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# Early Marriage, Social Networks and the Transmission of Norms\*

M Niaz Asadullah and Zaki Wahhaj  
University of Malaya<sup>†</sup> and University of Kent<sup>‡</sup>

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## Abstract

We investigate whether female early marriage is a conduit for the transmission of social norms, specifically norms relating to gender roles and rights within the household. We exploit differences in age at menarche between sisters as an exogenous source of variation in marriage age. This approach allows us to control for beliefs and attitudes that are transmitted from parents to children. Using a sample of unmarried adolescents, we first show that the timing of menarche has no direct effect on adolescent attitudes towards gender norms. Yet we find that early marriage increases agreement with statements supportive of traditional gender roles and gender bias in the allocation of resources. We also find some evidence that early marriage worsens the (self-reported) quality of a woman's post-marital social network.

JEL Codes: J12, J16, Z10

Keywords: Gender Roles, Social Norms, Schooling, Household Decision-Making

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<sup>†</sup>Email: m.niaz@um.edu.my . Address: Faculty of Economics and Administration, University of Malaya.

<sup>‡</sup>Email: z.wahhaj@kent.ac.uk. Address: School of Economics, Keynes College, University of Kent, Canterbury CT2 7NP, United Kingdom.

# 1 Introduction

A third of women in developing countries around the world marry before the age of 18, and about one in nine before the age of 15. In some parts of the world, these proportions are substantially higher. For example, among women aged 20-24, 66% in Bangladesh, 47% in India, 72% in Chad and 63% in Guinea were married before the age of 18 (UNFPA 2012). A large literature argues that early marriage disrupts the accumulation of human capital among adolescent girls due to early school drop-out, withdrawal from labour markets and adverse effects on health from early childbearing (literature reviewed by Jensen and Thornton 2003; UNFPA 2012; UNICEF 2001). For example, Field and Ambrus (2008) estimate, for Bangladeshi women, that each year of marriage postponement leads to 0.22 years of additional schooling; Sekhri and Debnath (2014) find, in the case of Indian women, postponing marriage leads to improved reading and numeracy skills for their children; while Glick, Handy and Sahn (2015) estimate that the age of first birth is delayed by 0.5 years for each year of marriage postponement among young women in Madagascar.

In line with this evidence, international development agencies, national governments and NGO's have made concerted efforts in recent years to lower the incidence of early marriage through new legislation on child marriage, improved enforcement of existing laws and interventions aimed at adolescents. In 2015, 'ending child marriage' was made one of the targets of the Sustainable Development Goals.

In this paper we investigate whether female early marriage is a conduit for the transmission of social norms, specifically norms relating to gender roles and rights within the household (which we henceforth call 'gender norms'). Gender norms are believed to play an important role in perpetuating gender inequalities in child survival, education, control over assets and economic participation in a wide range of developing countries (see World Bank 2006 and Eriksson 2015 for reviews of this literature)<sup>1</sup>. And changes in norms and attitudes are believed to be important for changing the process whereby individuals in a society are allocated to tasks, which is itself an integral part of economic development (Fafchamps 2011). We hypothesize four potential pathways through which female early marriage in developing countries can affect women's beliefs and attitudes towards traditional gender norms. Girls who marry later may have different attitudes because (i) of increased schooling and exposure to a school curriculum presenting alternative views; (ii) of improved social networks, e.g. stronger bonds with school friends, and role models in the form of school teachers; (iii) delayed marriage leads to matching with men (and in-laws) with different (e.g. more progressive) attitudes towards traditional norms; (iv) experience of marital responsibilities, including childbearing, may have a direct effect on beliefs and attitudes, and younger brides are more susceptible to these experiences.

The challenge for empirical research on the consequences of early marriage is that girls

who marry early tend to be poorer, have less educated parents, and to be born in rural areas; but these background characteristics can have a direct effect on their opportunities and subsequent life choices (such as schooling, fertility and employment) as well as beliefs and attitudes. A recent set of studies have used variation in the timing of menarche across women to estimate the impact of early marriage on future outcomes in an instrumental variable framework. The rationale for this approach is that, in patriarchal societies, women face strong social pressures to marry from the onset of menarche (Ortner 1978, Dube 1997; Wahhaj 2015); while the timing of menarche – it has been argued – has limited correlation with women’s background characteristics that may directly impact upon subsequent outcomes. This approach was pioneered by Field and Ambrus (2008), mentioned above, and subsequently used by Sekhri and Debnath (2014) and Chari, Heath, Maertens and Fatima (2017). Sunder (2015) and Hicks and Hicks (2015) have adopted the same approach to investigate the consequences of female early marriage for Uganda and Western Kenya respectively.

However, if the implicit assumption that the age of menarche is uncorrelated with socio-economic background does not hold, then the exclusion restriction for the instrumental variable will be violated and the corresponding IV estimates will be biased. To investigate the effects of early marriage on gender norms, we introduce an innovation to the identification strategy described above by making use of a unique dataset with first-hand information on the age of menarche and marriage timing of sisters. Specifically, following the existing literature, we use the age of menarche as an instrument for marriage timing but exploit only the variation in age of menarche *between sisters*. To the extent that sisters are raised within the same household by the same parents, this approach allows us to abstract away from variation in the age of menarche that is due to common environmental and socio-economic factors. In addition, it provides a plausible identification strategy for estimating the effects of marriage timing on beliefs and attitudes towards norms, which are typically transmitted from parents to children: there is little reason why a sister who reaches menarche at an earlier age should differ in social attitudes and beliefs other than the social consequences of reaching menarche.

Using a first-stage equation similar to those used in previous studies, we estimate that a one-year delay in age of menarche delays marriage by 0.403 years. An alternative model with sister fixed-effects yields broadly similar results. However, the inclusion of sister fixed-effects reduces the second-stage estimates of the effects of marriage age on schooling by about one-third (from 0.625 years to 0.422 years for year of delay in marriage). This suggests that the estimated relationship between the age of marriage and female schooling without sister fixed-effects is biased by unobservable socio-economic characteristics that influence both the age of menarche and subsequent outcomes.

Using the age of menarche as an instrument, and sister fixed-effects to capture individual-specific unobserved socio-economic characteristics, we provide evidence that early marriage

affects a woman’s attitudes towards traditional gender norms and the characteristics of her social network. In particular, early marriage reduces the likelihood – and number – of women in her social network who made a non-traditional life choice (completed secondary school, used contraception before the birth of her first child, engaged in an income-generating activity) and increases her agreement with statements supportive of gender bias in the allocation of resources and traditional gender roles. Using a sample of unmarried female adolescents, we show that age of menarche has no direct effect on attitudes towards traditional gender norms, indicating that our instrumental variable approach is picking up the effects of marriage timing itself rather than socialisation within the parental household following the onset of puberty.

Of the four pathways for the potential effects of early marriage on women’s attitudes towards traditional gender norms highlighted above, we find little evidence that age of marriage affects the characteristics of, and practices within, the groom’s household (husband’s education and occupation, father-in-law’s landholdings, purdah practice within the marital household) and, therefore, are inclined to rule out (iii). We find that our effects persist among subsamples of women who (a) have never attended school and (b) those who have a ‘high quality’ social network due to factors exogenous to their age of marriage and, therefore, conclude that (i) and (ii) cannot, on their own, account for the effects of marriage on attitudes towards gender norms. Taken together, the evidence suggests that (iv) may be an important pathway through which early marriage affects norm transmission.

Our findings are closely related to a literature on the intergenerational transmission of gender role attitudes. Notable contributions within economics include Fernández, Fogli and Olivetti (2004) who show, using variation in female labour participation across the United States during World War II, that men with mothers who worked are more likely to have wives in work; and Farré and Vella (2013) who find, using the US National Longitudinal Survey of Youth that gender role attitudes expressed by female respondents affects their children’s attitudes, as well as female labour market decisions in the next generation.<sup>2</sup> We add to this literature by highlighting the role of early marriage in perpetuating attitudes aligned with traditional gender norms in a developing country context.

The remainder of the paper is organised as follows. In the next section, we describe the context, and the data used in our analysis, and how key variables were constructed. In Section 3, we describe the conceptual framework for investigating marriage timing decisions. We discuss the empirical strategy – as well as threats to identification – in Section 4. The estimations are reported in Section 5. In Section 6, we analyse the data to explore possible pathways for norm transmission. Issues related to measurement error and reporting bias are discussed in Section 7. Conclusions are presented in Section 8.

## 2 Data and Context

### 2.1 Context

For adolescent girls in Bangladesh, marriage brings about a sudden change in roles and responsibilities. It typically involves leaving school and withdrawing from the labour market to undertake domestic duties in the marital household (Amin et al. 2014; Amin, Mahmud & Huq, 2002). Thus, not only does early marriage disrupt education (as evidenced by Field and Ambrus 2008), it can also shape the bride’s social network, her contact with potential role models and, consequently, her social views.

Nevertheless, the experience of adolescent girls in Bangladesh is presently going through a period of significant change. Since the early 1990s, a number of government-led initiatives and programmes have decreased the cost of, and access to, secondary schools for girls, and the growth of the ready-made garments sector has increased labour market opportunities for women. Female secondary school enrollment has risen three-fold over a 20-year period<sup>3</sup> and the literature has linked this phenomenon to the falling cost of schooling and increasing returns to female education on the labour market (Asadullah and Chaudhury 2009, Schurmann 2009, Heath and Mobarak 2015). The growth of NGOs with gender-focused programmes and initiatives that use women as service providers is widely believed to have increased female economic participation over the same period (Drèze and Sen 2013; Asadullah, Savioa, Mahmud 2014).

Despite these changes, Bangladesh has one of the highest rates of female early marriage in the world: according to the 2011 Demographic and Health Survey, 64.9% of women aged 20-24 were married before the age of 18 (NIPORT 2013). Based on this measure, only two other countries in the world have a higher incidence (UNFPA 2012). During the preceding two decades, the incidence of child marriage declined gradually, driven primarily by delayed marriage among young adolescent girls, while marriage among 16-17 year olds have, in fact, increased. (Raj, McDougal and Rusch 2012).

### 2.2 Description of the Data

The analysis in this paper is based on two nationwide surveys of rural and urban households in Bangladesh, the 2014 Women’s Life Choices and Attitudes Survey (WiLCAS), and the 2005 Bangladesh Adolescent Survey (BAS).

The 2014 WiLCAS is a survey purposefully designed by the authors for the present study. It included individual interviews with women in the age group 20-39 years and collected information on their personal background (place and date of birth, parental characteristics), education (enrolment history, highest level of education completed), child-related information (including age of childbirth), employment, marital history (including groom characteristics),

social networks (including characteristics of network members) and attitudes towards regarding traditional social norms. The first phase of survey, conducted between May and July 2014, was based on a sample consisting of (i) all rural households in the 2010 Bangladesh Household Income and Expenditures Survey (HIES) which had at least one female household member in the age-group 16-35 years; (ii) a random 50% of rural households in the 2010 HIES which did not have women in this age group; (iii) a stratified sample of urban households, based on a full household census in 87 non-metropolitan urban primary sampling units, followed by a random selection of 20 households from each unit. The 87 primary sampling units were randomly selected from those included the 2010 HIES, with at least one unit each district.<sup>4 5</sup> This procedure yielded a sample of 7,974 households (1,436 in urban areas) and 6,293 individual interviews with women in the age group 20-39 years (1,557 in urban areas).

The first phase of the survey also included basic information and contact details on sisters of respondents to the individual interviews. A random sample of 1,500 sisters aged 20-39 years, stratified by region, was drawn up based on this information. They were traced and interviewed between November 2014 and January 2015. Of the original sample, 1,471 sisters were successfully traced, and 26 more were added from a reserve list to replace those who could not be located. This process led to 1,495 individual interviews with sisters of the first phase respondents.<sup>6</sup> For our empirical strategy, we require groups of two or more sisters who are all married (see Section 4). Combining data from the first and the second phase, we obtain 1,033 pairs of married sisters, 153 cases of 3 married sisters and 12 cases of 4 married sisters.

About 90% of the women in the 2014 WiLCAS had experienced marriage by the time of the survey. Therefore, we use the 2005 BAS to investigate whether the timing of menarche can potentially affect attitudes towards gender norms among unmarried adolescent girls (to test its validity as an excluded instrument in the IV framework). The 2005 BAS is a nationally representative survey of adolescents designed by the Population Council. It includes information on their family background, environment, schooling, time use, as well as beliefs and attitudes. The sample is based on 361 randomly selected clusters from 1,000 primary sampling units used by the Bangladesh Bureau of Statistics to generate district-level statistics. From each cluster, 60 households were selected for the survey, and one adolescent aged 10-24 chosen from each household with one or more adolescents. The final sample included 21,656 households and 14,942 adolescents. (See Gani (2007) for a detailed description of the survey). By 2014, these adolescents were aged between 19 and 33. Thus, there is considerable overlap with the cohorts sampled for the 2014 WiLCAS.

## 2.3 Descriptive Statistics

In Table 1, we provide summary statistics on key variables on married respondents from WiLCAS.<sup>7</sup> The first column shows figures for the full sample, while the second column is based on the full sample of respondents interviewed during the first phase of the survey, which was designed to be nationally representative. The mean female age of marriage is 16.5 years, and mean years of schooling is 5.1 years. The third column is based on the first phase respondents for whom one or more sisters were chosen to be interviewed in phase 2. Although these respondents were chosen at random, those with one or more sisters were, by design, more likely to be selected and therefore, we check the extent to which they are representative of the population. We find no statistical difference between the two samples in terms of father's education (at the mean), and father's probability of being in a low-paying activity, but the sub-sample has a lower mean for mother's education (-0.14 years) and a higher mean for father's landholdings (0.053 acres), as well as a higher probability of being muslim (2.1 ppts), albeit the differences are small. We find no statistically significant difference in the number of brothers but, as we would expect, we find relatively large differences in the number of sisters (0.77 years). Due to these differences, we report results for both the full sample of respondents and the sub-sample of sister-groups in the subsequent analysis.

Next, we investigate whether and to what extent the age of menarche varies by parental and individual characteristics of the respondents. Figure 1 shows the mean age of menarche and 95% confidence intervals for women with different sets of parental characteristics. We find that respondents whose mothers attended school have a significantly higher age of menarche compared to those whose mothers had no schooling (the 95% confidence intervals do not overlap). The same applies in the case of father's schooling and father's occupation. Although the actual differences are small, this evidence suggests that the age of menarche, as a potential instrument for marriage age, may not satisfy the exclusion restriction if parental characteristics are not controlled for. We elaborate further on this issue in Section 4.1.

## 2.4 Measuring Attitudes towards Gender Norms and the Quality of Social Networks

Two important variables in the subsequent analysis are our measure of the respondents' attitudes towards traditional gender norms, and the quality of their social network. Therefore we describe at some length how these were constructed and the patterns in the data.

The WILCAS respondents were read out 10 statements regarding gender roles and the appropriate allocation of resources across genders; for example "Boys require more nutrition than girls to be strong and healthy", and "When a woman is engaged in work outside of the home, her children suffer because they are deprived of their mother's attention." For each they were asked whether they 'strongly agreed', 'somewhat agreed', 'somewhat disagreed',



‘strongly disagreed’ or ‘did not know’. They were asked a further 6 questions about the appropriateness of female employment outside the household and male help with domestic work. The full set of statements and questions are provided in Table 2. It is important to note that these statements/questions do not each represent a distinct gender norm; rather, they represent different ways to capture attitudes towards the same norm of division of gender roles within the household; with some statements potentially capturing variation in attitudes better than others. Therefore, we aggregate the responses to create a single variable capturing gender norm attitudes using two different approaches: (i) a measure of attitudes towards traditional gender norms using the number of statements/questions out of 16 with which the respondent’s attitudes were aligned with the traditional norm;<sup>8</sup> (ii) an alternative measure of attitudes using principal-components analysis on the 16 responses using the procedure developed by Filmer and Pritchett (2001). The adolescent respondents in the 2005 BAS were asked questions regarding their attitudes towards gender roles, similar to those included in the 2014 WiLCAS. We construct a measure of gender norm attitudes on the basis of five questions in the 2005 BAS for which descriptive statistics are provided in Table 3.

The WiLCAS survey respondents were also asked to list women within their social network who had (i) completed secondary school, (ii) remained unmarried till the completion of secondary school, (iii) used contraception before the birth of her first child; or (iv) engaged in an income-generating activity, either paid employment or an entrepreneurial activity (independently or with another family member). We defined the social network to include (a) members of her immediate or extended family; (b) school friends, and women and girls in the neighbourhood where she grew up; (c) any other women from whom she sought advice on personal matters, or would consider as a role model when making important life-changing decisions. This information was intended to capture the extent to which the respondent’s social network could provide her with information or examples of non-traditional choices regarding important personal decisions. Descriptive statistics regarding their responses are provided in Table 4. In the following analysis, we investigate whether the respondents’ timing of marriage affects the probability that her social network includes women in social network categories (b) and (c) who had experienced any of the choices/outcomes (i)-(iv) above. Given that the social network measures are self-reported, they represent the respondent’s *perceived* quality of the network rather than its actual quality. There may be significant differences between the two as respondents may be unaware of choices regarding education and employment made by women within her network. Nevertheless, as far as the hypothesized pathways for shaping gender norm attitudes are concerned, we argue that it is the perceived quality which is important: because if a respondent is ignorant of a ‘progressive choice’ made by someone in her social network, then she cannot be influenced by it.

The adolescent respondents in the 2005 BAS were not asked comparable questions about

the choices of women in their social network. However, they were asked to list the individuals with whom they had the closest personal relationships (up to a maximum of three). Summary statistics of their responses are given in Table 5. The number of friends listed by the respondents among their closest personal relationships provides a rough measure of their friendship network. We find that 62% of respondents reported at least one friend, with a mean of 1.04 friends over the whole sample.

### 3 Conceptual Framework

In this section we describe the conceptual framework which guides the empirical analysis in this paper. There are a number of ways in which marriage age can affect an adult woman’s attitudes towards traditional gender norms, which we list below:

1. Girls who marry later remain in school for longer. The school curriculum can shape pupils’ attitudes towards traditional gender norms.
2. Girls who marry later are likely to have a different social network. This is because she has had a longer period to establish links with school friends, more exposure to potential role models such as school teachers, etc.
3. Marriage timing is likely to affect the characteristics of the marital household. The bride’s attitudes towards traditional gender norms may be influenced by interactions with her spouse, her co-habiting in-laws, etc.
4. Girls who experience early marriage may be more susceptible to her experiences within the marital household, including early childbearing and taking on domestic responsibilities. So marriage timing may have an effect on attitudes towards traditional social norms, regardless of the characteristics of the marital household.

We model the timing of marriage for a woman as the solution to an optimisation problem subject to a set of constraints. The key constraint is that, for our specific social context, girls cannot marry before attaining menarche. The objective function may be based on either the expected utility of the girl or her parents, or a weighted sum of the two – we do not specify which as the main insight discussed below would apply in all these cases. The girl (or her parents) may derive utility directly from postponing marriage, but doing so may also affect the set of available partners and other socio-economic consequences, which has to be taken into account in the optimisation problem.

Consider the marriage-timing decision for an individual  $j$ . The marriage decision involves a choice of  $a$  (age) and  $\mathbf{g} = (g_1, g_2, \dots, g_k)$  (vector of groom attributes). Thus, marriage age and groom characteristics are jointly determined. We can provide empirical support for

this implicit assumption using WiLCAS in which 72% of married women indicated that the "most important reason for the marriage" was that their "parents felt that it was too good a proposal to refuse" (See Table A1), implying that marriage age and groom characteristics were jointly determined by the family's acceptance of a marriage proposal from the groom's party. We denote by  $\Omega(a, \mathbf{X}_j)$  the choice set of potential marriages (i.e. groom attributes) for a girl with family characteristics  $\mathbf{X}_j$  opting to marry at age  $a$ . Other outcomes that may be affected by marriage timing include  $e$ , her level of schooling;  $n$ , the quality of her post-marital social network; and  $s$ , a measure of her attitudes towards traditional gender norms. We define a vector  $\mathbf{y} = (e, n, s)$  to summarise these outcomes. Given that attitudes can be shaped by a number of other factors as discussed above, we let  $s = \hat{s}(a, e, \mathbf{g}, n)$ . Similarly, let  $e = \hat{e}(a)$  and  $n = \hat{n}(a, e, \mathbf{g})$ .<sup>9</sup>

The optimisation problem can be written as

$$\max_{a, \mathbf{g}} U_j(a, \mathbf{y}(a, \mathbf{X}_j), \mathbf{g}; \mathbf{X}_j) \quad (1)$$

subject to

$$\mathbf{g} \in \Omega(a, \mathbf{X}_j) \quad (2)$$

$$a \geq \underline{a}_j \quad (3)$$

where  $U_j(\cdot)$  is the individual or family-specific objective function, and  $\underline{a}_j$  is an individual-specific age constraint. In the present context,  $\underline{a}_j$  is given by the girl's age of menarche. In our empirical analysis, our goal is to estimate  $\frac{ds}{da}$  at  $a = \underline{a}_j$ ; i.e. how, for individuals for whom the age of menarche is a binding constraint, an increase in the age of marriage affects attitudes towards traditional gender norms. By taking the total derivative of the maximand in (1) with respect to  $a$ , we obtain the different channels through which the age of marriage can potentially affect attitudes:<sup>10</sup>

$$\frac{ds}{da} \Big|_{a=\underline{a}_j} = \frac{\partial s}{\partial a} \Big|_{a=\underline{a}_j} + \frac{\partial s}{\partial e} \frac{\partial \hat{e}}{\partial a} \Big|_{a=\underline{a}_j} + \frac{\partial s}{\partial n} \frac{\partial \hat{n}}{\partial a} \Big|_{a=\underline{a}_j} + \sum_{l=1}^k \frac{\partial s}{\partial g_l} \frac{\partial g_l}{\partial \underline{a}_j} \quad (4)$$

The terms on the right-hand side of (4) correspond to the four hypothesized ways in which age of marriage can affect attitudes, listed at the beginning of this section. The first term represents the direct effect of marriage age on attitudes; the second and third terms are, respectively, the effects of marriage age on attitudes through its effects on schooling and on the girl's social network; the last term is the effect of marriage age on attitudes via its effect on groom characteristics. Note that the last term involves the direct effect of the age constraint – as opposed to the age of marriage – on groom characteristics. This is because of our assumption that the marriage timing decision and the choice of groom are made concurrently rather than sequentially.

## 4 Empirical Strategy

Our objective is to investigate how women’s age of marriage affect their attitudes towards traditional gender norms. As there are a number of pathways through which age of marriage may affect these attitudes, as discussed in the previous section and represented by the terms on the right-hand side of equation (4), we also aim to estimate the effect of marriage age on related outcomes, including the woman’s schooling, characteristics of the groom and the marital household, and the quality of the woman’s social network.

As mentioned above, the incidence of early marriage is strongly correlated with socio-economic characteristics – in Bangladesh as in other developing countries – that can have a direct effect on these outcomes. This is particularly true in the case of the respondent’s social network and her attitudes towards traditional gender norms which, as shown in the subsequent analysis, is strongly influenced by parental background. Therefore, regressing our outcome variables of interest on marriage age can potentially lead to biased estimates on the effects of marriage timing. Specifically, let us suppose that  $a_{ji}$  denotes the age of marriage of individual  $j$  from family  $i$ ;  $y_{ji}$  represents a post-marriage outcome and  $\mathbf{Z}_{ji}$  is a vector of omitted socio-economic characteristics correlated with  $a_{ji}$ . The composite error term is given by  $\varphi_{ji} = \mathbf{Z}_{ji}\boldsymbol{\zeta} + \varepsilon_{ji}$  and  $\mathbf{E}(\varepsilon_{ji}) = 0$ . The equation of interest is as follows:

$$y_{ji} = \alpha + \mathbf{X}_i\boldsymbol{\beta} + \mathbf{I}_{ji}\boldsymbol{\gamma} + \lambda a_{ji} + \varphi_{ji}$$

where  $\mathbf{X}_i$  is a vector of family characteristics – parental education, occupation, assets, religion; and  $\mathbf{I}_{ji}$  is a vector of individual characteristics. The presence of  $\mathbf{Z}_{ji}$  in the error term implies that the orthogonality condition is violated i.e.  $Cov(a_{ji}, \varphi_{ji}) \neq 0$  and  $a_{ji}$  is endogenous. The bias in the OLS estimate of  $\lambda$  is captured by the quantity  $\boldsymbol{\zeta} [Cov(a_{ji}, \mathbf{Z}_{ji}) / Var(a_{ji})]$ . If  $Cov(a_{ji}, \mathbf{Z}_{ji})$  is positive, (e.g. daughters from richer and more educated families marry later) and  $\boldsymbol{\zeta}$  is positive (higher pre-marital socio-economic status produce more favourable marriage outcomes) then the OLS estimate of  $\lambda$  is upward-biased.

We follow the recent literature by using the age of menarche as an instrumental variable for the age of first marriage (Field and Ambrus 2008; Sekhri and Debnath 2014; Chari et al. 2017). The 2SLS estimate of  $\lambda$  will be smaller unless the bias in the OLS is dominated by measurement errors in  $a_{ji}$ . However, a necessary condition for the 2SLS model to be valid is the orthogonality of the instrument to the error term. As suggested by the descriptive evidence in Section 2.3 (as well as the literature on the determinants of menarche discussed in the next sub-section), the orthogonality assumption may be violated in the data.

Now, let us assume that the omitted socio-economic correlates of age at marriage (and post-marital outcomes)  $\mathbf{Z}_i$  is common to sisters, i.e. specific to their households of birth. Then the composite error terms can be written as  $\epsilon_{ji} = \mathbf{Z}_i + \varepsilon_{ji}$  and  $\varphi_{ji} = \mathbf{Z}_i + u_{ji}$ . The first-stage and second-stage equations can be written as:

$$\text{First-Stage : } \quad a_{ji} = \tilde{\alpha} + \mathbf{X}_i \tilde{\boldsymbol{\beta}} + \mathbf{I}_{ji} \tilde{\boldsymbol{\gamma}} + \zeta m_{ji} + \epsilon_{ji} \quad (5)$$

$$\text{Second-Stage: } \quad y_{ji} = \alpha + \mathbf{X}_i \boldsymbol{\beta} + \mathbf{I}_{ji} \boldsymbol{\gamma} + \lambda a_{ji} + \varphi_{ji} \quad (6)$$

where  $m_{ji}$  is the instrumental variable, age of menarche. The presence of  $\mathbf{Z}_i$  in the first-stage error term implies that  $Cov(a_{ji}, \varphi_{ji}) \neq 0$  and  $Cov(m_{ji}, \epsilon_{ji}) \neq 0$ . Nonetheless, our IV  $m_{ji}$  is “almost valid” in the sense that  $Cov(m_{ji}, \epsilon_{ji})$  is small. (We discuss the empirical literature regarding  $Cov(m_{ji}, \epsilon_{ji})$  in the next sub-section). In that case, the standard IV model may still not produce an unbiased estimate of the main parameter of interest,  $\lambda$ , even if  $Cov(a_{ji}, m_{ji}) > 0$  and large. Given an invalid instrument, the bias is possibly greater than for OLS, although less so compared to the case where the instrument is also weak (Murray 2006).

The estimated  $\lambda_{IV}$  is equivalent to  $\lambda + Cov(m_{ji}, Z_{ji}) / Cov(m_{ji}, a_{ji})$  (Wooldridge 2002, p. 101). The bias in  $\lambda_{IV}$  is positive if  $Cov(m_{ji}, Z_{ji})$  is greater than  $Cov(m_{ji}, a_{ji})$  and  $Cov(m_{ji}, Z_{ji}) > 0$ . We show in Section 5 that  $a_{ji}$  is a strong IV; therefore the quantity  $Cov(m_{ji}, Z_{ji})$  has to be very large to create a positive bias in  $\lambda_{IV}$ . The bias in  $\lambda_{IV}$  is larger than that in  $\lambda_{OLS}$  if  $Cov(m_{ji}, Z_{ji})$  (or  $Cov(m_{ji}, \varphi_{ji})$ ) is bigger than  $Cov(m_{ji}, a_{ji}) \times Cov(a_{ji}, \varphi_{ji})$ . As we cannot observe  $u_{ji}$ , we cannot be certain about the exact size of the inconsistencies in IV and OLS (Wooldridge 2002, p. 102).

In this context, the within-transformation removes  $Z_j$  from the composite error term so that  $Cov(m_{ji}, \epsilon_{ji}) = 0$  (and hence  $Cov(m_{ji}, \varphi_{ji}) = 0$ ) while  $Cov(a_{ji}, u_{ji})$  (and  $Cov(a_{ji}, \varphi_{ji})$ ) is still, potentially, non-zero because of individual-specific, unobserved, socio-economic correlates. Running the 2SLS model on the first-differenced versions of equations (5) and (6) – i.e. regressing  $\Delta y_i$  on  $\Delta X_i$  and  $\Delta I_i$  using the instrument  $\Delta m_i$  – can, in principal, produce an unbiased estimate of  $\lambda$ . We discuss in the next sub-section the potential issues with this IV strategy and additional measures taken to rectify them.

## 4.1 Validity of the Instrumental Variable Strategy

The rationale for using the age of menarche as an IV for age of first marriage is as follows. In patriarchal societies, women have traditionally faced strong social pressures to marry from the onset of puberty (Ortner 1978; Dube 1997; Wahhaj 2015). On the other hand, marriage before puberty, while it exists, is increasingly rare in these societies. Figure 3 shows, for our full sample of respondents, the distribution of the difference between age of marriage and onset of menarche. We find that less than 2% of women were married before puberty, and more than one-third were married within 3 years of reaching puberty. Thus, the pattern is consistent with the idea that the onset of menarche is a necessary condition for entering the marriage market and also that the timing of menarche was a binding constraint for a significant fraction of women in our sample.

However, the age at which women attain puberty may be determined by other factors that directly affect marriage timing. If so, our proposed IV would not satisfy the exclusion restriction. Based on their review of the medical literature on the determinants of the age of onset of menarche, Field and Ambrus (2008) conclude that "genetic factors are by far the strongest predictors of adolescent development and that random genetic variation is a significant component of timing". However, they also highlight other factors that can potentially influence the timing of menarche, particularly in developing countries, including geography and climate, strenuous physical activity and stress, exposure to endocrine-disrupting chemicals, sex composition of the peer group, and abrupt changes in diet in utero or in childhood.<sup>11</sup> For our empirical strategy to be viable, we need to introduce adequate controls – or make a convincing case that the mechanism in question is not an important determinant of the timing of menarche – for each of these factors.

The key element in our strategy to control for these other factors is the use of sister fixed-effects.<sup>12</sup> Any variation in the timing of menarche due to differences in socio-economic or environmental characteristics ought to be subsumed in these fixed-effects given that sisters are - almost without exception - raised in the same household. However, girls raised within the same household at different points in time may be exposed to different economic shocks which may affect nutrition and stress levels and, thus, produce differences in their rates of physical development.

It is important to note that the factors, highlighted in the medical literature, that can accelerate menarche relate to *acute* physical and psycho-social stress, associated with malnutrition, safety and security, elevated risk of mortality, etc. (see, for example, Chisholm, Quinlivan, Petersen, Coall 2005 for a review of the literature) as opposed to stress associated with everyday activities. We argue that experiences of acute stress will have a much smaller disparity within the same family than across households, localities, etc. And, therefore, the use of sister fixed-effects in our identification strategy is an improvement over that used in the existing literature.

If sisters raised within the same household at different points in time have, nevertheless, differential exposure to economic shocks that affect the timing of menarche, we should expect larger differences in age of menarche between sisters to occur when there is a bigger gap in their ages (since sisters close in age are likely to have similar experiences of household shocks at any given age). The differences in the age of menarche between sisters in our sample tends to be small. Computing the difference for all sister pairs in the WiLCAS sample, we find that the sisters attained menarche at the same age in 34.6% of cases; there was a one year difference in the age of menarche in a further 46.8% of cases, a two year difference in 13.8% of cases, and a difference of 3 or more years in 4.9% of cases. In Figure 4, we plot the distribution of age differences in sister-pairs for sisters who (i) attained menarche at the same age and (ii) those who attained menarche at different ages. The two distributions look

very similar and a Kolmogorov-Smirnov test cannot reject the null hypothesis that the two distributions are identical.

Even in the absence of shocks, sisters may experience different levels of health investments associated with their birth-order. To investigate this possibility, we show, in Figure 2, the variation in the age of menarche by the respondent’s birth order in the family. The differences by birth order are small and the 95% confidence intervals are overlapping for every birth-order. The figure also shows that the variation in the mean age of menarche by birth year is limited to a narrow band around 12.6 years. The most extreme cases occur for the 1981 cohort (12.5 years) and the 1993 cohort (12.8 years). These patterns suggest that the variation in the timing of menarche between sisters is, for the most part, not being driven by differences in birth order, birth cohort or differential exposure to household economic shocks.

Nevertheless, following Sekhri and Debnath (2014), we include fixed effects for the respondent’s birth year in our estimation because “Extreme weather conditions like drought and flooding in the mother’s birth year might lead to crop failure, resulting in transitory but severe malnutrition. ... [such that] females born during these unprecedented weather events may experience delayed age at menarche, as they are more likely to be malnourished” (Sekhri and Debnath, 2014), while recent evidence has shown that droughts have a direct effect on marriage timing and the incidence of early marriage in developing countries (Corno, Hildebrandt and Voena, 2017).

Sisters who grew up in the same household may have been exposed to different geographical and environmental factors because of migration by the parental household during their pre-adolescence. Given that the WiLCAS dataset includes information on the respondents’ place of birth and full migration history, we control for these potential effects on the timing of menarche by including fixed effects for the respondents’ district of birth (which is typically the place of residence in the respondents’ pre-teen years).

## **4.2 Effect of Age at Menarche on Adolescent Attitudes and Friendships**

Next, we address the question whether the timing of menarche has a direct effect on women’s attitudes towards traditional gender norms. This may occur if parents begin to socialise their daughters for marriage when they attain puberty; this process may involve inculcating them with traditional views regarding gender roles within the household, and younger girls may be more susceptible to this process. If this hypothesis holds true, then the empirical strategy described in the previous section would be picking up the direct effects of the age at menarche and the exclusion restriction on the instrumental variable would be violated.

We can test this hypothesis by investigating the relationship between the timing of menarche and attitudes towards gender norms for a sample of adolescent girls who have not yet

reached the typical age of marriage. The 2014 WiLCAS, used in the main analysis, includes female respondents only between the ages of 20 and 39; about 90% of them had experienced marriage by the time of the survey and, therefore, the sample is not suitable for such an investigation. Therefore, we make use of the 2005 Bangladesh Adolescent Survey – briefly presented in Section 2.2 – for this analysis. The survey included limited parental information but as most of the adolescents were unmarried and living with parents at the time of the survey, we are able to use characteristics of their *current* household to control for their socio-economic background. In our analysis, we restrict the sample to girls below the age of 18.

In Table 6, column 1, we report estimates on the effect of the age at menarche on attitudes towards gender roles for the subset of adolescent girls who had reached puberty by the time of the survey. We include controls for their age, number of brothers and sisters, mother’s education, household landholdings, self-reported economic condition of the household, and a dummy for whether the respondent was married at the time of the survey. To control for environmental factors that may affect the timing of the onset of puberty (as discussed in Section 4.1), we include village dummies. The estimated effect of the timing of menarche on the adolescent’s agreement with statements representing traditional gender norms is very close to zero, and statistically insignificant. By contrast, married adolescents are more in agreement with such statements. In Table 6, column 2, we include both girls who have reached puberty and those who have not, and replace the age at menarche variable with a dummy indicating whether the adolescent had reached puberty by the time of the survey. The estimates indicate that menarche *decreases* agreement with statements representing traditional gender roles (p-value = 0.103). Married girls, as before, are more in agreement with such statements.

In Table 6, columns 3 and 4, we repeat the exercise using the respondents’ friendship network – as described in Section 2.4 and Table 5 – to explore whether the timing of menarche can affect a woman’s social network, which would violate the exclusion restriction. Specifically, we use the number of non-relative friends reported by respondents, when asked to list their closest relationships, as the dependent variable. The patterns we obtain are similar to those in columns 1 and 2. In the subsample of postpubescent girls, age of menarche has a small, positive but statistically insignificant effect on the friendship network (column 3). In the full sample, the effect of menarche is close to zero and statistically insignificant (column 4). By contrast, the event of marriage has a large, negative and statistically significant effect in both estimations.

The estimates in Table 6 do not provide an ideal test of the exclusion restriction for our IV because of the limited nature of information on gender norm attitudes and social networks in the 2005 BAS. Nevertheless, it is reassuring that we find no effect of age at menarche on gender norm attitudes and the friendship network, albeit the event of marriage has strong



effects on both outcomes. In the next section, we investigate the effect of early marriage on attitudes towards traditional gender norms within the IV framework.

## 5 Results

**First-Stage Estimates:** Estimates of the first-stage equation in (5) are reported in Table 7. Columns (1) and (2) shows the estimates for the full sample and the sample of sisters respectively. In each case we include controls for parental education, landholdings, occupation, religion, total number of siblings and sisters, and fixed-effects for birth year and district-of-birth. We also include binary variables to indicate whether the respondent had (i) a younger sister or (ii) an older sister within four years of her age, to capture the effects of ‘sibling rivalry’ in marriage timing, as documented by Vogl (2013) in the South Asian context. In column (3), we provide estimates for the first-stage equation using sister fixed-effects, removing parental characteristics from the equation. According to the full sample estimates, a one year delay in menarche postpones marriage, on average, by 0.403 years (with a standard error of 0.034). This is similar to the corresponding estimate (0.445 years) obtained by Chari et al. (2017) using the 2005 India Human Development Survey; but lower than that (0.74 years) obtained by Field and Ambrus (2008) using the 1996 Matlab Health and Socioeconomic Survey for Bangladesh. The difference with Field and Ambrus (2008) may be due to the fact that the incidence of marriage around the age of puberty has diminished in Bangladesh in the past two decades such that the age at menarche is less likely to be a binding constraint for the respondents in our sample.

Although the full sample, by design, is more representative than the sisters’ sample, a comparison between the estimates in columns (2) and (3) gives an indication whether the estimated relation between the timing of marriage and age at menarche is being driven by unobserved socio-economic characteristics. In fact, we find that the estimated effect using sister fixed-effects (0.565 years) is broadly similar to that obtained for the same sample controlling for observable parental characteristics (0.515 years) and the difference between them is not statistically significant. This suggests that the observed relationship between age of marriage and the age at menarche is not being driven by unobserved socio-economic characteristics – which would be absorbed by the sister fixed-effects.

An F-test for the null hypothesis that the coefficient of the age at menarche is equal to zero yields F-statistics of 137.10, 89.10 and 50.22 for the full sample, sister sample, and sister FE estimates, indicating that all three would provide a strong ‘first-stage’ to investigate the effects of marriage timing on other outcomes.

**Effect of Early Marriage on Schooling:** Table 8 shows the 2SLS and 2SLS-FE estimates of the effect of marriage age on years of schooling. According to the full sample estimates, a one-year postponement in marriage increases schooling by 0.726 years. The

Cragg-Donald Wald F statistics for the estimates are 146.78 and 134.36 respectively, indicating that weak identification is not an issue with the 2SLS estimates. The effect on schooling is more than three-fold larger than that obtained by Field and Ambrus (2008) (0.22 years). Here again, the younger cohorts in our sample may make a crucial difference. As discussed in Section 2.1, government initiatives on tuition and stipend programmes since the early 1990's has significantly increased female access to secondary schooling in Bangladesh. Therefore, the postponement of marriage – due to exogenous factors – may have a much larger effect on female secondary schooling for more recent cohorts compared to its effects on previous cohorts.

The 2SLS effects obtained using the sisters' sample are broadly similar to those obtained using the full sample (0.625 years of increased schooling, and 0.821 years' delay in the birth of the first child; the corresponding Cragg-Donald Wald F statistics are 105.49 and 80.72). Introducing sister fixed-effects to the specification – in lieu of observable parental characteristics – reduces the estimated effect on schooling by one-third (to 0.422 years; the Cragg-Donald Wald F statistic is 51.02). This suggests that there are unobserved parental characteristics that are correlated with both the age at menarche and schooling attainment, causing the 2SLS estimates to be biased. Therefore, the 2SLS-FE results provide our preferred estimates of the effect of early marriage on schooling and on other outcomes discussed below.

We obtain similar results using a binary education variable indicating whether the respondent has completed at least grade 6, also shown in Table 8. The 2SLS estimates for the full sample indicate that a one-year postponement in marriage increases the probability of completion of grade 6 by 7.1 percentage points. For corresponding 2SLS estimate for the sisters' sample is 6.2 percentage points which decreases by one-third when we include sister fixed-effects. We repeat the exercise using primary school enrolment. While the 2SLS estimate is positive and statistically significant, the estimated effect disappears in our preferred 2SLS-FE estimation with the sisters' sample. This is expected because the decision to enrol in primary school (typically between the ages of 6 and 8 in our data) invariably precedes the onset of puberty and marriage; therefore, exogenous changes in marriage timing should not affect primary school enrolment.

For the purpose of comparison, we also report estimates of the effects of marriage age on age at first childbirth in Table 8. With the full sample, we find that a one-year delay in age of marriage postpones the age at first childbirth by 0.974 years, which is broadly similar to – but higher than – the estimated obtained by Chari et al. (2017) for India (0.759 years). In this instance, introducing sister fixed-effects makes little difference to the estimated effect.

**Age at Menarche and Groom Characteristics:** Next, we investigate the relationship between the timing of menarche and the characteristics of the groom in the respondent's first marriage. According to Table A1, 72% of married women in WiLCAS indicated that the

"most important reason for the marriage" was that their "parents felt that it was too good a proposal to refuse". This implies that in nearly three out of four cases, that marriage age and groom characteristics were jointly determined by the bride's family's acceptance of a marriage proposal from the groom's party, as modeled in Section 3. Thus, timing of menarche can have a direct impact on groom characteristics by affecting marriage proposals received or the parents' ability to accept them (given that they need to abide by social norms that discourage the marriage of pre-pubescent girls as discussed in Section 4.1). Therefore, we argue that 2SLS estimates of age of marriage on groom characteristics would not have a clear interpretation. For this reason, we provide reduced-form estimates of the effect of age at menarche on the husband's characteristics instead. The reduced-form effects of the age at menarche on the husband's characteristics, if any, have the following interpretation: they show whether social constraints regarding the timing of marriage affects the type of husband that is chosen for her (or that she chooses herself).

The full sample OLS estimates, shown in column (1) in Table 9 indicate that women who experienced menarche at an older age married men with more schooling, who were less likely to be in a low-earning occupation (either a day-labourer or an artisan) and whose fathers had more land. The OLS and FE estimates for the sisters' sample are shown in columns (2) and (3) respectively. Introducing fixed-effects shifts each of the estimated effects of the timing of onset of menarche towards zero, which suggests that the OLS estimates are biased due to unobserved parental characteristics. In particular, using the FE estimates, there is little evidence that the timing of menarche affects the groom's characteristics.

**Effect of Early Marriage on Social Networks and Gender Norms:** Table 10 shows the 2SLS and 2SLS-FE estimates of the effect of marriage age on our measure of the respondent's social network and agreement with traditional gender norms. According to the full sample 2SLS estimates, a one-year delay in marriage increases the probability that a woman in the respondent's social network has made or experienced one or more of the 'progressive' choices/outcomes (described in Section 2.4) by 4.8 percentage points; and increases the number of such individuals in the social network by 3.5 percentage points (both significant at the 1% level). The 2SLS-FE estimates are similar in magnitude to the 2SLS estimates, albeit statistically insignificant in the case of the binary measure. Thus, we find some evidence that early marriage adversely affects the quality of a woman's social network. Strictly speaking, as per the discussion in Section 2.4, the evidence corresponds to an effect of early marriage on the *perceived* quality of the social network rather than the actual quality, given that the network measures are self-reported.

We also investigate whether early marriage affects the social network on the intensive margin – more precisely, whether it affects the frequency of contact within the social network. For this purpose, using the subsample of women whose social network (excluding relatives) include at least one woman who has made progressive choices, we calculate the proportion

of the network with whom the respondent is (i) in daily contact and (ii) at least in monthly contact. As shown in Table 10, the 2SLS and 2SLS-FE estimates of the effect of delayed marriage on frequency of contact is positive but statistically insignificant.

Turning to the effect of early marriage on gender norm attitudes, the 2SLS estimates (Table 10, first row, column 2) imply that a one-year delay in marriage reduces her agreement with statements expressing traditional gender norms (significant at the 1% level for both the PCA index and the count-based measure). In particular, the estimate for the count-based measure corresponds to disagreement with one additional statement expressing a traditional gender norm for every three years of delay in marriage. The 2SLS-FE estimates for traditional gender norms – both the PCA index and the count-based measure – are nearly identical to the 2SLS estimates for the sisters’ sample and statistically significant (columns 3 and 4). The similarity between these two sets of estimates suggests that our full sample results for gender norms are not affected by correlation between age at menarche and unobserved parental characteristics that directly affect attitudes towards gender norms, given that the sister fixed-effects would absorb these unobserved characteristics. Thus, we find support for the hypothesis that early marriage results in more traditional views regarding gender norms.<sup>13</sup>

## 6 Pathways of Impact on Attitudes Towards Gender Norms

In Section 3, we highlighted four pathways through which early marriage can affect women’s attitudes towards gender norms: schooling, the quality of her post-marital social network, characteristics of the groom’s household, and the direct consequences of joining the marital household at an early age. We can explore these hypotheses to some extent by investigating the effects of early marriage on attitudes in subsamples where certain pathways are unavailable. For example, in the case of women who have never attended school, any estimated effect of marriage timing on attitudes towards gender norms must rely on a channel other than education.

**School Enrollment and Progressive Social Networks:** In Table 11, column 1, we report 2SLS estimates for gender norms in the subsample of women who never attended school. As primary school enrollment occurs before the typical age of menarche, school enrollment can be regarded as exogenous to the timing of onset of puberty. The estimated effects are statistically significant and, in fact, larger in magnitude than the full sample estimates reported in Table 10 (using either the PCA index or the count-based measure). This indicates that the effects of marriage timing on attitudes is not due to its effects on schooling alone.

In Table 11, column 3, we report corresponding estimates for the subsample of women

who have one or more elder sisters who either completed secondary school or engaged in work outside of the home. These respondents have, as per our measure, a ‘high quality’ social network due to factors exogenous to the respondent’s marriage decision.<sup>14</sup> Once again, we find effects which are larger than the full sample estimates (albeit statistically insignificant in the case of the PCA index). Thus, marriage timing affects gender attitudes even for women whose pre-existing social network included female family members who made progressive social choices. As these women would retain a ‘high quality’ social network even in the case of early marriage, the results suggest that social networks are not the primary channel through which early marriage affects attitudes towards gender norms.

Using the subsamples described above, we can also explore potential heterogeneity in the effects of early marriage on gender norm attitudes. In Table 11, columns 2 and 4, we provide the corresponding estimates for women who (i) had enrolled in school (column 2); (ii) do not have an elder sister who completed secondary school or engaged in work outside of the home (column 4). The estimated coefficients are smaller in magnitude than the corresponding coefficients in columns 1 and 3 but we cannot reject the hypothesis of equality of coefficients (using a Z-test) between columns 1 and 2 (schooling), or between columns 3 and 4 (social network).<sup>15</sup> We repeat the exercise using the respondent’s mother’s completion of primary schooling (columns 5 and 6), and the respondent’s mother’s participation in NGO activities such as microcredit programmes (columns 7 and 8), to split the sample. The rationale for using these background characteristics to split the sample is that maternal schooling or participation in NGO activities can serve as a conduit for non-traditional gender norms for our respondents. However, in neither case can we reject the hypothesis that the estimated coefficients across the two subsamples are equal.

**Early Marriage and Purdah Practice:** Could marriage timing affect a woman’s attitudes towards traditional gender norms by influencing which household she marries into? The estimates in Table 9 suggest not, as girls who are constrained to marry later – due to delayed onset of puberty – do not end up with significantly different groom characteristics compared to those who experience early onset of puberty. However, we have considered only a limited set of characteristics of the marital household in Table 9. Women who experience early marriage may marry into households that are more conservative in ways not captured by the husband’s education and the father-in-law’s land holdings. For this reason, we introduce to the analysis a more direct measure of the marital household’s attitudes towards traditional norms, namely whether girls and women from the household practise *purdah*. In this context, *purdah* refers to a cultural norm that restricts the presence of women in public spaces (see Paul 1992 and White 1992 for in-depth discussions of *purdah* practice in the rural Bangladeshi context). The practice of *purdah* can take the form of clothing worn by a woman in a public space to cover her face or hands as a sign of modesty or an outer garment worn over ordinary clothing for the same reason; alternatively, it can involve the use of a chaperon in public

spaces, and restricted movement outside of the home.

To capture the practice of *purdah*, female respondents in WiLCAS were asked "Are girls/women from this household required to use *purdah* when they go out?" The advantage of this measure is that it refers to the rules imposed by the household rather than the personal choice of the respondent.<sup>16</sup> Arguably, households with more conservative attitudes towards gender norms would observe stricter rules regarding *purdah*. We have shown elsewhere that there is considerable geographic variation in *purdah* practice across Bangladesh and this practice can account for a significant part of the gender gap in paid work participation (Asadullah and Wahhaj 2017).

The last set of estimates in Table 10 shows the effects of marriage timing on *purdah* practice for the full sample and the sisters' sample. The dependent variable is binary, taking a value of 1 if girls and women from the household (into which the respondent has married) are required to observe *purdah* outside of the home and 0 otherwise. The first two columns report estimates based on the linear probability model while the last column is based on a linear probability model with sister fixed-effects. In each case, we find that the effect of marriage postponement is estimated to be close to zero with a small confidence interval. In the final row we present corresponding estimates for *purdah* practice by the household's female members for religious and social reasons (as opposed to reasons stemming from security concerns or personal reasons). Once again, we find that the estimated effects of marriage postponement are close to zero with high precision. Therefore, we find no evidence that women who experience early marriage are marrying into more conservative households.<sup>17</sup>

## 7 Measurement Error and Reporting Bias

It is worth noting that our 2SLS estimates of the effects of early marriage on various outcomes – schooling, age of first childbirth and attitudes towards gender norms – are consistently larger in magnitude than the OLS estimates (Tables 8 & 10). This pattern is also obtained in existing work by Field and Ambrus (2008), Sekhri and Debnath (2014) and Chari et al. (2017). The pattern is somewhat surprising as the typical concern with OLS estimates in this context is that there are unobserved socio-economic characteristics that are positively correlated with both marriage timing and the outcome variables, in which case the estimates would be biased upward. Chari et al. (2017) offer a number of possible explanations including: (i) that the local average treatment effect captured by the 2SLS estimates may be larger than the average effect for the whole population; (ii) classical measurement error in the age of marriage.

A potential concern in the case of measurement error is reporting bias in age of marriage. For example, using demographic surveillance data from the Matlab district in Bangladesh, Streatfield et al. (2015) provide evidence of women underreporting marriage age in a random

sample survey from the same area. If reporting bias in age of marriage is correlated with that in age at menarche, this can potentially bias our IV estimates. To explore this concern, we compare the reported age of marriage in WiLCAS, with an alternative measure of marriage age calculated using (i) the date of birth recorded on the respondent’s national ID card or birth certificate (verified by the enumerator) and (ii) the year of the marriage ceremony, as reported by the respondent. While this second measure is also prone to measurement error, it is, arguably, less likely to be influenced by systematic bias in reporting.<sup>18</sup> The distribution of the difference between the two measures, shown in Figure 5, is nearly symmetric around zero which is inconsistent with reporting bias in the stated age of marriage. Therefore, we conclude that the reported marriage age in WiLCAS is unlikely to be influenced by reporting bias.

Even in the absence of deliberate misreporting, it is possible that measurement error in reported marriage age and age at menarche are correlated if respondents use the former as a point of reference to recollect the latter.<sup>19</sup> To investigate this concern, we follow Field and Ambrus (2008) and compare the distribution of reported age of marriage and age at menarche for two subsamples of women: (i) women with mothers who never attended school, and (ii) women with mothers who had at least some schooling before the onset of puberty. We expect the second group to have experienced later marriage due to variation in parental preferences, or other socio-economic factors in the parental household. These same factors, as noted in Section 2.3, may have a small effect on the age of onset of puberty; but the difference in the distribution of the reported age at menarche between the two subsamples should be significant if respondents were using the marriage event as a point of reference. Figure 6 shows the distributions of marriage age and age of onset of menarche for the two subsamples. As expected, the distribution of the age of marriage for women whose mothers had some schooling shows a strong rightward shift compared to women whose mothers had no schooling. By contrast, the corresponding distributions for the reported age of onset of menarche are nearly identical. Therefore, we conclude that respondents were unlikely to be using the marriage event as a reference point to recollect the timing of onset of puberty.

## 8 Conclusion

We investigated whether female early marriage is a conduit for the transmission of social norms, specifically norms relating to gender roles and rights within the household. To the extent that these norms can shape decision-making and resource allocation within the household, they can have important consequences for household members including investment in children and economic participation of adults. Our 2SLS and 2SLS-FE estimates indicate that early marriage increases agreement with statements supportive of traditional gender roles and gender bias in the allocation of resources. This type of agreement may reflect a

shift in beliefs or expectations as a consequence of early marriage.

To identify the effect of early marriage on gender norms, we exploit variation in the age at menarche between sisters as an exogenous source of variation in marriage age. This is possible thanks to a purposefully designed survey of Bangladeshi women which included tracking and interviewing sisters of a subset of female respondents. We use this approach to control for beliefs and attitudes that are transmitted from parents to children.

The onset of puberty is an important life event in the lives of Bangladeshi women and its timing can potentially impact upon beliefs and expectations through the number of channels – including schooling, social networks, characteristics of the groom, and, potentially, socialisation within the parental household (starting with menarche). We investigate these channels by repeating the analysis for subsamples of women for whom specific channels would have been present or absent, as well as estimating an equivalent equation for a sample of adolescents (a subset of whom had not experienced marriage at the time of the survey). The analysis indicates that schooling and social networks cannot individually account for the entire effect of marriage timing on attitudes towards traditional norms. We also find little evidence that age at menarche affects characteristics of the groom and the marital household, or that early menarche directly leads to increased agreement with traditional gender norms. Taken together, the evidence suggests that our estimated effects are driven by the socialisation and experiences of young brides within the marital household.



# Notes

<sup>1</sup>Recent research on this topic includes Mabsout and Staveren (2010), who provide evidence that gender norms within a group mediate the effects of standard bargaining power variables on various outcomes; and Maertens (2013) who finds that "perceptions of the ideal age of marriage significantly constrain the education that parents aspire to have for their daughters, but not their sons."

<sup>2</sup>See also Thornton, Alwin and Camburn (1983) and Moen, Erickson and Dempster-McClain (1997), for sociological studies on the intergenerational transmission of gender role attitudes.

<sup>3</sup>According to the Bangladesh Demographic and Health Survey 2011, 60.2% of women aged 20-24 had at least some secondary-schooling, compared to 20.8% of women aged 40-44 (NIPORT 2013).

<sup>4</sup>About 15% of the original HIES rural households could not be traced and these were replaced with randomly selected households with comparable demographic characteristics within the same primary sampling unit.

<sup>5</sup>The rationale for conducting a household census in the urban areas to construct a sample rather than revisiting HIES households (as was done in rural areas) was to avoid the risk of high attrition, given that urban households in Bangladesh are typically much more mobile than rural households.

<sup>6</sup>Two sisters who were traced during the second phase were unable to complete the interviews because of disabilities.

<sup>7</sup>89 women with whom individual interviews were conducted in WiLCAS are excluded from our sample and the remaining analysis, because they reported ages outside of the range 20-39 years.

<sup>8</sup>In the case of the 10 statements, we group together the two responses 'strongly agreed' and 'somewhat agreed', and the two responses 'somewhat disagreed' and 'strongly disagreed'.

<sup>9</sup>We assume that groom attributes do not affect the girl's schooling outcome as women in our sample almost universally terminate schooling prior to or at the time of marriage.

<sup>10</sup>To obtain the equation in (4), let  $s^*$  denote attitudes towards traditional gender norms given by the solution to the optimisation problem in (1). Using the formula for the Total Derivative, we have

$$\frac{ds^*}{da_j} = \frac{ds}{da} \frac{da}{da_j} = \frac{\partial s}{\partial a} \frac{da}{da_j} + \frac{\partial s}{\partial e} \frac{\partial \hat{e}}{\partial a} \frac{da}{da_j} + \frac{\partial s}{\partial n} \frac{\partial \hat{n}}{\partial a} \frac{da}{da_j} + \sum_{l=1}^k \frac{\partial s}{\partial g_l} \frac{dg_l}{da_j}$$

If the constraint in (3) is binding, then  $a = a_j$  and  $\frac{da}{da_j} = 1$ . Substituting for  $\frac{da}{da_j}$  above, we obtain (4).

<sup>11</sup>See also Sekhri and Debath (2014) and Chari et al. (2017) for further discussions of this literature.

<sup>12</sup>Note that in the following discussion, we use the terms 'sister fixed-effects' and 'family fixed-effects' interchangeably.

<sup>13</sup>Given our IV framework, these estimates necessarily capture local average treatment effects, which raises the question whether they vary with the age of marriage. To investigate, we obtained OLS estimates of age of marriage on gender norm attitudes using (i) marriage age dummies, (ii) a quadratic term involving age of marriage. We find no evidence of nonlinearity with either approach. These results are not shown in the paper but available from the authors upon request.

<sup>14</sup>More precisely, the decisions of elder sisters are, arguably, exogenous to the respondent's age of marriage. To test the validity of this argument, we estimate the effect of the respondent's age of marriage on progressive

choices within her own (pre-marital) family and find no effect. Results are available upon request.

<sup>15</sup>In this context, it is worth noting recent evidence of substantial gender bias in school textbooks in Bangladesh (Islam and Asadullah 2018), which can explain the finding that schooling itself does not significantly change the effect of early marriage on gender norm attitudes.

<sup>16</sup>Although the dataset includes information on the type of garment worn for the practice of *purdah*, we do not use this information to construct our indicators as some types of garments are religion-specific – e.g. the *niqab* and *hizab* are specific to Islam – while *purdah*, if defined in broad terms, is practised across religions in the region.

<sup>17</sup>We also find that controlling for *purdah* practice has little effect of the age of marriage on attitudes towards gender norms. Results are not reported but available upon request.

<sup>18</sup>We do not use this alternative measure of marriage age in our estimation as the WiLCAS respondents were able to produce a national ID card or birth certificate in only 71% of cases.

<sup>19</sup>Nevertheless, Field and Ambrus (2008) argue that this is unlikely to be the case for women in rural Bangladesh, where the onset of puberty is regarded an important life event in itself, associated with significant changes in household responsibilities, social interactions and even clothing.

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**Figure 1: Age of Menarche and Parental Background**

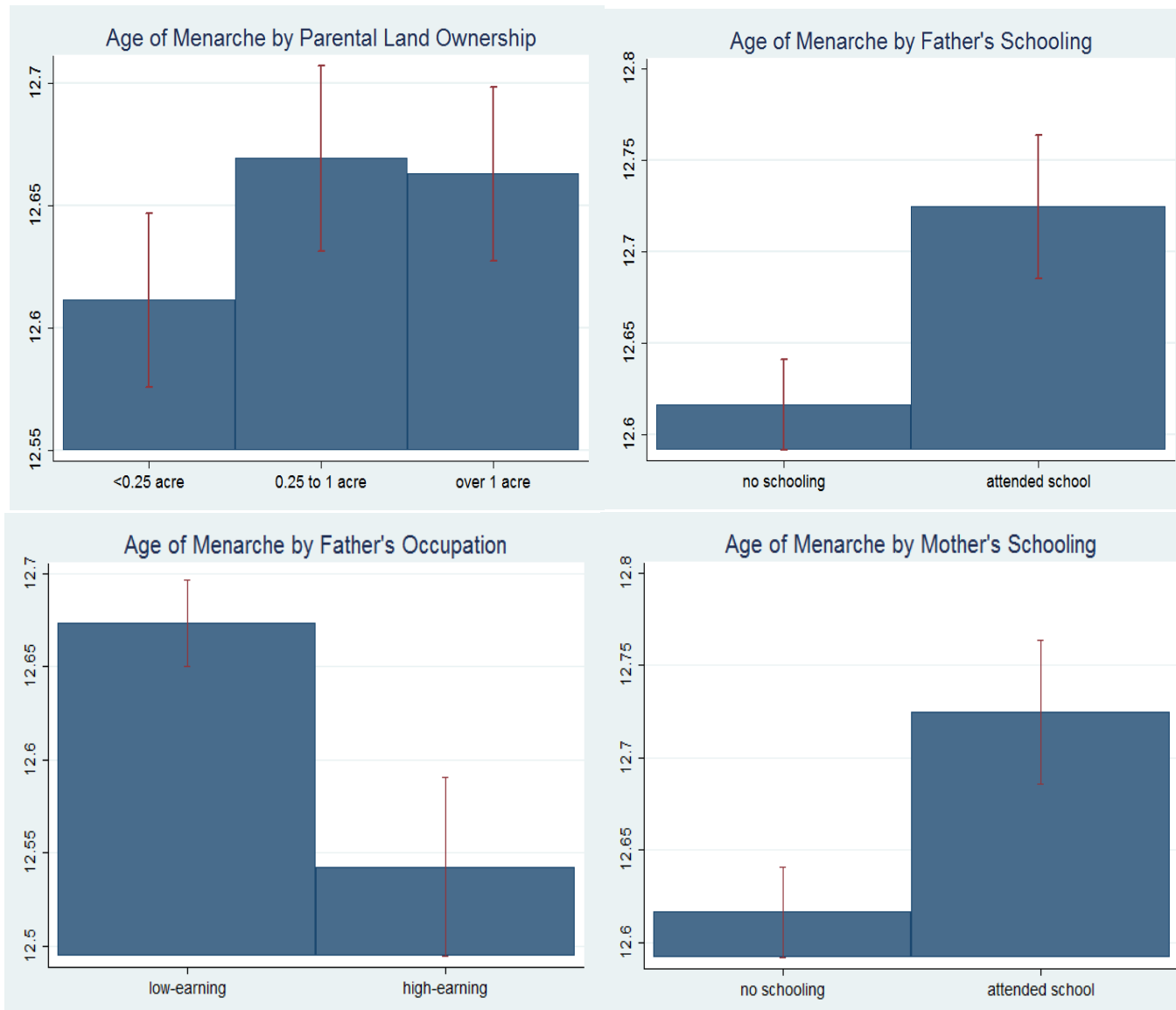


Figure 1 shows the mean age of onset of menarche, together with 95% confidence intervals, for female respondents to the 2014 WiLCAS, by different parental characteristics.

**Figure 2: Age of Menarche and Individual Characteristics**

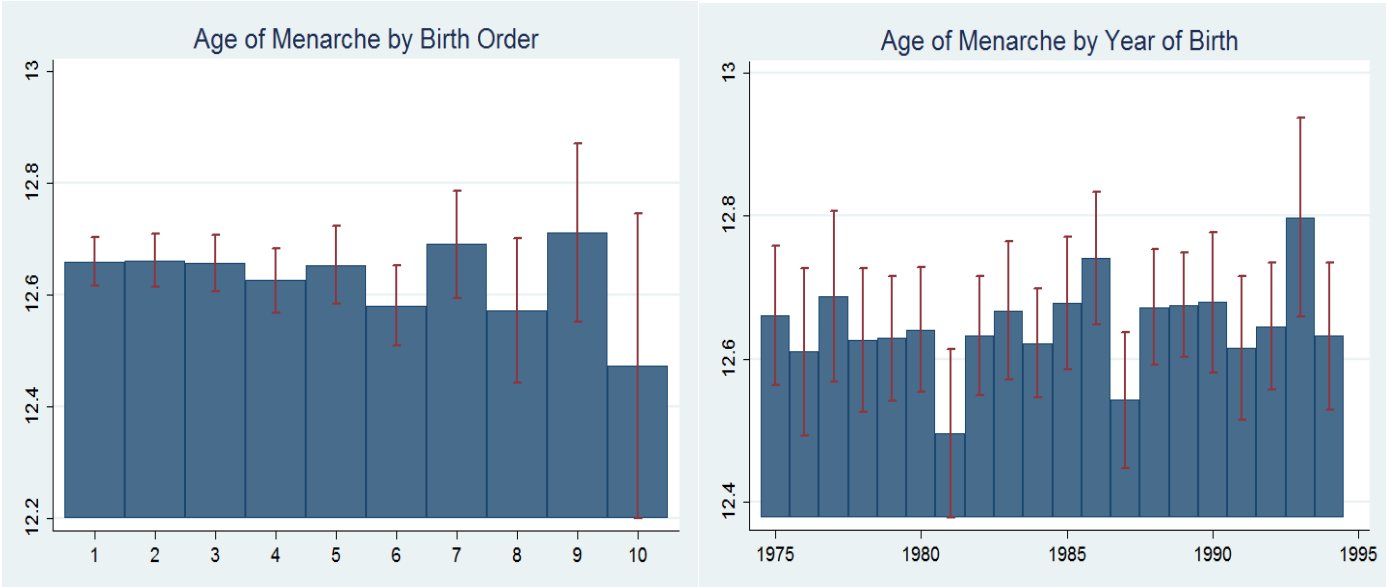


Figure 2 shows the mean age of onset of menarche by birth order and by year of birth, together with 95% confidence intervals, for respondents to the 2014 WiLCAS.

Figure 3: Onset of Menarche and Age of Marriage

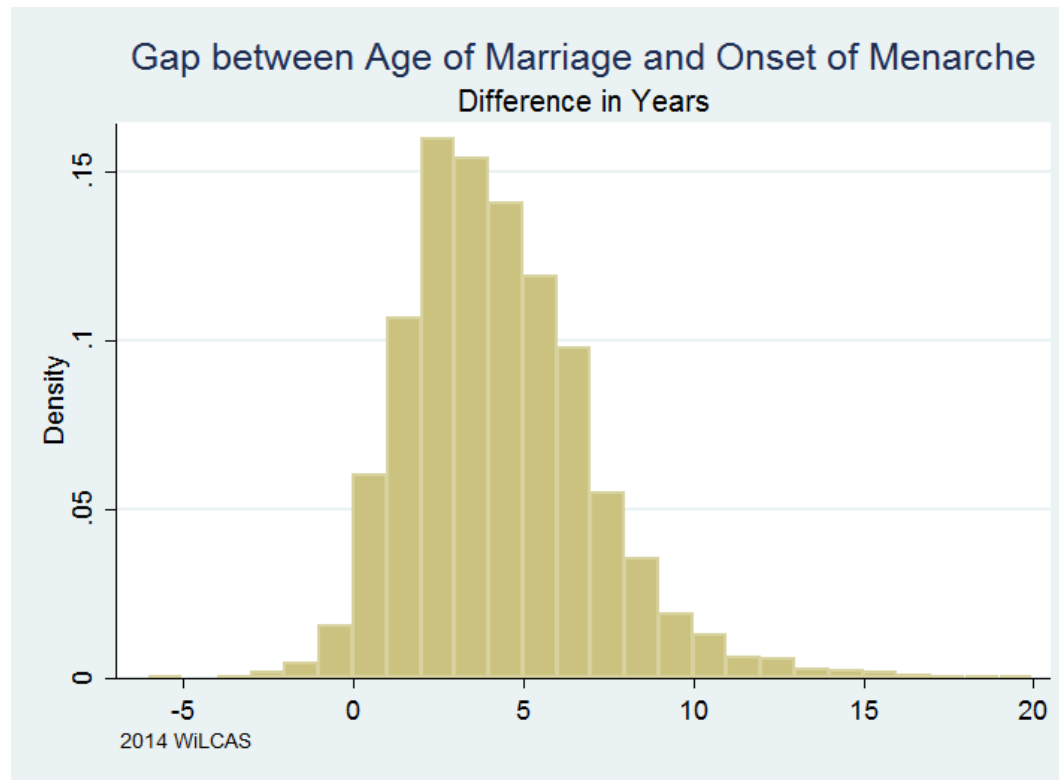


Figure 3 shows a histogram of the gap between age of marriage and age of onset of menarche for female respondents in the 2014 WILCAS.



Figure 4: Difference in Age & Timing of Onset of Menarche between Sisters

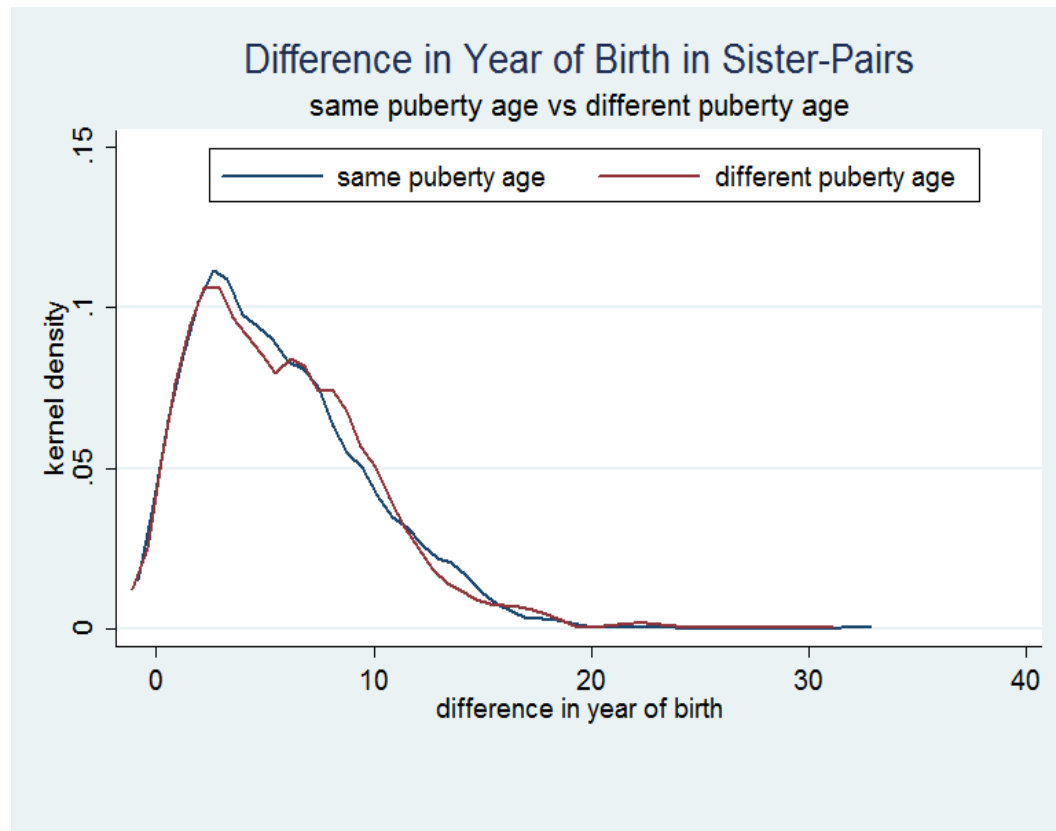


Figure 4 shows the distribution (Epanechnikov kernel) of the difference in year of birth across sister pairs, for (i) pairs who attained puberty at the same age and (ii) pairs who attained puberty at different ages. Source: 2014 WILCAS and authors' calculations.

Figure 5: Distribution of Differences between Reported Age of Marriage and Alternative Measure

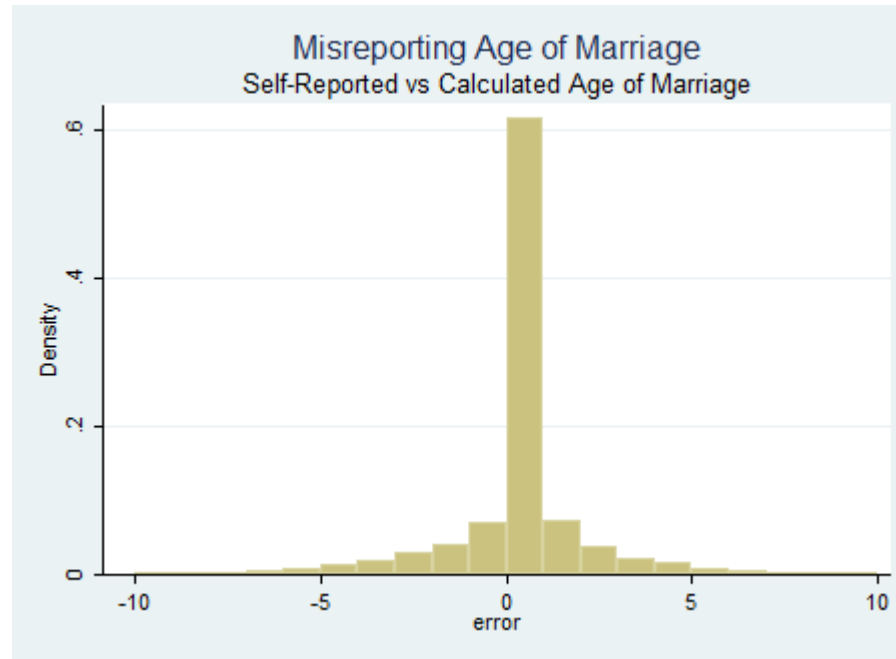


Figure 5 shows a histogram of the difference between the reported age of marriage and an alternative measure of marriage age based on reported year of the marriage ceremony and date of birth indicated on respondent's national ID card or birth certificate. The sample is restricted to respondents with a national ID card or birth certificate (N=5509). Source: 2014 WiLCAS and authors' calculations.

Figure 6: Distribution of Age of Marriage & Age of Onset of Menarche

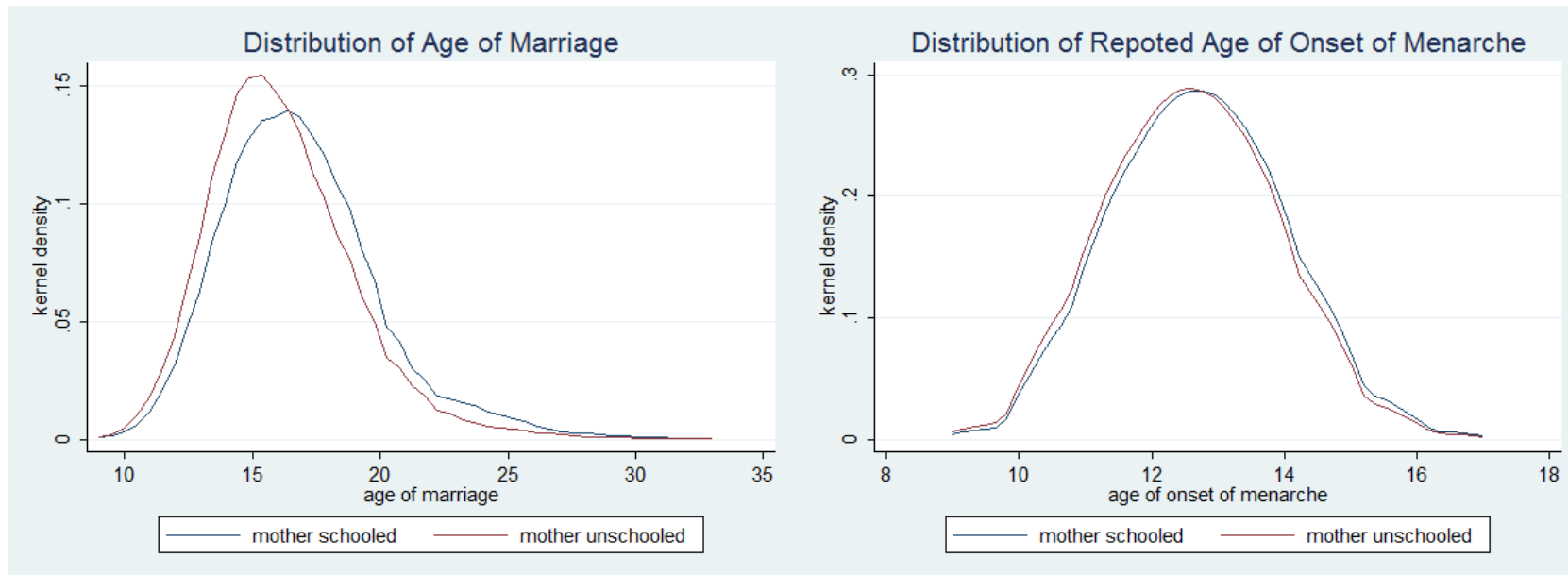


Figure 6 shows the distribution (Epanechnikov kernel, bandwidth=1) of reported marriage age and onset of menarche for the sample of women aged 25-39 years, who experienced the onset of menarche between the ages of 10 and 16. Source: 2014 WiLCAS and authors' calculations.

**Table 1: Summary Statistics**

	Full Sample	Phase 1 Respondents	Phase 1 Respondents with Sisters in Phase 2	Difference (p-value)
Father's Education	2.917 (0.045)	2.894 (0.050)	2.901 (0.107)	0.012 (0.95)
Mother's Education	1.568 (0.032)	1.573 (0.035)	1.431 (0.073)	0.142 (0.09) *
Father employed in a low-paying	0.197 (0.005)	0.250 (0.006)	0.233 (0.011)	0.017 (0.21)
Father's Landholdings	1.02 (0.010)	1.003 (0.011)	1.057 (0.023)	-0.053 (0.04) **
Respondent is Muslim	0.894 (0.004)	0.887 (0.004)	0.910 (0.008)	-0.021 (0.03) **
Respondent's Age	29.40 (0.063)	29.42 (0.072)	30.05 (0.148)	-0.632 (0.00) ***
Respondent's Years of Education	5.113 (0.043)	5.072 (0.048)	5.143 (0.104)	-0.070 (0.54)
Respondent's Age of Marriage	16.46 (0.312)	16.43 (0.034)	16.356 (0.073)	0.073 (0.37)
Respondent's Age of Menarche	12.649 (0.032)	12.652 (0.012)	12.624 (0.025)	0.028 (0.32)
# of Siblings	5.516 (0.026)	5.321 (0.029)	6.065 (0.059)	-0.749 (0.00) ***
# of Sisters	3.302 (0.018)	3.107 (0.020)	3.873 (0.039)	-0.766 (0.00) ***
# of Brothers	2.214 (0.017)	2.209 (0.019)	2.192 (0.042)	0.018 (0.70)
# of younger Sisters within 4 years	0.350 (0.006)	0.315 (0.007)	0.513 (0.017)	-0.199 (0.00) ***
# of elder Sisters within 4 years	0.23 (0.005)	0.191 (0.005)	0.313 (0.015)	-0.12 (0.00) ***
Agreement with Traditional Gender Norms	6.53 (0.030)	6.767 (0.033)	6.656 (0.071)	0.11 (0.16)
Social Network (# w/ progressive choices)	0.947 (0.014)	0.874 (0.015)	0.905 (0.034)	-0.0308 (0.36)
Purdah Practice	0.688 (0.005)	0.668 (0.006)	0.709 (0.012)	-0.041 (0.00) ***
Husband's Years of Schooling	4.675 (0.048)	4.666 (0.054)	4.747 (0.118)	-0.082 (0.53)
Husband in a low- paying occupation	0.243 (0.005)	0.249 (0.006)	0.231 (0.012)	0.018 (0.17)
Father-in-law's Landholdings	1.095 (0.021)	1.056 (0.020)	1.136 (0.046)	-0.080 (0.10) *
Respondent's Age of First Birth	19.311 (0.046)	19.290 (0.053)	19.820 (0.144)	-0.537 (0.00) ***
Observations	7,425	5,949	1,288	

Source: 2014 WILCAS and Authors' Calculations

Note: The table shows the mean of the listed variables for the full sample of married women (column 1), the sample of respondents in Phase 1 of the survey (which was designed to be nationally representative; column 2), and the sample of Phase 1 respondents whose sisters were tracked in Phase 2 (column 3), with standard errors shown in parentheses. The final column shows the difference in the mean in the preceding two columns; with p-values from the corresponding t-tests shown in parentheses.

**Table 2: Agreement with Statements Reflecting Traditional Gender Norms**

Statement	% agree
1. Boys require more nutrition than girls to be strong and healthy.	41.0%
2. School education is more important for boys than for girls.	37.7%
3. University education is more important for boys than for girls.	46.8%
4. A wife ought to be less educated than her husband.	56.1%
5. When a woman is engaged in work out side of the home, her children suffer because they deprived of their mother's attention.	87.6%
6. A woman should not earn more than her husband as this can cause tensions within the household.	66.2%
7. A husband should have final say in all important family matters.	39.7%
8. There are some circumstances in which a husband is justified in using physical violence against his wife.	28.0%
Observations	7425
Statement	% disagree
9. Outdoor sports are important for the health and well-being of adolescent girls just as it is for boys.	45.3%
10. There are some circumstances in which a woman is right to ask for divorce from her husband.	42.8%
11. It is appropriate for a women to take up employment outside of the household before marriage.	29.3%
12.It is appropriate for a women to take up employment outside of the household before giving birth to a child.	37.3%
13. It is appropriate for a women to take up employment outside of the household when she has young children.	74.5%
14. A husband should help his wife make the bed in the morning.	21.1%
15. A husband should help his wife with cooking when she is sick.	7.3%
16. A husband should help his wife when she is busy collecting/harvesting/threshing crops.	5.3%
Observations	7425

Source: 2014 WiLCAS and Authors' Calculations

Note: For statements 1-8, the figures correspond to the percentage of respondents who 'strongly agreed' or 'somewhat agreed'. For statements 9 & 10, the figures correspondend to the percentage of respondents who 'somewhat disagreed' or 'strongly disagreed'. Statements 11-16 were framed as questions, and the figures correspond to the percentage of respondents who disagreed with the proposition.

**Table 3: Agreement with Statements Reflecting Traditional Gender Norms for Adolescents**

	%
	19.8%
Should there be any differences between sons and daughters enjoying facilities at home? (% Yes)	
	55.5%
Who makes a greater contribution to the economic development of the family? (% Son)	
Who needs more food among household members? (% Males or Boys)	50.1%
Who needs more education between sons and daughters? (% Sons)	14.1%
It is difficult for a woman to have a good relationship with her husband if she works outside (% Agree)	28.7%
<b>Observations</b>	<b>4506</b>

Source: 2005 Bangladesh Adolescent Survey and Authors' Calculations

Note: Sample includes all female adolescents below the age of 18.

**Table 4: Characteristics of Respondents' Social Network**

	Friends, Neighbours, Role Models		Extended Family	
	mean	% with none	mean	% with none
<i>Individuals in Respondents' Social Network who ...</i>				
- completed secondary school	0.729 (1.07)	56.07	0.705 (0.952)	52.62
- remained unmarried till completion of secondary school	0.668 (1.04)	59.53	0.649 (0.926)	56.27
- used contraception before birth of first child	0.385 (0.741)	73.24	0.311 (0.628)	75.76
- engaged in an income-generating activity	0.334 (0.706)	76.08	0.279 (0.590)	77.86
- made at least one of the above choices	0.947 (1.18)	45.71	0.825 (0.991)	45.51
<b>Observations</b>	7425		7425	

Source: 2014 WiLCAS and Authors' Calculations.

Note: The table shows the mean number of individuals known to respondents who chose/experienced the events described. Standard deviations are shown in parantheses. The category 'extended family' excludes the respondents' relatives by marriage. The columns labelled '% with none' indicate the proportion of respondents who were not aware of any individual within their social network who had experienced the event described.

**Table 5: Closest Relationships of Female Adolescents**

	% (1)	Mean (2)
Parents	33.1%	0.39 (0.60)
Spouse/Fiance	6.3%	0.06 (0.25)
Siblings	9.2%	0.10 (0.32)
Cousins	7.7%	0.10 (0.38)
Friends	62.0%	1.04 (1.03)
Observations	4506	4506

Source: 2005 Bangladesh Adolescent Survey and Authors' Calculations

Note: Column (1) shows the % of female adolescents below 18 who reported, for each of the listed categories, at least one individual in that category, among their closest personal relationships (uo to 3). Column (2) shows the corresponding mean and the standard deviation is shown in parentheses.



**Table 6: Estimated Effect of Onset of Menarche and Marriage on Adolescents: Friendship Network & Attitudes Towards Gender Norms**

	Attitudes towards Gender Norms		Friendship Network	
	(1)	(2)	(3)	(4)
Age of Menarche	-0.0073 (0.031)		0.044 (0.027)	
Menarche Dummy		-0.133* (0.068)		-0.005 (0.057)
Married	0.174** (0.073)	0.166** (0.068)	-0.555*** (0.071)	-0.572*** (0.063)
Year-of-Birth Controls	Year Dummies	Year Dummies	Year Dummies	Year Dummies
Sample	Experienced Menarche	All Adolescent Girls	Experienced Menarche	All Adolescent Girls
Observations	2479	4506	2479	4506

Source: 2005 Bangladesh Adolescent Survey and Estimates by Authors

Note: In columns (1) and (2), the dependent variable indicates how many out of five statements expressing traditional gender norms the respondent is in agreement with. In columns (3) and (4) the dependent variable is the number of non-relatives listed by the respondent among her 'closest relationships'. Each regression includes controls for family background and village of residence. Statistical significance is denoted by \*\* (5% level) and \* (10% level)

**Table 7: First-Stage Equation for Age of Marriage**

	Full Sample (1)	Sister Sample (2)	Sister Sample (3)
Year of Birth	0.0426 *** (0.0101)	0.0333 * (0.0196)	0.0311 (0.0278)
Age of Menarche	0.403 *** (0.034)	0.569 *** (0.060)	0.515 *** (0.0726)
Younger Sister within 4 years	-0.317 *** (0.0584)	-0.380 *** (0.0822)	-0.331 *** (0.108)
Older Sister within 4 years	0.146 ** (0.0679)	0.115 (0.097)	0.368 *** (0.121)
Father's Education	0.021 ** (0.001)	0.006 (0.0163)	--
Mother's Education	0.100 *** (0.0143)	0.121 *** (0.0259)	--
Father employed in a low-earning activity	-0.037 (0.083)	0.131 (0.148)	--
<i>Parental Land Ownership (omitted category: less than 0.25 acres)</i>			
-- 0.25 to 1 acre	0.003 (0.071)	-0.0144 (0.130)	--
-- more than 1 acre	0.021 (0.080)	0.139 (0.139)	--
<i>Respondent's Religion (omitted category: Muslim)</i>			
-- Hindu	0.492 *** (0.071)	0.371 * (0.197)	--
-- Other	1.025 *** (0.431)	-0.257 (0.830)	--
Sister Fixed Effects	--	No	Yes
Observations	7328	2530	2530
F-Test (Coefficient of Menarche Age = 0)	137.10	89.10	50.22

Note: The dependent variable is the respondent's age of marriage. Columns (1) and (2) also include controls for parental landholdings, father's occupation, religion and total number of siblings and sisters. All specifications include district-of-birth dummies and year-

**Table 8: Estimated Effects of Marriage Postponement on Schooling, Child Birth**

	OLS (1)	2SLS (2)	2SLS (3)	2SLS-FE (4)
Years of Schooling	0.305*** (0.147)	0.726*** (0.098)	0.625*** (0.109)	0.422*** (0.124)
Sister Fixed Effects	--	--	No	Yes
Sample	Full	Full	Sister	Sister
Observations	7329	7328	2530	2496
Secondary Schooling (binary)	0.031*** (0.002)	0.071*** (0.013)	0.062*** (0.016)	0.043** (0.020)
Sister Fixed Effects	--	--	No	Yes
Sample	Full	Full	Sister	Sister
Observations	7329	7328	2530	2496
Primary School Enrolment	0.017*** (0.002)	0.060*** (0.013)	0.051*** (0.015)	0.023 (0.018)
Sister Fixed Effects	--	--	No	Yes
Sample	Full	Full	Sister	Sister
Observations	7329	7328	2530	2496
Age of First Childbirth	0.716*** (0.019)	0.974*** (0.135)	0.821*** (0.158)	0.957*** (0.192)
Sister Fixed Effects	--	--	No	Yes
Sample	Full	Full	Sister	Sister
Observations	6841	6840	2390	2251

Note: Columns (1) and (2) also include controls for parental landholdings, father's occupation, religions and total number of siblings and sisters. All regression include district-of-birth dummies and year-of-birth dummies. Family background variables are excluded when specification includes sister fixed-effects. Errors are clustered at the subdistrict-level. Statistical significance is denoted by \*\* (5% level) and \*\*\* (1% level)

**Table 9: Reduced Form Estimates of Age of Menarche on Husband's Characteristics**

	Full Sample (1)	Sister Sample (2)	Sister Sample (FE) (3)
Husband's Schooling	0.303*** (0.0499)	0.364*** (0.0805)	0.165* (0.0955)
Husband in low- earning Occupation	-0.0081 (0.005)	-0.0171** (0.008)	-0.0024 (0.011)
Father-in-law Landholdings	0.0455** (0.0217)	0.0351 (0.0510)	-0.0253 (0.0673)
Observations <sup>1</sup>	7306	2527	2527

Note: Column (1) also includes controls for parental landholdings, father's occupation, religions and total number of siblings and sisters. All regression include district-of-birth dummies and year-of-birth dummies. Family background variables are excluded when specification includes sister fixed-effects. Errors are clustered at the subdistrict-level. Statistical significance is denoted by \*\* (5% level) and \*\*\* (1% level).

<sup>1</sup>In the case of father-in-law's landholdings, some reports are missing because of the respondents' lack of knowledge; thus, the number of observations used are 7,137 and 2,451 for the full sample and sisters' sample respectively.

**Table 10: Estimated Effect of Marriage Postponement on Gender Norms, Social Networks and Purdah Practice**

	OLS (1)	2SLS (2)	2SLS Sister Sample (3)	2SLS Sister FE (4)
Agreement with Traditional Gender Norms (Count)	-0.072*** (0.011)	-0.374*** (0.090)	-0.447*** (0.103)	-0.447*** (0.167)
Agreement with Traditional Gender Norms (Index)	-0.027*** (0.004)	-0.084** (0.032)	-0.118*** (0.036)	-0.105* (0.056)
Observations	7329	7328	2530	2496
Social Network (1 = progressive choice, 0 = none)	0.149*** (0.0022)	0.0495*** (0.0157)	0.045*** (0.0169)	0.0389 (0.0273)
Social Network (# making progressive choices)	0.0348*** (0.0052)	0.151*** (0.0367)	0.129*** (0.0441)	0.122* (0.0681)
Observations	7312	7311	2521	2484
Social Network (% with daily contact)	-0.008*** (0.0023)	0.008 (0.0168)	0.0133 (0.0199)	0.107 (0.0716)
Social Network (% at least monthly contact)	-0.0068*** (0.0026)	0.0063 (0.0191)	-0.0046 (0.0191)	0.0271 (0.0666)
Observations	3768	3768	1437	925
Purdah Practice	0.0018 (0.0016)	0.0127 (0.0127)	0.0052 (0.0122)	0.0007 (0.0190)
Purdah for Religious or Social Reasons	-0.0019 (0.0018)	-0.0082 (0.0133)	-0.0058 (0.0137)	-0.0003 (0.0217)
Observations	7312	7311	2521	2484

Note: Columns (1) and (2) also include controls for parental landholdings, father's occupation, religions and total number of siblings and sisters. All regression include district-of-birth dummies and year-of-birth dummies. Family background variables are excluded when specification includes sister fixed-effects. Errors are clustered at the subdistrict-level. Statistical significance is denoted by \*\* (5% level) and \*\*\* (1% level)

**Table 11: Estimated Effect of Marriage Postponement on Gender Norms via Schooling & Social Networks**

	2SLS (1)	2SLS (2)	2SLS (2)	2SLS (3)	2SLS (5)	2SLS (6)	2SLS (7)	2SLS (8)
<i>Dependent Variable: Agreement with Traditional Gender Norms (Count)</i>								
Age of Marriage	-0.533** (0.224)	-0.322*** (0.1)	-0.454** (0.2)	-0.354*** (0.1)	-0.317** (0.151)	-0.387*** (0.111)	-0.4*** (0.136)	-0.377*** (0.114)
Z-test (t-statistic) <sup>1</sup>		0.86		0.45		0.37		0.13
p-value		0.39		0.65		0.71		0.9
Sample	No Schooling	Enrolled in School	Older Sister School/Work	No Older Sister School/Work	Mother finished primary school	Mother < 5 yrs school	Mother was NGO member	Mother not NGO member
Observations	1906	5422	1126	6202	1532	5796	1664	5664
<i>Dependent Variable: Agreement with Traditional Gender Norms (Index)</i>								
Age of Marriage	-0.170** (0.081)	-0.049 (0.036)	-0.118 (0.073)	-0.076** (0.036)	-0.049 (0.054)	-0.094** (0.041)	-0.135*** (0.050)	-0.066 (0.042)
Z-test (t-statistic) <sup>1</sup>		1.37		0.52		0.66		1.05
p-value		0.17		0.61		0.51		0.29
Sample	No Schooling	Enrolled in School	Older Sister School/Work	No Older Sister School/Work	Mother finished primary school	Mother < 5 yrs school	Mother was NGO member	Mother not NGO member
Observations	1906	5422	1126	6202	1532	5796	1664	5664

Note: All columns include controls for parental landholdings, father's occupation, religions and total number of siblings and sisters, district-of-birth dummies and year-of-birth dummies. Errors are clustered at the subdistrict-level. Statistical significance is denoted by \*\* (5% level) and \*\*\* (1% level)

<sup>1</sup> The Z-test corresponds to a test of equality of the estimated coefficient for age of marriage across the two subsamples; t-statistics for the Z-test shown with p-values underneath.

**Table A1: Main Reason for Marriage**

Reason	%
"My parents felt it was too good a proposal to refuse"	71.76
"I did not expect to study further"	7.75
"Parental pressure"	9.29
"Parental concern about my physical safety"	3.49
"It is what I wanted"	7.08
Other	0.63
Observations	7329

Note: Table shows responses to question "In your view, what was the most important reason for your marriage?" among the sample of married women in WiLCAS