomes. This may appear somewhat surprising, but we think three factors should be borne in mind. First, social norms dictate early marriage, and the women who actually get married later may be ones who are forced to do so for reasons that also have a negative impact on their outcomes. Second, it is important to note that the local average treatment effect interpretation of an instrumental variable estimate implies that we are estimating the causal effect of marriage and cohabitation for the subpopulation whose marriage/cohabitation timing is affected by the instrument, i.e. menarche. It is possible that causal effects for this subpopulation are larger than those for the population as a whole. Third, measurement error bias differentially affects OLS and IV estimates. If any measurement error in age at cohabitation is uncorrelated with age at menarche, this would tend to attenuate the estimates in the OLS regression but not in the IV regression. Even under the more realistic scenario in which there is also measurement error in the age at menarche which is correlated with the measurement error in age at marriage - say, because the respondents link these two events in their memories - the instrumental variable coefficient will still be less biased towards zero than the OLS estimate as long as the correlation in errors is less than one (Bound et al. 2001).

We now examine whether the age at marriage affects various elements of the household decision making process, both as important outcomes in their own right and as a potential channel linking age at marriage and children's human capital investments. We begin by looking at the effect of age of marriage on fertility. The results are in Table 7. The age at marriage has a statistically and economically significant impact on completed fertility in all three samples (Columns 1 and 5): The IV estimates indicate that a one year increase in age at marriage decreases the number of children the woman has given birth to by 0.08, 0.05 and 0.12 in the full, uneducated and child bride samples respectively. Part, but not all, of this reduction appears to reflect a reduction in desired fertility (Columns 2 and 6): A one-year delay in the age at marriage reduces the desired number of children by approximately 0.5 in the full sample. The point estimate is similar in the child bride sample (Panel C), and slightly smaller in the uneducated sample (Panel B), although neither of the latter coefficients is statistically significant. We also find consistently strong effects

on the age at first birth (Columns 3 and 7): A one year increase in the age at marriage delays childbearing by 0.80, 0.75 and 0.37 years in the full, uneducated and child bride samples respectively. The results on age at first birth suggest the possibility that the reduction in fertility may be partly due to a mechanical effect of delaying marriage, since most women in India bear children shortly after marriage. There is some suggestive evidence of such a mechanical effect: As we show in Columns 4 and 8, a delay in the age of marriage reduces the probability of contraceptive usage in all samples, which may be interpreted as reflecting an attempt to "catch up" to the household's desired fertility.

Next we examine the woman's self-reported assessments of her role in the household. Tables 8 and 9 present these results. Increasing the age of marriage by a year actually decreases the index of the woman's say in household decisions (namely, expensive household purchases, what to cook, how many children to have, what to do when children are ill and whom the children should marry) by a small but statistically significant mean of 0.028 standard deviations and decreases the index of whether she can go to certain places alone (namely, the local health center, the local store and relatives/friends) by an average of 0.034 standard deviations. However, later marriage actually increases the likelihood that a woman can go to these same places without permission. Note that the coefficients in this tables are more precisely estimated, allowing us to say with some precision that later marriage has no effect on her discussions with her husband. The results for bargaining indices are similar in the uneducated subsample and sample of child brides, suggesting that age effects contribute to the bargaining results in the overall sample. Other results (in Table 9) are similarly mixed: Each year a marriage is delayed increases by 1.8 percentage points the likelihood that a woman goes out with her husband and decreases by 1.6 percentage points the likelihood that men eat first in her household. It also decreases by 1.2 percentage points the probability that she worked for cash last year.

It thus appears that while bargaining power measured by some of the more traditional measures such as "having a say" and "ability to go to places alone" seems to decrease in response to later cohabitation, more general measures reflecting the quality of the relationship between the woman and her husband improve as a result of later cohabitation. Given our finding that later cohabitation improves child health, consistent with other papers that find effects of women's bargaining power on child health (Thomas 1994; Duflo 2003; Rangel 2006; Atkin 2009; Majlesi 2016),

one potential interpretation of the mixed nature of these results is that survey measures of participation in household decisions do not always measure how bargaining power is determined, especially in a vulnerable population like our subsample of child brides with no education.

In Tables 10 and 11, we test whether the age at marriage has differential effects depending on the gender of the child, as an indirect test of whether the age at marriage affects the woman's bargaining power. To test for such differences, we interact the age at marriage with an indicator for female children, while instrumenting age at marriage and its interaction with gender with the age at menarche and its interaction with the gender dummy. In the interest of space, we omit the results from the OLS specifications. Overall, Tables 10 and 11 do not indicate any strong evidence of differential investments in or outcomes for female children, although there is some suggestive evidence that male children benefit differentially in terms of nutrition (as measured by weight-for-height).

In Table 12, we examine whether the observed improvements in child health may be due to an improvement in health knowledge. We find a marked effect on health knowledge in the full sample: Increasing the age at marriage by one year increases the woman's knowledge of general health and HIV/AIDS. The effects are not entirely mediated by education, however, as indicated by the fact that delaying marriage also improves health knowledge among uneducated women (but to a smaller extent than in the full sample).

5 Concluding discussion

Combining a nationally representative household survey from India with an instrumental variable strategy that relies on the links between age of menarche, age of cohabitation and age of marriage, we establish the intergenerational health and education effects of early marriage and cohabitation. We first estimate the overall effects of delayed marriage (the net effect of later cohabitation, more education, and marital matching channels) and find that early marriage has an adverse effect on the woman's children in terms of size at birth and weight-for-height, as well as on learning outcomes as measured by reading and math tests. We attempt to understand the mediating channels by restricting the sample first to uneducated women (thereby excluding the education channel) and next by restricting the sample to uneducated women who were married at an early age but

did not enter into cohabitation until after menarche - in this sample, we are able to exclude educational attainment and spousal characteristics as mediating channels, and thereby focus on "age effects".

To understand mechanisms at the level of the household decision-making process, we examine the effect of early marriage on fertility and measures of the woman's status within the household. Later marriage results in a delay in childbearing (as measured by the age at first birth) and a decline in completed fertility. The latter partly reflects a change in preferences, as evidenced by a decline in (stated) desired fertility, but also partly a mechanical effect of delaying childbearing, as evidenced by a reduction in contraceptive usage, presumably in order to catch up to the household's fertility target. The associated delay in childbearing is significant in itself, because early childbearing is known to carry health risks for both mother and child (Miller 1993, Nour 2006 and Raj et al. 2009).

Our results on the bargaining/status outcomes are mixed: Later marriage appears to decrease her say in certain household decisions and her ability to go to places alone, while apparently improving her status on other dimensions. One interpretation of these results is that standard survey questions about decision-making may not be accurately capturing a woman's position in the household. For instance, if later marriage results in a woman's preferences being better aligned with her husband's, she might not need or want to "exert" her bargaining power.[22] Indeed, if woman's status does actually improve with later cohabitation – as suggested by the anthropological evidence and our empirical finding of improved child investment and outcomes – we join some recent papers in finding that improving a woman's status (say, by increasing her outside option) does not always increase standard measures of bargaining power, such as a woman's participation in household decisions (Haushofer and Shapiro 2013; Blattman et al 2014; Roy et al 2015; Heath and Tan 2015a). These findings suggest that these outcomes instead are results of both a woman's ability to make decisions and the outcome that would obtain without her involvement, so that participation in decisions does not always reflect bargaining power. This ambiguity in measurement could also help explain why Field and Ambrus (2008) find suggestive evidence of increased mobility.

[22]Indeed, women's empowerment is frequently conceptualized as the ability to make choices (Kabeer 1994) rather than actually making them. See Doss (2013) for a recent review of the empirical literature on intra-household bargaining and different ways to measure women's bargaining power.

Taken together, our results contribute to existing evidence that delayed marriage leads to beneficial outcomes for the next generation. Our additional finding that some of these results come from the channel of delayed age at cohabitation confirms the relevance of policies that seek to delay marriage, above and beyond those that seek to increase educational attainment, such as cash transfers conditional on remaining unmarried. That is, our results provide rationale for a program such as the "Our daughters, our wealth" program in Haryana, India that provides payments to parents of unmarried 18-year-olds, rather than in unmarried and in school, as Bangladesh's Female Stipend Program does. Such programs would help more families benefit from later marriage, even if they have chosen to no longer be in school.

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Table 1: Descriptive statistics

	Full sample		No education		No education, married before menarche	
	Mean	S. D.	Mean	S. D.	Mean	S. D.
Household characteristics						
Household size	5.41	2.40	5.69	2.49	5.90	2.56
Monthly per capita consumption (rupees)	1100.66	1026.52	662.46	591.65	637.31	573.90
Household asset index	14.95	5.84	9.23	4.90	8.45	4.54
Woman characteristics						
Age	32.19	7.98	33.86	7.94	35.02	7.71
Height (cm)	151.94	6.85	150.70	7.12	150.37	6.83
Education (years)	8.18	3.44	0.00	0.00	0.00	0.00
Age at marriage	18.57	3.48	16.82	2.65	12.77	3.57
Age at cohabitation	18.77	3.30	17.09	2.47	15.21	2.49
Age at menarche	13.78	1.36	13.61	1.22	14.00	1.43
Age at first birth	20.49	3.51	19.54	3.29	18.96	3.41
Number of children	2.37	1.45	3.36	1.90	3.94	2.09

Notes: The table presents the mean and standard deviation of selected household and woman-specific variables for each of the three analysis samples. The household is defined as the persons who live under the same roof and share the same kitchen for 6+ months. The full sample includes all ever-married women who were administered a women's questionnaire, who married just once and married under the age of 40 years. The household assets variable is an index that sums 30 dichotomous items measuring household possessions and housing quality.

Table 2: The effect of age at menarche on age at marriage/cohabitation

	Full sample	No education	No education, married before menarche
Age at menarche	0.445***	0.502***	0.591***
	(0.015)	(0.022)	(0.039)
Observations	31,537	13,457	2,425
R-squared	0.296	0.252	0.483

Notes: The table shows the results of the first-stage regressions for each of the analysis sample. In Columns 1 and 2, the dependent variable is the woman's age at marriage. In Column 3, the dependent variable is the woman's age at cohabitation. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Robust standard errors reported in parenthesis.

Table 3: The effect of age at marriage/cohabitation on child health investments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Any antenatal care	Home birth	Breastfeeding duration (weeks)	Vaccinations completed	Any antenatal care	Home birth	Breastfeeding duration (weeks)	Vaccinations completed
Panel A: Full sample								
Age at marriage	0.014***	-0.026***	-0.234***	0.007***	-0.006	-0.012*	0.852***	0.019**
	(0.001)	(0.001)	(0.036)	(0.001)	(0.006)	(0.007)	(0.237)	(0.008)
Observations	15,176	15,208	8,408	15,119	15,169	15,201	8,404	15,112
R-squared	0.352	0.382	0.276	0.220	0.337	0.377	0.187	0.215
Mean of dep variable	0.766	0.544	16.81	0.415	0.766	0.544	16.81	0.415
Kleibergen-Paap F-statistic					422.2	425.2	179.9	411.1
Panel B: No education								
Age at marriage	0.013***	-0.010***	-0.116*	0.003	-0.006	-0.004	0.511	0.004
	(0.002)	(0.002)	(0.067)	(0.002)	(0.010)	(0.009)	(0.271)	(0.009)
Observations	6,571	6,613	3,465	6,612	6,568	6,610	3,463	6,609
R-squared	0.345	0.297	0.323	0.284	0.338	0.297	0.302	0.284
Mean of dep variable	0.616	0.753	17.82	0.300	0.616	0.753	17.82	0.300
Kleibergen-Paap F-statistic					289.5	288.5	126.7	291.8
Panel C: No education, married before menarche								
Age at cohabitation	0.022**	-0.01	-0.059	-0.002	0.082***	-0.008	1.446	-0.020
	(0.007)	(0.006)	(0.203)	(0.006)	(0.023)	(0.020)	(0.855)	(0.020)
Observations	1,227	1,234	619	1,228	1,227	1,234	619	1,228
R-squared	0.487	0.383	0.563	0.444	0.447	0.382	0.503	0.439
Mean of dep variable	0.521	0.834	18.90	0.233	0.521	0.834	18.90	0.233
Kleibergen-Paap F-statistic					112.2	110.0	24.10	101.4

Notes: The table presents the results of OLS and IV regressions in which the dependent variables are pre- and post-natal health inputs pertaining to the last two births since 2000 of each of the three samples of women (excluding also women who married twice and women who had their first marriage over the age of 40). In Columns 5-8, the age at marriage is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 4: The effect of age at marriage/cohabitation on child health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Size at birth	Weight for height (z-score)	Major sickness	One-year mortality	Size at birth	Weight for height (z-score)	Major sickness	One-year mortality
Panel A: Full sample								
Age at marriage	0.001	0.008	-0.000	-0.003***	0.025**	0.084**	-0.001	-0.000
	(0.002)	(0.006)	(0.000)	(0.000)	(0.011)	(0.036)	(0.001)	(0.002)
Observations	15,144	12,204	63,830	88,338	15,137	12,200	63,763	88,224
R-squared	0.195	0.129	0.014	0.029	0.185	0.116	0.014	0.028
Mean of dep variable	2.924	-0.410	0.0154	0.0585	2.924	-0.410	0.0154	0.0585
Kleibergen-Paap F-statistic					423.0	300.1	1769	2915
Panel B: No education								
Age at marriage	0.005	0.018	-0.000	-0.003***	0.057***	0.050	0	0.001
	(0.003)	(0.010)	(0.000)	(0.001)	(0.014)	(0.041)	(0.001)	(0.002)
Observations	6,595	5,578	31,947	46,287	6,592	5,576	31,908	46,218
R-squared	0.262	0.183	0.019	0.032	0.233	0.181	0.017	0.031
Mean of dep variable	2.903	-0.446	0.0152	0.0749	2.903	-0.446	0.0152	0.0749
Kleibergen-Paap F-statistic					288.3	248.1	1292	2130
Panel C: No education, married before menarche								
Age at cohabitation	0.017*	0.071**	-0.000	-0.002	0.121***	0.171**	-0.005**	-0.000
	(0.009)	(0.025)	(0.001)	(0.002)	(0.032)	(0.083)	(0.002)	(0.004)
Observations	1,229	1,087	6,119	9,507	1,229	1,087	6,112	9,485
R-squared	0.368	0.332	0.084	0.058	0.295	0.321	0.079	0.057
Mean of dep variable	2.890	-0.584	0.0159	0.0961	2.890	-0.584	0.0159	0.0961
Kleibergen-Paap F-statistic					108.6	99.83	623.0	1140

Notes: The table presents the results of OLS and IV regressions in which the dependent variables are health outcomes of children of each of the three samples of women (excluding also women who married twice and women who had their first marriage over the age of 40). Size at birth is recorded for each of the last two births since 2000. Weight-for-height is recorded for children under the age of 5. Major sickness is recorded for all household members: The analysis sample includes children under 18. One-year mortality is recorded for all children. In Columns 5-8, the age at marriage is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height. Controls for child age are included when examining the outcomes of weight-for-height and sickness. Robust standard errorsin parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 5: The effect of age at marriage/cohabitation on child educational investments

	(1)	(2)	(3)	(4)
	OLS		IV	
	Years of education	Currently enrolled	Years of education	Currently enrolled
Panel A: Full sample				
Age at marriage	0.049***	0.008***	0.113***	0.025***
	(0.004)	(0.001)	(0.026)	(0.004)
Observations	54,341	45,819	54,269	45,764
R-squared	0.592	0.160	0.591	0.149
Mean of dep variable	5.380	0.798	5.380	0.798
Kleibergen-Paap F-statistic			1450	1244
Panel B: No education				
Age at marriage	0.030***	0.004***	0.075**	0.018***
	(0.007)	(0.001)	(0.035)	(0.006)
Observations	27,964	23,936	27,923	23,903
R-squared	0.471	0.175	0.470	0.171
Mean of dep variable	4.537	0.707	4.537	0.707
Kleibergen-Paap F-statistic			1029	923.8
Panel C: No education, married before menarche				
Age at cohabitation	0.037*	0.007*	0.149**	0.021**
	(0.020)	(0.003)	(0.060)	(0.010)
Observations	5,370	4,620	5,360	4,613
R-squared	0.512	0.248	0.510	0.245
Mean of dep variable	4.235	0.676	4.235	0.676
Kleibergen-Paap F-statistic			493.6	436.3

Notes: The table presents the results of OLS and IV regressions in which the dependent variables are educational investments in children of each of the three samples of women (excluding also women who married twice and women who had their first marriage over the age of 40). Enrollment only pertains to children between the ages of 6 and 18 years; Number of years of education pertains to all children over the age of 6, whether or not they are enrolled in school. In Columns 3-4, the age at marriage is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height, as well as for child age. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 6: The effect of age at marriage/cohabitation on child educational outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS			IV		
	Reading	Writing	Math	Reading	Writing	Math
Panel A: Full sample						
Age at marriage	0.045***	0.013***	0.041***	0.061**	0.013	0.048**
	(0.004)	(0.002)	(0.003)	(0.025)	(0.009)	(0.019)
Observations	10,423	10,328	10,378	10,411	10,316	10,366
R-squared	0.250	0.191	0.272	0.249	0.191	0.272
Mean of dep variable	2.630	0.700	1.585	2.630	0.700	1.585
Kleibergen-Paap F-statistic				311.7	310.7	311.7
Panel B: No education						
Age at marriage	0.013	0.005	0.007	0.027	-0.002	0.036
	(0.008)	(0.003)	(0.006)	(0.037)	(0.013)	(0.028)
Observations	5,235	5,194	5,224	5,229	5,188	5,218
R-squared	0.234	0.211	0.264	0.233	0.210	0.260
Mean of dep variable	2.257	0.592	1.292	2.257	0.592	1.292
Kleibergen-Paap F-statistic				193.5	193.4	194.8
Panel C: No education, married before menarche						
Age at cohabitation	0.015	0.015	0.020	0.139*	0.039	0.117*
	(0.021)	(0.009)	(0.017)	(0.069)	(0.024)	(0.053)
Observations	1,009	995	1,007	1,008	994	1,006
R-squared	0.403	0.350	0.388	0.378	0.343	0.360
Mean of dep variable	2.144	0.541	1.207	2.144	0.541	1.207
Kleibergen-Paap F-statistic				72.98	71.91	73.46

Notes: The table presents the results of OLS and IV regressions in which the dependent variables are scores on survey-administered tests of reading, writing and math scores of children of each of the three samples of women (excluding also women who married twice and women who had their first marriage over the age of 40). The tests were administered to children between the ages of 8 and 11. A reading score of 1 corresponds to ability to read letters, 2 corresponds to ability to read words, 3 corresponds to ability to read paragraphs and 4 corresponds to ability to read stories, a math score of 1 corresponds to ability to do recognize numbers, 2 to ability to do subtraction and 3 to ability to do division, a writing score of 1 refers to the ability to write with 2 or fewer mistakes. In Columns 4-6, the age at marriage is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height, as well as for child age. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 7: The effect of age at marriage/cohabitation on fertility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Number of children	Desired number of children	Age at first birth	Contraceptive usage	Number of children	Desired number of children	Age at first birth	Contraceptive usage
Panel A: Full sample								
Age at marriage	-0.130***	-0.038***	0.759***	-0.009***	-0.083***	-0.046***	0.772***	-0.017***
	(0.003)	(0.002)	(0.006)	(0.001)	(0.019)	(0.014)	(0.029)	(0.005)
Observations	20,962	30,555	29,166	28,642	20,938	30,523	29,134	28,614
R-squared	0.410	0.289	0.526	0.261	0.405	0.289	0.525	0.259
Mean of dep variable	2.837	2.390	20.03	20.03	2.837	2.390	20.03	20.03
Kleibergen-Paap F-statistic	.		.	.	599.8	1.251	842.7	825.2
Panel B: No education								
Age at marriage	-0.129***	-0.033***	0.687***	-0.009***	-0.053*	-0.020	0.678***	-0.013*
	(0.007)	(0.003)	(0.012)	(0.002)	(0.029)	(0.014)	(0.047)	(0.007)
Observations	9,381	12,991	12,725	12,228	9,368	12,966	12,709	12,213
R-squared	0.363	0.292	0.381	0.309	0.354	0.291	0.381	0.309
Mean of dep variable	3.465	2.636	19.44	19.44	3.465	2.636	19.44	19.44
Kleibergen-Paap F-statistic	.		.	.	399.9	532.9	535.5	473.8
Panel C: No education, married before menarche								
Age at cohabitation	-0.112***	-0.039***	0.509***	-0.005	-0.117**	-0.045	0.476***	0.011
	(0.021)	(0.009)	(0.033)	(0.005)	(0.057)	(0.027)	(0.096)	(0.015)
Observations	1,734	2,343	2,326	2,240	1,733	2,285	2,322	2,238
R-squared	0.426	0.393	0.328	0.386	0.426	0.372	0.328	0.382
Mean of dep variable	3.942	2.785	18.96	18.96	3.942	2.785	18.96	18.96
Kleibergen-Paap F-statistic	.		.	.	177.5	236.1	221.7	211.3

Notes: The table presents the results of OLS and IV regressions in which the dependent variables are fertility measures for each of the three samples of women (excluding also women who married twice and women who had their first marriage over the age of 40). The sample in Columns 1 and 5 is restricted to women who state that they do not desire any more children. ln Columns 5-8, the age at marriage is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's height. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 8: The effect of age at marriage/cohabitation on bargaining power

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	Say in hh decisions (index)	Can go places alone (index)	Do not need permission to go places (index)	Discuss with husband (index)	Say in hh decisions (index)	Can go places alone (index)	Do not need permission to go places (index)	Discuss with husband (index)
Panel A: Full sample								
Age at marriage	-0.001	-0.003	0	0.017***	-0.028***	-0.034***	0.071***	0.006
	[0.002]	[0.002]	[0.002]	[0.002]	[0.010]	[0.010]	[0.010]	[0.010]
Observations	31,446	31,446	31,446	31,446	31,409	31,409	31,409	31,409
R-squared	0.354	0.225	0.234	0.275	0.348	0.217	0.194	0.274
Mean of dep variable	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kleibergen-Paap F-statistic					904.8	792.122	904.759	904.8
Panel B: No education								
Age at marriage	0.001	-0.010***	-0.007**	0.003	-0.056***	-0.027*	0.067***	0.024*
	[0.003]	[0.003]	[0.003]	[0.003]	[0.014]	[0.015]	[0.014]	[0.014]
Observations	13,426	13,426	13,426	13,426	13,406	13,406	13,406	13,406
R-squared	0.399	0.245	0.252	0.275	0.383	0.244	0.218	0.273
Mean of dep variable	-0.0929	-0.2575	-0.1751	-0.644	-0.0929	-0.2575	-0.1751	-0.644
Kleibergen-Paap F-statistic					566.4	566.4	566.4	566.4
Panel C: No education, married before menarche								
Age at cohabitation	-0.015	-0.013	-0.014	-0.001	-0.115***	-0.073**	0.009	0.014
	[0.010]	[0.011]	[0.009]	[0.010]	[0.030]	[0.030]	[0.023]	[0.031]
Observations	2,424	2,424	2,424	2,424	2,420	2,420	2,420	2,420
R-squared	0.508	0.28	0.386	0.324	0.481	0.269	0.385	0.323
Mean of dep variable	-0.9876	-0.5388	-0.2435	-0.3889	-0.9876	-0.5388	-0.2435	-0.3889
Kleibergen-Paap F-statistic					229.1	229.1	229.1	229.1

Notes: The table presents the results of OLS and IV regressions in which the dependent variables are measures of status in the household of each of the three samples of women (excluding women who married twice and women who had their first marriage over the age of 40). Each index is constructed by normalizing a series of binary variables to have mean zero and standard deviation one and then summing the normalized variables, and then renormalizing the final outcome to again have standard deviation one. "(Self-reported) say in household decisions index" includes whether the respondent has a (self-reported) say in expensive household purchases, what to cook, how many children to have, what to do when children are ill and whom the children should marry. "Can go to places alone index" includes whether the respondent is allowed to go alone to the local health center, the local store, relatives/friends. "Do not need permission to go to places index" includes whether the respondent has to ask permission from her in-laws to go to the local health center, the local store or visit relatives and friends. "Discuss with husband index" includes whether or not the respondent and her husband sometimes talk about business matters, household expenditure and local politics. In Columns 5-8, the age at marriage/cohabitation is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 9: The effect of age at marriage/cohabitation on household bargaining (contd)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV			
	1(Men Eat First)	1(Go out with husband)	1(Worked for cash last year)	Hours of work	1(Men Eat First)	1(Go out with husband)	1(Worked for cash last year)	Hours of work last year
Panel A: Full sample								
Age at marriage	-0.004***	0.015***	-0.004***	-1.101	-0.016***	0.018***	-0.012***	-5.142
	[0.001]	[0.001]	[0.001]	[1.387]	[0.004]	[0.005]	[0.004]	[6.952]
Observations	31,354	31,292	31,446	31,446	31,318	31,256	31,409	31,409
R-squared	0.367	0.254	0.232	0.149	0.362	0.254	0.229	0.149
Mean of dep variable	0.3083	0.5236	0.2337	301.0447	0.3083	0.5236	0.2337	301.0447
Kleibergen-Paap F-statistic					901.1	896	904.8	904.8
Panel B: No education								
Age at marriage	-0.002*	0.006***	-0.004**	-4.661**	-0.015**	0.011	-0.002	-0.745
	[0.001]	[0.002]	[0.001]	[2.298]	[0.006]	[0.007]	[0.006]	[9.840]
Observations	13,396	13,371	13,426	13,426	13,377	13,352	13,406	13,406
R-squared	0.391	0.285	0.312	0.246	0.386	0.284	0.312	0.245
Mean of dep variable	0.3735	0.4145	0.3463	405.1328	0.3735	0.4145	0.3463	405.1328
Kleibergen-Paap F-statistic					563.1	564.9	566.4	566.4
Panel C: No education, married before menarche								
Age at cohabitation	0.003	-0.008	0.001	4.104	0.004	0.018	0.003	7.924
	[0.004]	[0.004]	[0.005]	[6.833]	[0.012]	[0.012]	[0.012]	[18.106]
Observations	2,418	2,418	2,424	2,424	2,414	2,414	2,420	2,420
R-squared	0.504	0.368	0.372	0.314	0.503	0.356	0.373	0.314
Mean of dep variable	0.4186	0.3521	0.3633	393.8911	0.4186	0.3521	0.3633	393.8911
Kleibergen-Paap F-statistic					227.7	229.4	229.1	229.1

Notes: The table presents the results of OLS and IV regressions in which the dependent variables apply to each of the three samples of women (excluding women who married twice and women who had their first marriage over the age of 40). The variable 1(Worked for cash last year) indicates whether the woman reports any cash earnings last year, "including DA, housing allowance given in cash, etc.". The variable hours of work is constructed by multiplying the reported number of days worked last year by the number of hours worked in a usual day. In Columns 5-8, the age at marriage/cohabitation is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 10: Differential effects of age at marriage/cohabitation on child investments by gender

	(1)	(2)	(3)	(4)	(5)	(6)
	Health investments				Educational investments	
	Any antenatal care	Home birth	Breastfeeding duration	Vaccinations completed	Years of education	Currently enrolled
Panel A: Full sample						
Age at marriage	-0.011	-0.021**	0.808***	0.004	0.145***	0.025***
	(0.007)	(0.009)	(0.261)	(0.010)	(0.032)	(0.005)
Age at marriage * Female child	0.011	0.022	0.122	0.038**	-0.078	-0.001
	(0.011)	(0.013)	(0.444)	(0.015)	(0.047)	(0.007)
Observations	15,169	15,201	8,404	15,112	54,269	45,764
R-squared	0.336	0.371	0.184	0.196	0.590	0.149
Kleibergen-Paap F-statistic	98.66	97.90	34.85	99.15	329.5	319.1
Panel B: No education						
Age at marriage	-0.010	-0.006	0.373	-0.013	0.116***	0.022***
	(0.012)	(0.012)	(0.335)	(0.012)	(0.042)	(0.007)
Age at marriage * Female child	0.008	0.003	0.288	0.037*	-0.100	-0.009
	(0.016)	(0.016)	(0.468)	(0.015)	(0.059)	(0.010)
Observations	6,568	6,610	3,463	6,609	27,923	23,903
R-squared	0.337	0.297	0.301	0.273	0.469	0.170
Kleibergen-Paap F-statistic	87.29	85.76	53.15	137.2	239.7	219.2
Panel C: No education, married before menarche						
Age at cohabitation	0.067	-0.019	1.992	-0.05	0.146	0.016
	(0.030)	(0.029)	(1.159)	(0.027)	(0.084)	(0.013)
Age at cohabitation * Female child	0.029	0.022	-1.066	0.059	0.006	0.011
	(0.039)	(0.034)	(2.006)	(0.031)	(0.132)	(0.021)
Observations	1,227	1,234	619	1,228	5,360	4,613
R-squared	0.439	0.377	0.497	0.419	0.509	0.245
Kleibergen-Paap F-statistic	47.51	43.10	5.346	40.18	100.3	99.82

Notes: The table presents the results of IV regressions in which the dependent variables are health and educational investments for the children of the three samples of women (excluding women who married twice and women who had their first marriage over the age of 40). The age at marriage is instrumented by the age at menarche, and the interaction between age at marriage and gender is instrumented by the interaction between age at menarche and gender. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height and child age and gender. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 11: Differential effects of age at marriage/cohabitation on child outcomes by gender

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Health outcomes				Educational outcomes		
	Size at birth	Weight for height (z-score)	Major sickness	One-year mortality	Reading	Writing	Math
Panel A: Full sample							
Age at marriage	0.012	0.110**	-0.000	-0.002	0.051	0.011	0.048
	(0.013)	(0.041)	(0.001)	(0.002)	(0.029)	(0.010)	(0.023)
Age at marriage * Female child	0.033*	-0.071	-0.002	0.004	0.008	0.002	-0.013
	(0.020)	(0.060)	(0.002)	(0.003)	(0.042)	(0.015)	(0.033)
Observations	15,137	12,200	63,763	88,224	10,081	9,992	10,040
R-squared	0.176	0.115	0.013	0.027	0.255	0.194	0.275
Kleibergen-Paap F-statistic	98.18	64.77	444.7	769.5	68.28	68.96	68.12
Panel B: No education							
Age at marriage	0.052**	0.114**	-0.001	-0.001	0.033	0.005	0.026
	(0.017)	(0.052)	(0.002)	(0.003)	(0.040)	(0.014)	(0.030)
Age at marriage * Female child	0.011	-0.142	-0.004	0.004	-0.031	-0.022	0.006
	(0.023)	(0.066)	(0.002)	(0.004)	(0.060)	(0.022)	(0.044)
Observations	6,592	5,576	31,908	46,218	5,076	5,037	5,067
R-squared	0.232	0.173	0.015	0.031	0.236	0.208	0.266
Kleibergen-Paap F-statistic	84.82	86.24	314.7	564.8	40.62	40.58	40.76
Panel C: No education, married before menarche							
Age at cohabitation	0.113**	0.342**	-0.001	0.005	0.175	0.039	0.116
	(0.042)	(0.119)	(0.003)	(0.006)	(0.089)	(0.028)	(0.063)
Age at cohabitation * Female child	0.016	-0.332*	-0.008*	-0.010	-0.091	0.003	0.008
	(0.061)	(0.143)	(0.004)	(0.009)	(0.120)	(0.044)	(0.095)
Observations	1,229	1,087	6,112	9,485	994	980	992
R-squared	0.291	0.283	0.073	0.055	0.375	0.341	0.359
Kleibergen-Paap F-statistic	42.52	36.74	160.5	385.2	27.15	26.11	27.53

Notes: The table presents the results of IV regressions in which the dependent variables are health and educational outcomes for the children of the three samples of women (excluding women who married twice and women who had their first marriage over the age of 40). The age at marriage is instrumented by the age at menarche, and the interaction between age at marriage and gender is instrumented by the interaction between age at menarche and gender. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height and child age and gender. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

Table 12: The effect of age at marriage/cohabitation on health knowledge

	(1)	(2)	(3)	(4)
	Knowledge - general health (score out of 6)	Knowledge - AIDS (score out of 5)	Knowledge - general health (score out of 6)	Knowledge - AIDS (score out of 5)
Panel A: Full sample				
Age at marriage	0.028***	0.111***	0.084**	0.166***
	(0.002)	(0.003)	(0.034)	(0.023)
Observations	32,752	32,752	32,715	32,715
R-squared	0.299	0.352	0.277	0.346
Mean of dep variable	2.569	2.269	2.569	2.269
Kleibergen-Paap F-statistic			1.372	1.372
Panel B: No education				
Age at marriage	0.007**	0.027***	0.053***	0.062**
	(0.003)	(0.005)	(0.015)	(0.024)
Observations	13,943	13,943	13,923	13,923
R-squared	0.268	0.273	0.257	0.271
Mean of dep variable	2.343	1.072	2.343	1.072
Kleibergen-Paap F-statistic			581.7	581.7
Panel C: No education, married before menarche				
Age at cohabitation	-0.006	0.020	0.013	0.066
	(0.009)	(0.013)	(0.029)	(0.040)
Observations	2,435	2,435	2,430	2,430
R-squared	0.366	0.383	0.365	0.380
Mean of dep variable	2.261	0.834	2.261	0.834
Kleibergen-Paap F-statistic			256.3	256.3

Notes: The table presents the results of OLS and IV regressions in which the dependent variables are fertility preferences and health knowledge of the three samples of women (excluding also women who married twice and women who had their first marriage over the age of 40). The two knowledge scores are calculated by summing the number of correct answers (out of 6 and 5 questions, respectively) to a series of multiple choice questions. In Columns 4-6, the age at marriage is instrumented by the age at menarche. All regressions include caste fixed effects and district fixed effects, and control for the mother's age and height. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).

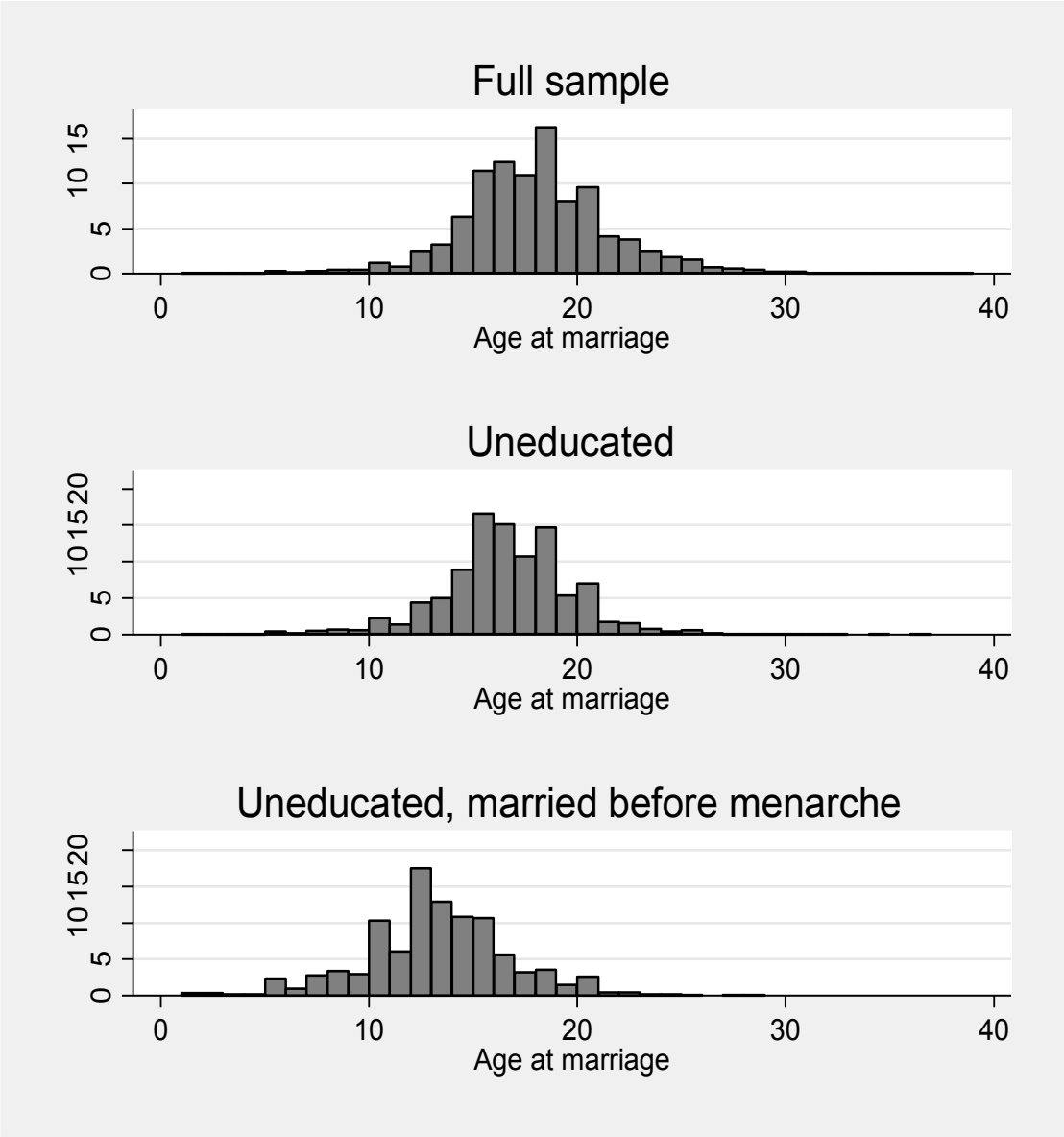

Figure 1

The figure shows the distribution of the age at marriage, for the three samples.

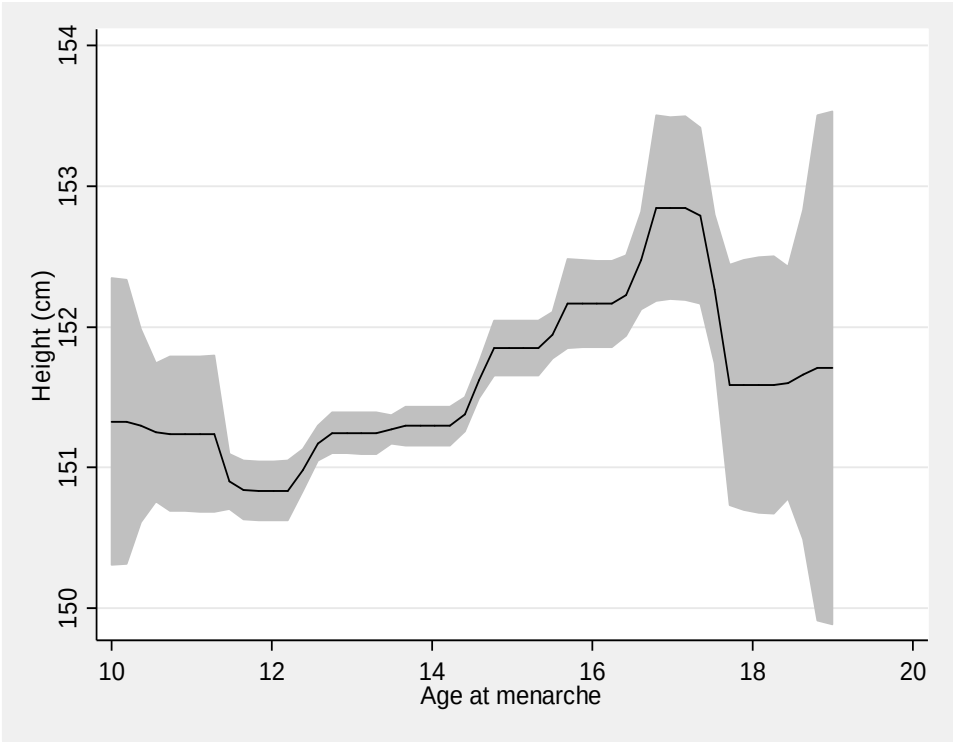

Figure 2: Average adult height by age at menarche

The figure plots a smoothed local polynomial to the relationship between adult height and the woman's age at menarche. 95% confidence intervals are shown in gray.

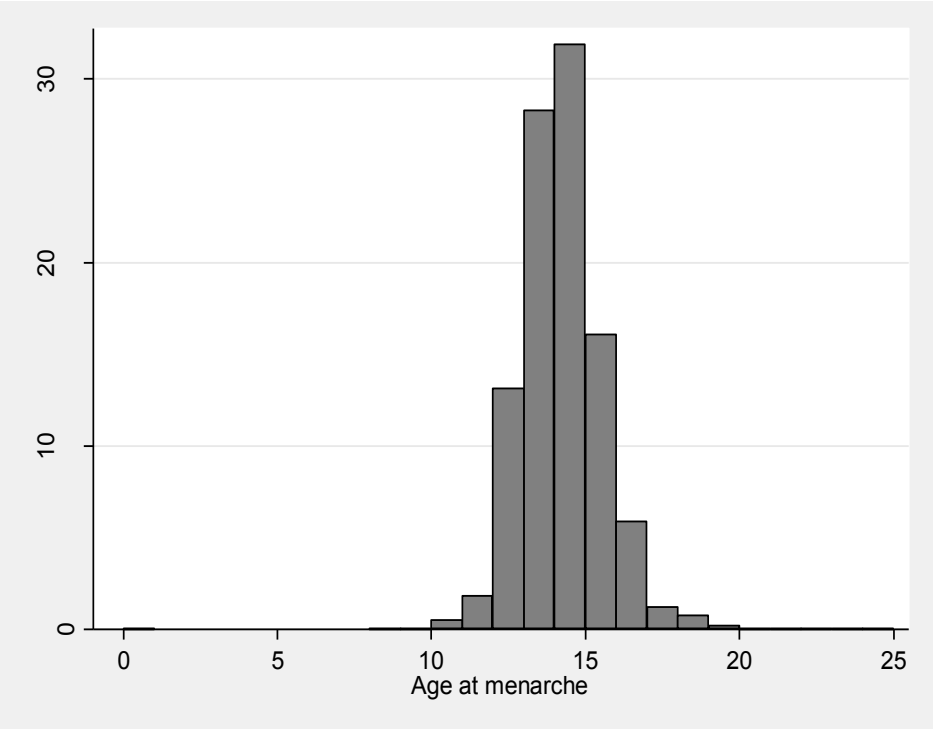

Figure 3
The figure shows the distribution of the age at menarche (for the full sample).

Appendix Table 1: Does age at menarche affect spousal characteristics?

	(1)	(2)	(3)	(4)
	OLS			
	Mother-in-law's education (in yrs)	Father-in-law's education (in yrs)	Distance to natal village (in hrs)	Spouse lives in same village
Panel A: Full sample				
Age at menarche	0.209***	0.298***	-0.001	-0.002***
	(0.011)	(0.019)	(0.014)	(0.001)
	0.00000	0.00000	0.96429	0.00246
Observations	9,284	6,647	32,445	32,662
R-squared	0.313	0.287	0.057	0.141
Mean of dep variable	2.390	4.155	3.519	0.139
Panel B: No education				
Age at menarche	0.027***	0.090***	-0.010	-0.003***
	(0.009)	(0.030)	(0.019)	(0.001)
	0.00156	0.00247	0.58018	0.00351
Observations	3,173	2,121	13,832	13,905
R-squared	0.155	0.228	0.079	0.161
Mean of dep variable	2.636	1.820	3.327	0.123
Panel C: No education, married before menarche				
Age at menarche	0.012	-0.111	0.001	-0.005
	(0.021)	(0.105)	(0.058)	(0.003)
	0.55760	0.28927	0.98439	0.08404
Observations	552	303	2,415	2,431
R-squared	0.212	0.328	0.143	0.194
Mean of dep variable	2.785	1.565	3.379	0.0930

Notes: The regression results examine whether observable characteristics of the spousal household are affected by the woman's age at menarche. The sample sizes shrink significantly in the case of the education of the father and mother-in-law, because the parents-in-law could only be identified in the data for a subset of the women. Robust standard errors in parentheses. *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 1% level. Statistical significance is corrected for the multiplicity of outcomes tested, using the False Discovery Rate correction procedure of Benjamini et al (2006).