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Early marriage, social networks and the transmission of norms

M. Niaz Asadullah[1]

[1] Professor of Development Economics, Faculty of Economics, University of Malaya, Malaysia; Honorary Research Fellow, Global Development Institute, The University of Manchester, United Kingdom

Email: m.niaz@um.edu.my

Zaki Wahhaj[1]

[1] Senior Lecturer, School of Economics, University of Kent, United Kingdom

Email: z.wahhaj@kent.ac.uk

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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 the 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 in Bangladesh, we first show that the timing of onset of menstruation has no direct effect on adolescent attitudes on attitudes towards gender norms. Yet we find that early marriage increases agreement with statements supportive of gender bias in the allocation of resources, and worsens the quality of a woman's post-marital social network. We also find evidence suggesting that schooling is a complement and the quality of the social network a substitute of later marriage in terms of their effects on attitudes towards traditional gender norms.

Keywords

Gender roles, social norms, schooling, household decision-making

JEL Codes

J12, J16, Z10

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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 at 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 NGOs 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)[1]. 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). Female early marriage in developing countries, as noted above, typically involves the early termination of schooling to take on a new role within the marital household. These changes occur at an age when beliefs and attitudes may be more susceptible to new encounters and experiences than in the case of older brides and, thus, early marriage can potentially play an important role in the transmission of social norms.

The challenge for empirical research on the consequences of early marriage is that girls who marry early tend to be born in rural areas, be poorer and have less educated parents; but these background characteristics can have a direct effect on their

[1] 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."

opportunities and subsequent life choices (such as schooling, fertility and employment). A recent set of studies have used variation in the timing of menarche, the onset of menstruation, across women to estimate the impact of early marriage on future outcomes in an IV framework. The rationale for this approach is that, in patriarchal societies, women face strong social pressures to marry from the onset of menstruation (Ortner 1978, Dube 1997); while it has been argued that the timing of menarche has limited correlation with women's background characteristics that may directly impact 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.

Nevertheless, if the age at menarche is correlated with socioeconomic background, then it would not satisfy the exclusion restriction for instrumental variables and the corresponding IV estimates would 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 at menarche and marriage timing of sisters. Specifically, following the existing literature, we use the age at menarche as an instrument for marriage timing but exploit only the variation in age at 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 at menarche that is due to environmental and socioeconomic 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 the onset of menstruation delays marriage by 0.403 years. An alternative model with family fixed effects yields broadly similar results. However, the inclusion of family fixed effects reduces the second stage estimates of the effects of marriage timing on schooling by about a third (from 0.625 years to 0.422 years). This suggests that the estimated relationship between the age at marriage and female schooling without family fixed effects is biased by unobservable socioeconomic characteristics that influence both the menarche and subsequent outcomes.

Using the timing of menarche as an instrument, and family fixed effects to capture the respondent's unobserved socioeconomic 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 have 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 the timing 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.

We hypothesise four potential pathways for the estimated effects on attitudes. Girls who marry later may have different attitudes towards traditional gender norms because:

(i) of increased schooling;

(ii) of improved social networks;

(iii) delayed marriage leads to matching with men (and in-laws) with different (eg more progressive) attitudes towards traditional norms;

(iv) views and practices within the marital households have a stronger influence on a younger bride.

We find little evidence that age at 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) have a high quality social network due to factors exogenous to the timing their marriage decision and, therefore, conclude that (i) and (ii) cannot, on their own, account for the effects of marriage on attitudes towards gender norms. Additionally, we find that schooling and delayed marriage are complements in shifting attitudes towards traditional gender norms while delayed marriage and a better quality social network are substitutes. Taken together, the evidence suggests that (iv) may be an important pathway through which early marriage affects norm transmission.

The remainder of the paper is organised as follows. In the next section, we describe the context and 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 household duties in the marital household (Amin et al 2014; Amin, Mahmud and 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 enrolment has risen three-fold over a 20 year period[2] 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).

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 has, in fact, increased. (Raj et al 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, performance on national examinations), child-related information (childbirth, school enrolment, educational expenditures, and other investments in education and health), and employment, marriage and migration history. 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 census carried out in 87 non-metropolitan urban primary sampling units throughout the

[2] 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).

country.[3] 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.[4] 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. The 2005 BAS is a nationally representative survey of adolescents designed by the Population Council. It includes information on 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 respondents from WiLCAS. The column (1) is based on the full sample of respondents interviewed during phase 1 of the survey, which was designed to be nationally representative. The mean female age at marriage is 16.4 years, and mean years of schooling is 5.2 years. Column (2) 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 that, for most parental background variables, the difference in mean between the

[3] 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.

[4] Two sisters who were traced during phase 2 were unable to complete the interviews because of disabilities.

full sample and subsample is not statistically significant. There is a statistically significant difference in mean age (1 year), mean mother s education (0.18 years) and mean of father's landholdings (0.073 acres) but the absolute differences are relatively small. There is also no statistically significant difference in the number of brothers but, as we would expect, we find relatively large differences in the number of sisters (0.82 years). Due to these differences, we report results for both the full sample of respondents and the subsample of sister groups in the subsequent analysis.

Table 1: Summary statistics

	Full sample	Phase 1 respondents	Phase 1 respondents with sisters in phase 2	Difference (p-value)	
Father's education	2.960 (3.865)	2.943 (3.872)	2.892 (3.853)	0.051 (0.68)	
Mother's education	1.612 (2.760)	1.62 (0.035)	1.44 (0.171)	0.18 (0.04)	*
Father employed in a low-paying activity	0.196 (0.397)	0.211 (0.005)	0.217 (0.011)	-0.006 (0.64)	
Father's landholdings	1.014 (0.830)	0.999 (0.010)	1.072 (0.024)	-0.073 (0.01)	**
Respondent's age	29.15 (5.705)	29.09 (0.071)	30.037 (0.152)	-0.947 (0.00)	***
Respondent's years of education	5.253 (3.785)	5.233 (0.047)	5.074 (0.128)	0.159 (0.18)	
Respondent's age at marriage	16.462 (2.695)	16.427 (0.034)	16.335 (0.078)	0.092 (0.28)	
Number of siblings	5.488 (2.220)	5.283 (0.027)	6.083 (0.060)	-0.8 (0.00)	***
Number of sisters	3.293 (1.557)	3.097 (0.019)	3.916 (0.040)	-0.819 (0.00)	***
Number of brothers	2.195 (1.465)	2.185 (0.018)	2.167 (0.043)	0.018 (0.70)	
Observations	7,854	6,292	1,192		

Source: 2014 WiLCAS and Authors' Calculations

Note: The table shows the mean of the listed variables for the full sample, the sample of respondents in Phase 1 of the survey (which was designed to be nationally representative), and the sample of Phase 1 respondents whose sisters were tracked in Phase 2. 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.

Next, we investigate whether and to what extent the age at menarche varies by parental and individual characteristics of the respondents. Figure 1 shows the mean age at 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 at 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 at 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.

Figure 1: Age at menarche and parental background

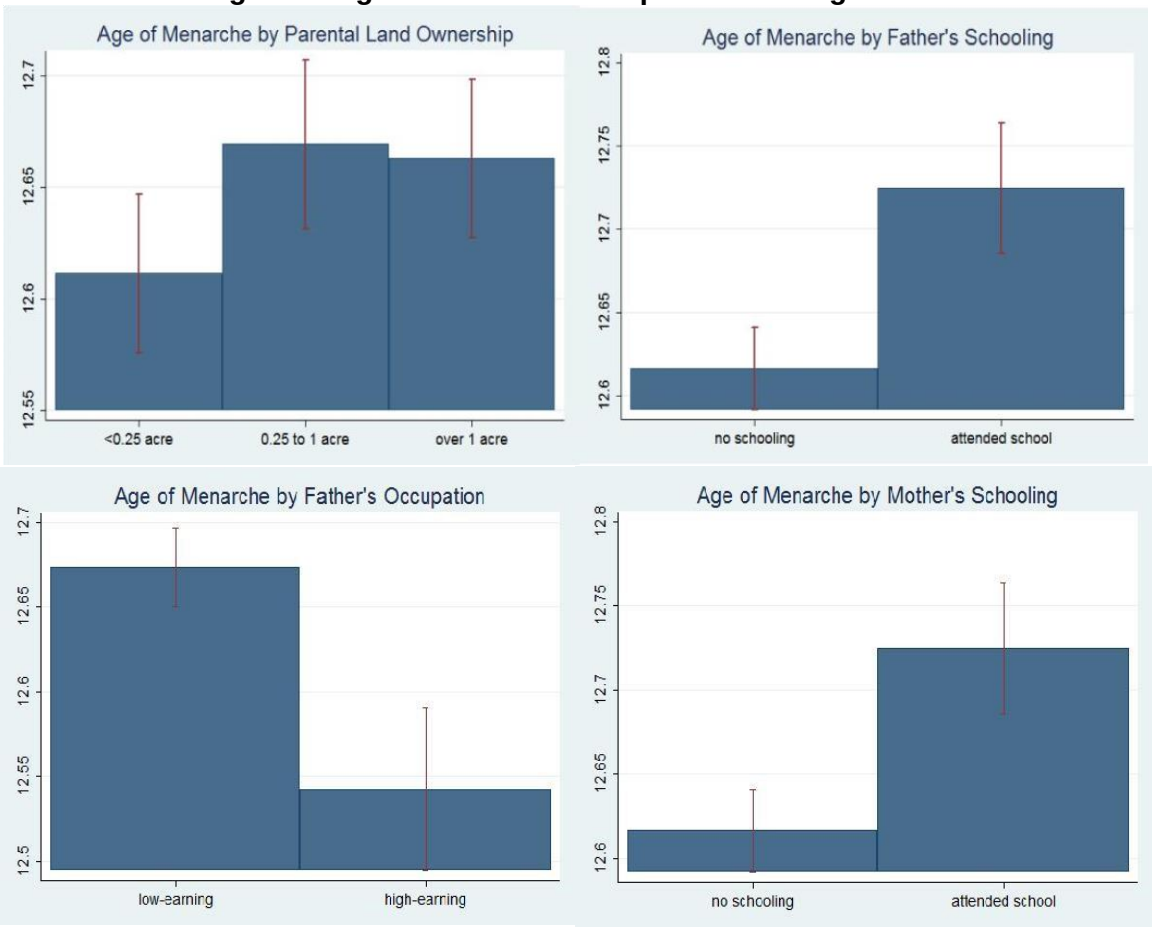


Figure 1 shows the mean age at menarche, together with 95% confidence intervals, for female respondents to the 2014 WiLCAS, by different parental characteristics.

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 six questions about the appropriateness of female employment outside of the household and male help with domestic work. We constructed 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.[5] (The full set of statements and questions are provided in Table 3.) We also use the 16 responses to construct an alternative measure of attitudes using principal-components analysis (PCA) based on the procedure developed by Filmer and Pritchett (2001) (henceforth, we refer to this measure as the PCA index). 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 2.

Table 2: Agreement with statements reflecting traditional gender norms for adolescents

	%
Should there be any differences between sons and daughters enjoying facilities at home? (% Yes)	17.6%
Who makes a greater contribution to the economic development of the family? (% Son)	55.7%
Who needs more food among household members? (% Males or boys)	49.5%
Who needs more education between sons and daughters? (% Sons)	19.7%
It is difficult for a woman to have a good relationship with her husband if she works outside (% Agree)	39.8%

[5] 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.

Source: 2005 Bangladesh Adolescent Survey and Authors' Calculations

Table 3: Agreement with statements reflecting traditional gender norms

Statement	% agree
1. Boys require more nutrition than girls to be strong and healthy.	40.2%
2. School education is more important for boys than for girls.	37.0%
3. University education is more important for boys than for girls.	46.1%
4. A wife ought to be less educated than her husband.	55.2%
5. When a woman is engaged in work out side of the home, her children suffer because they deprived of their mother's attention.	87.2%
6. A woman should not earn more than her husband as this can cause tensions within the household.	65.5%
7. A husband should have final say in all important family matters.	39.1%
8. There are some circumstances in which a husband is justified in using physical violence against his wife.	27.7%
Statement	**% disagree**
9. Outdoor sports are important for the health and wellbeing of adolescent girls just as it is for boys.	44.9%
10. There are some circumstances in which a woman is right to ask for divorce from her husband.	42.4%
11. It is appropriate for a woman to take up employment outside of the household before marriage.	71.5%
12. It is appropriate for a woman to take up employment outside of the household before giving birth to a child.	63.5%
13. It is appropriate for a woman to take up employment outside of the household when she has young children.	26.1%
14. A husband should help his wife make the bed in the morning.	79.2%
15. A husband should help his wife with cooking when she is sick.	92.7%
16. A husband should help his wife when she is busy collecting/harvesting/threshing crops.	94.7%

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.

The 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 de ned 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 lifechanging 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.

Table 4: Characteristics of respondents' social network

	Friends, neighbours, role models		Extended family	
Individuals in respondents' social network who:	mean	% with none	mean	% with none
- completed secondary school	0.749 (1.09)	55.60	0.713 (0.956)	52.32
- remained unmarried until completion of secondary school	0.685 (1.06)	59.06	0.656 (0.931)	55.95
- used contraception before birth of first child	0.383 (0.741)	73.44	0.314 (0.630)	75.54
- engaged in an income-generating activity	0.33 (0.697)	76.18	0.28 (0.589)	77.73
- made at least one of the above choices	0.959 (1.18)	45.49	0.834 (0.994)	45.07

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 errors 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. Standard errors are in parentheses.

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 the views expressed in the marital household. So marriage timing may have an effect on attitudes towards traditional social norms, regardless of the views of the members 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 the age at 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 socioeconomic 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 $g = (g_1, g_2 \ldots g_k)$ (vector of groom attributes). We denote by $\Omega(a,\mathbf{X}_j)$ the choice set of potential marriages (ie 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 $\boldsymbol{y} = (e, n, s)$ to summarise these outcomes. Given that attitudes can be shaped by a number of other factors as discussed above, we let $s = \hat{s}(a, e, \boldsymbol{g}, n)$. Similarly, let $e = \hat{e}(a)$ and $n = \hat{n}(a, e, \boldsymbol{g})$.[6]

The optimisation problem can be written as

$$\max_{a,g} U_j\big(a, \boldsymbol{y}\big(a, \boldsymbol{X}_j\big), g; \boldsymbol{X}_j\big)$$

subject to

$$g \in \boldsymbol{\Omega}\big(a, \mathbf{X}_\mathrm{j}\big)$$

$$a \geq \underline{a}_j$$

where $U_j(.)$ 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 at menarche. In our empirical analysis, our goal is to estimate ds/da at $a = \underline{a}_j$; ie how, for individuals for whom the age at menarche is a binding constraint, an increase in the age at marriage affects attitudes towards traditional gender norms. There are multiple channels through which the age at marriage can potentially affect attitudes, as shown below:

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

[6] 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.

Therefore, to identify the channel through which age at marriage affects attitudes, we also aim to estimate $\frac{\partial \hat{e}}{\partial a}|_{a=\underline{a}_j}$, $\frac{\partial \hat{n}}{\partial a}|_{a=\underline{a}_j}$ and $\frac{\partial g_l}{\partial \underline{a}_j}|_{a=\underline{a}_j}$ for $l = 1,..,k$. Note that the equation involves the direct effect of the age constraint as opposed the age at marriage on groom characteristics. This is because 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 at marriage affect their attitudes towards traditional gender norms. As there are several pathways through which age at marriage may affect these attitudes, 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 socioeconomic 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 their attitudes towards traditional gender norms which, as shown in the subsequent analysis, is strongly in 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. To resolve this problem, we follow the recent literature by using the age at menarche as an IV for the age at first marriage (Field and Ambrus 2008; Sekhri and Debnath 2014; Chari et al 2017). We discuss in the next subsection the potential issues with this IV strategy. The first stage and second stage equations are as follows:

First stage: $$a_{ij} = \alpha_0 + \boldsymbol{X}_i\boldsymbol{\beta} + \boldsymbol{I}_{ji}\boldsymbol{\gamma} + \zeta m_{ji} + \delta_{d(ji)} + \theta_i + \varepsilon_{ji}$$

Second stage: $$y_{ij} = \alpha_0 + \boldsymbol{X}_i\boldsymbol{\beta} + \boldsymbol{I}_{ji}\boldsymbol{\gamma} + \lambda m_{ji} + \delta_{d(ji)} + \theta_i + \varepsilon_{ji}$$

where a_{ji} is age at marriage for individual j from family i; m_{ji} is the age of menarche; $\boldsymbol{X_i}$ is a vector of family characteristics parental education, occupation, assets, religion; $\boldsymbol{I_{ji}}$ is a vector of individual characteristics year of birth and sibling birth order; θ_i are sibling fixed effects (FE), $d(ji)$ are district of birth dummies; and y_{ji} is the outcome variable schooling, partner attributes, etc.

It is reasonable to suppose that the marriage timing decision and the choice of husband are made concurrently rather than sequentially (as in the conceptual framework in Section 3). Therefore, it is unclear how 2SLS estimates for the effect of marriage age on groom characteristics and terms of marriage should be interpreted. However, it is meaningful to ask how social constraints on marriage timing due to the age at menarche rule affects these outcomes. Therefore, we also provide reduced form estimates for the groom characteristics and the terms of marriage as follows:

Reduced form: $$g_{ij} = \alpha_0 + \boldsymbol{X}_i\boldsymbol{\beta} + \boldsymbol{I}_{ji}\boldsymbol{\gamma} + \boldsymbol{\zeta} m_{ji} + \delta_{d(ji)} + \theta_i + \varepsilon_{ji}$$

where g_{ji} stands for the groom's education, occupation, parental assets, etc.

4.1. Validity of the instrumental variable strategy

The rationale for using the age at menarche as an IV for age at 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). On the other hand, marriage before puberty, while it exists, is increasingly rare in these societies. Figure 2 shows, for our full sample of respondents, the distribution of the difference between age at marriage and at 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 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.

Figure 2: Age at menarche and age at marriage

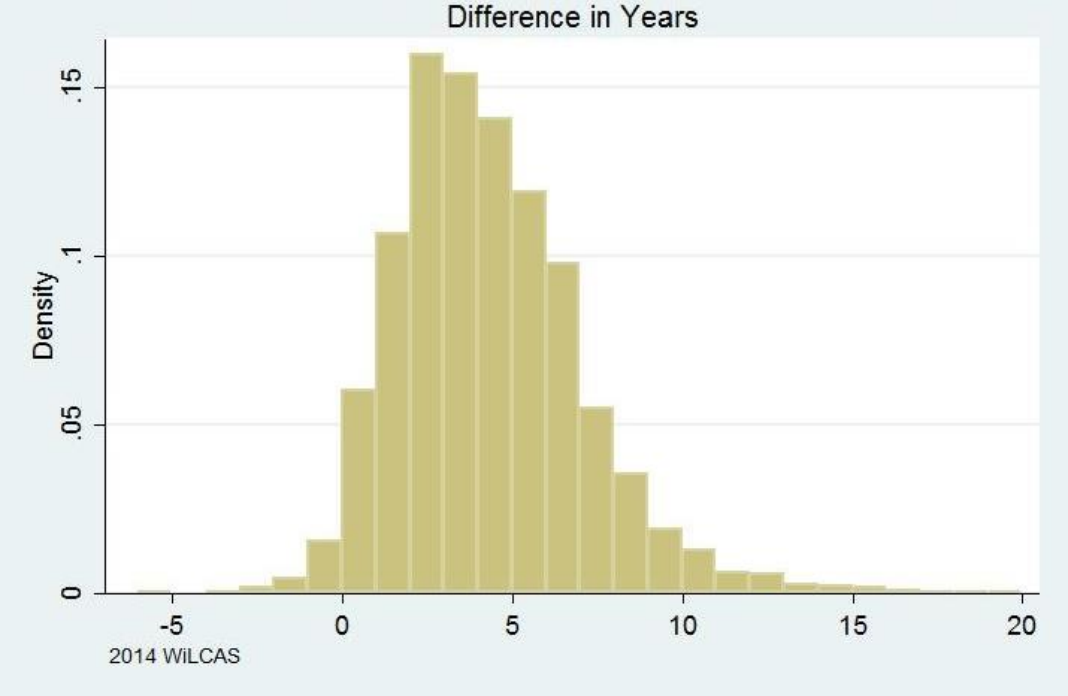


Figure 2 shows a histogram of the gap between age at marriage and age at menarche for female respondents in the 2014 WiLCAS.

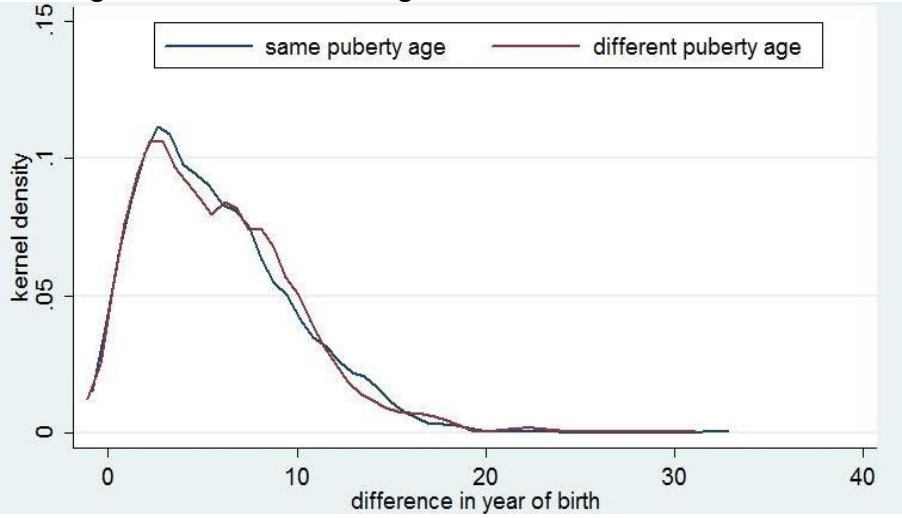
However, the age at which women attain puberty may be determined by other factors that directly affect marriage timing. If so, our proposed IV would not satisfy the exclusion restriction. Based on their review of the medical literature on the determinants of the age at menarche, Field and Ambrus (2008) 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.[7] 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 family fixed effects. Any variation in the timing of menarche due to differences in socioeconomic 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.

If this hypothesis holds true, we should expect larger differences in age at 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 at 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 at menarche in a further 46.8% of cases, a two year difference in 13.8% of cases, and a difference of 3 of more years in 4.9% of cases. In Figure 3, 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.

Figure 3: Difference in age at menarche between sisters



Source: 2014 WiLCAS and authors' calculations. Figure 3 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.

[7] See also Sekhri and Debath (2014) and Chari et al (2017) for further discussions of this literature.

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 4, the variation in the age at 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 at 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). Given these patterns, it is unlikely that the variation in the timing of menarche between sisters is driven by differences in birth order, birth cohort or exposures to different household shocks.

Nevertheless, following Sekhri and Debnath (2014), we include fixed effects for the respondent's birth year in our estimation to account for the possibility that "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).

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).

Figure 4: Age at menarche and individual characteristics

Figure 4 shows the mean age at menarche by birth order and by year of birth, together with 95% confidence intervals, for respondents to the 2014 WiLCAS.

4.2. Effect of menarche on adolescent attitudes

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 the hypothesis holds true, then the empirical strategy described in the previous section would pick up the direct effects of the onset of menstruation 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 at marriage. The 2014 WiLCAS, used in the main analysis, includes female respondents only between the ages 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 socioeconomic background. In our analysis, we restrict the sample to girls below the age of 18.

In Table 5 column (1) we report estimates of 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 5 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. For the estimates in columns (1) and (2), we assume a linear relation between the dependent variable and the birthyear. To control better for cohort effects, we replace the continuous year of birth variable with year of birth dummies in columns (3) and (4). The estimates we thus obtain are similar to those in columns (1) and (2).

The estimates in Table 5 do not support the hypothesis that early onset of menarche has a direct effect on attitudes towards traditional gender norms. Therefore, there is no

evidence that the age at menarche violates the exclusion restriction. By contrast, the estimated coefficient of the marriage variable albeit endogenous suggests that the event of marriage has a significant effect on these attitudes, increasing agreement with traditional gender norms. In the next section, we estimate these effects within an IV framework.

Table 5: Estimated effect of menarche and marriage on adolescents attitudes towards gender norms

	(1)	(2)	(3)	(4)
Age at menarche	-0.0007 (0.030)		-0.0073 (0.031)	
Menarche dummy		-0.094 (0.058)		-0.133* (0.068)
Married	0.166** (0.145)	0.148** (0.064)	0.174** (0.073)	0.166** (0.068)
Year of birth controls	Linear	Linear	Year dummies	Year dummies
Sample	Experienced menarche	All adolescent girls	Experienced menarche	All adolescent girls

Source: 2005 Bangladesh Adolescent Survey and Estimates by Authors

Note: Each regression includes controls for family background and village of residence. Statistical significance is denoted by ** (5% level) and * (10% level)

5. Results

First stage estimates: Estimates of the first stage equation in (5) are reported in Table 6. 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 the onset of menstruation postpones marriage, on average, by 0.403 years (with a standard error of 0.034). In comparison, the corresponding estimate obtained by Field and Ambrus (2008), using the 1996 Matlab Health and Socioeconomic Survey for Bangladesh, is 0.74 years. The weaker effect obtained for the 2014 WiLCAS may be due to the fact that incidence of marriage around the age of puberty has diminished in Bangladesh in the past two decades such that menarche is less likely to be a binding constraint for the respondents in our sample.

Table 6: First stage equation for age at marriage

	Dependent variable: age at marriage					
	Full sample		Sister sample		Sister sample	
	(1)		(2)		(3)	
Year of birth	0.0426	***	0.0333	*	0.0311	
	(0.0101)		(0.0196)		(0.0278)	
Age at menarche	0.403	***	0.569	***	0.515	***
	(0.034)		(0.060)		(0.0726)	
Younger sister within 4 yrs	-0.317	***	-0.380	***	-0.331	***
	(0.0584)		(0.0822)		(0.108)	
Older sister within 4 yrs	0.146	**	0.115		0.368	***
	(0.0679)		(0.097)		(0.121)	
Father's education	0.021	**	0.006		--	
	(0.001)		(0.0163)			
Mother's education	0.100	***	0.121	***	--	
	(0.0143)		(0.0259)			
Sister fixed effects	--		No		Yes	
Observations	7328		2530		2530	
F-Test (coefficient of menarche age = 0)	137.10		89.10		50.22	

Note: 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 of birth dummies. Errors are clustered at the subdistrict level. Statistical significance is denoted by ** (5% level) and *** (1% level)

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 menarche is being driven by unobserved socioeconomic 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 at marriage and the age at menarche is not being driven by unobserved socioeconomic 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 7 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 1990s have 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. This highlights the importance of using sister fixed effects to estimate the effects of the age at marriage on other outcomes.

For the purpose of comparison, we also report estimates of the effects of marriage age on age at first child birth in Table 7. With the full sample, we find that a one-year delay in age at 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 family fixed effects makes little difference to the estimated effect.

Table 7: Estimated effects of marriage postponement on schooling, child birth

	OLS	2SLS	2SLS	2SLS-FE
	(1)	(2)	(3)	(4)
Schooling	0.305***	0.726***	0.625***	0.422***
	(0.147)	(0.098)	(0.109)	(0.124)
Sister fixed effects	--	--	No	Yes
Sample	Full	Full	Sister	Sister
Observations	7329	7328	2530	2496
Age at first childbirth	0.716***	0.974***	0.821***	0.957***
	(0.019)	(0.135)	(0.158)	(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)

Onset of menstruation 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. Following the discussion in Section 3, we provide reduced form estimates of the effect of age at menarche on the husband's characteristics, rather than 2SLS estimates. 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 she chooses herself). Given that the marriage timing decision and the choice of husband are made concurrently rather than sequentially, it is unclear how the 2SLS estimates should be interpreted.

The full sample OLS estimates, shown in column (1) in Table 8 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 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.

Table 8: Reduced form estimates of age at menarche on husband's characteristics

	Full sample	Sister sample	Sister sample (FE)
	(1)	(2)	(3)
Husband's schooling	0.303***	0.364***	0.165*
	(0.0499)	(0.0805)	(0.0955)
Husband in low-earning occupation	-0.0089*	-0.0189**	-0.0027
	(0.005)	(0.008)	(0.011)
Father-in-law landholdings	0.0455**	0.0351	-0.0253
	(0.0217)	(0.0510)	(0.0673)

Note: Column (1) also includes controls for parental landholdings, father's occupation, religions and total number of siblings and sisters. All regressions 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).

Effect of early marriage on social networks and gender norms: Table 9 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). A one year delay in marriage also reduces her agreement with statements expressing traditional gender norms (significant at the 1% level for both the PCA index and the count-based measure).

The 2SLS-FE estimates for traditional gender norms are nearly identical to the 2SLS estimates for the sisters' sample and statistically significant. In the case of the social network measures, the 2SLS estimates are smaller in magnitude than the 2SLS estimates and statistically insignificant in the case of the binary measure. But the differences between the two sets of estimates are not statistically significant. Thus, we find evidence that early marriage adversely affects a woman's social network and also results in more traditional views regarding gender norms.

Table 9: Estimated effect of marriage postponement on gender norms, social networks and purdah practice

	OLS	2SLS	2SLS Sister Sample	2SLS Sister FE
	(1)	(2)	(3)	(4)
Agreement with traditional gender norms (Count)	-0.072***	-0.374***	-0.447***	-0.447***
	(0.011)	(0.090)	(0.103)	(0.167)
Agreement with traditional gender norms (Index)	-0.027***	-0.084**	-0.118***	-0.105*
	(0.004)	(0.032)	(0.036)	(0.056)
Social network (1 = progressive choice, 0 = none)	0.149***	0.0482***	0.0437***	0.0356
	(0.0022)	(0.0156)	(0.0169)	(0.0274)
Social network (# making progressive choices)	0.0348***	0.151***	0.129***	0.122*
	(0.0052)	(0.0367)	(0.0441)	(0.0681)
Purdah practice	0.0018	0.0116	0.0031	-0.0017
	(0.0016)	(0.0124)	(0.0121)	(0.0192)
Purdah for religious or social reasons	-0.0021	-0.0101	-0.0079	-0.0088
	(0.0018)	(0.0131)	(0.0139)	(0.0224)

Note: Columns (1) and (2) also include controls for parental landholdings, father's occupation, religions and total number of siblings and sisters. All regressions 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)

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 10 column (1) we report 2SLS estimates for gender norms in the subsample of women who have never attended school. As primary school enrollment occurs before the typical age at menarche, school enrollment can be regarded as exogenous to the timing of puberty. The estimated effects are statistically significant and, in fact, larger in magnitude than the full sample estimates reported in Table 9 (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 10 column (2) 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.[8] 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.

In Table 10 columns (3)-(8) we provide 2SLS estimates for the full sample, and 2SLS and 2SLS-FE estimates for the sisters' sample, where binary variables indicating no schooling, and the presence of elder sisters who made progressive choices, are interacted, in turn, with marriage age.[9] Across specifications, we find consistently that the absence of schooling weakens the effect of later marriage on gender norm attitudes (positive and statistically significant interaction coefficient). In other words, schooling is a complement of later marriage as far as their effects on gender norm attitudes are concerned. The corresponding estimates in the case of sisters who made progressive choices are weaker (statistically significant only when fixed effects are introduced) but suggestive that the presence of elder sisters making progressive choices weakens the effect of later marriage on gender norm attitudes; that is, a progressive social network is a substitute of later marriage as far as their effects on gender norm attitudes are concerned.

[8] More precisely, the decisions of elder sisters are, arguably, exogenous to the respondent's age at marriage. To test the validity of this argument, we estimate the effect of the respondent's age at marriage on progressive choices within her own (pre-marital) family and find no effect. Results are available upon request.

[9] We use the age at menarche, and the binary variable interacted with the age at menarche, as instruments for early marriage, and the binary variable interacted with early marriage, in the first stage regressions.

Table 10: Estimated effect of marriage postponement on gender norms via schooling and social networks

	2SLS	2SLS	2SLS	2SLS	2SLS-FE	2SLS	2SLS	2SLS-FE
	(1)	(2)	(3)	(5)	(6)	(4)	(7)	(8)
Dependent variable: agreement with traditional gender norms (Count)								
Age at marriage	-0.533** (0.224)	-0.454** (0.200)	-0.356*** (0.092)	-0.436*** (0.101)	-0.382*** (0.166)	-0.374*** (0.092)	-0.453*** (0.105)	-0.412*** (0.163)
Age at marriage x no schooling	--	--	0.024*** (0.006)	0.018* (0.011)	0.024 (0.015)	--	--	--
Age at marriage x older sister school/work	--	--	--	--	--	0.001 (0.004)	0.015** (0.006)	0.032*** (0.011)
Sample	No schooling	Older sister school/work	Full	Sisters	Sisters	Full	Sisters	Sisters
Observations	1906	1126	7328	2530	2496	7292	2519	2480
Dependent variable: agreement with traditional gender norms (Index)								
Age at marriage	-0.170** (0.081)	-0.119 (0.073)	-0.072** (0.033)	-0.111*** (0.036)	-0.084 (0.056)	-0.840** (0.033)	-0.119*** (0.037)	-0.094* (0.055)
Age at marriage x no schooling	--	--	0.015*** (0.002)	0.011*** (0.004)	0.009* (0.005)	--	--	--
Age at marriage x older sister school/work	--	--	--	--	--	-0.000 (0.001)	0.004 (0.002)	0.009** (0.004)
Sample	No schooling	Older sister school/work	Full	Sister	Sister	Full	Sister	Sister
Observations	1906	1126	7328	2530	2496	7292	2519	2480

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)

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 8 suggest not, as girls who are constrained to marry later due to delayed onset of menstruation do not end up with significantly different groom characteristics compared to those who experience earlier menarche. However, we have considered only a limited set of characteristics of the marital household in Table 8. 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 are required to use purdah when they go out. In this context, *purdah* refers to the use of clothing to cover the wearer's hair, face or hands as a sign of modesty or an outer garment worn over the wearer's ordinary clothing for the same reason. The advantage of this measure is that it refers to the rules imposed by the household rather than the personal choice of the respondent.[10] 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 penultimate row in Table 9 shows the estimated 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. Columns (1) and (2) 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.[11]

[10] 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 eg the *niqab* and *hizab* are specific to Islam while purdah, if defined in broad terms, is practised across religions in the region.

[11] We also find that controlling for purdah practice does not significantly change the estimated effect of the age at marriage on attitudes towards gender norms. Results are not reported but available upon request.

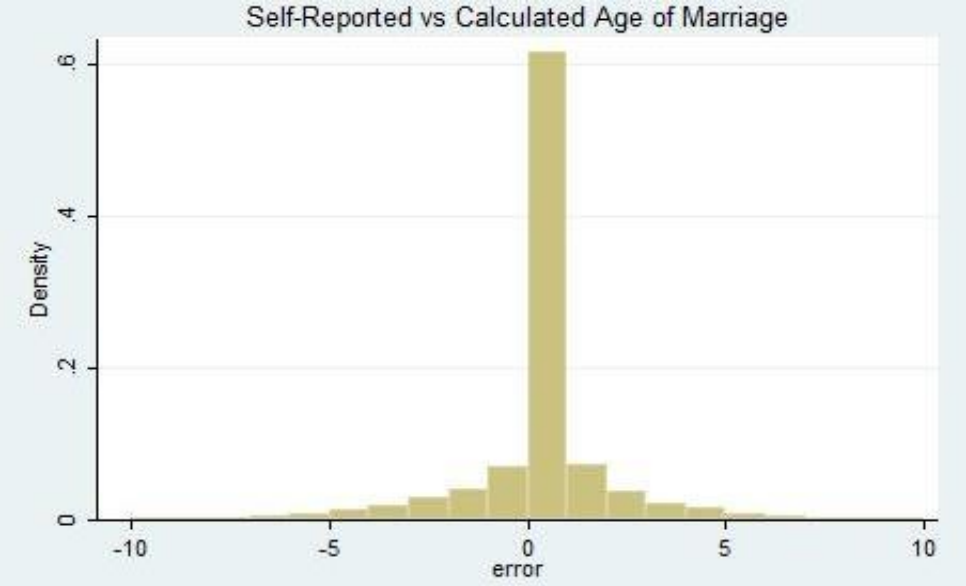
7. Measurement error and reporting bias

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 7 and 9). 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 socioeconomic 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) measurement error in the age at marriage.

A potential concern in the case of measurement error is reporting bias in the age at 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 at 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 at 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.[12] 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 at marriage. Therefore, we conclude that the reported marriage age in WiLCAS is unlikely to be influenced by reporting bias.

[12] 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.

Figure 5: Distribution of differences between reported age at marriage and alternative measure



Source: 2014 WiLCAS and authors' calculations. Figure 5 shows a histogram of the difference between the reported age at 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).

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.[13] To investigate this concern, we follow Field and Ambrus (2008) and compare the distribution of reported age at 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 socioeconomic factors in the parental household. These same factors, as noted in Section 2.3, may have a small effect on the age at 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 at menarche for the two subsamples. As expected, the distribution of the age at 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 at 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 puberty.

[13] Nevertheless, Field and Ambrus (2008) argue 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.

Figure 6: Distribution of age at marriage and age at menarche

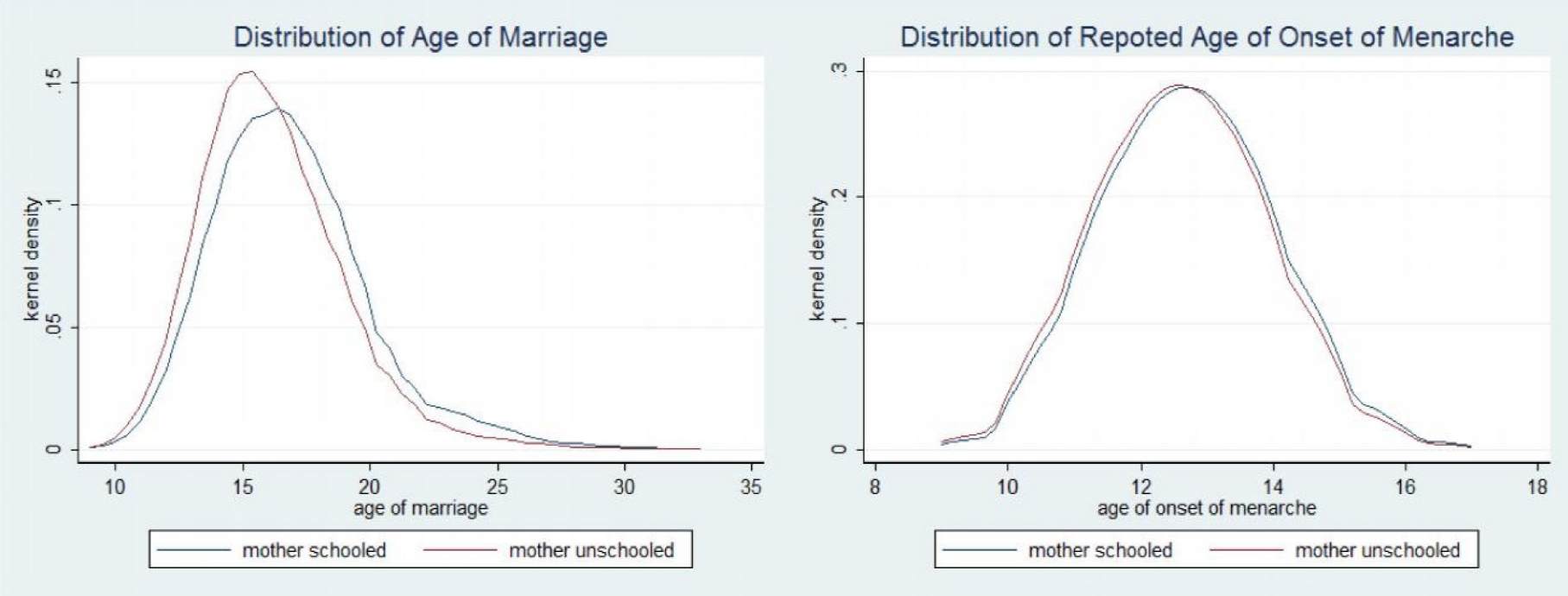


Figure 6 shows the distribution (Epanechnikov kernel, bandwidth=1) of reported a menarche for the sample of women aged 25-39 years, who experienced the onset of menarche between the ages of 10 and 16. Source: 2014 WiLCAS and authors' calculations.

8. Conclusion

In this paper, 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 decisionmaking and resource allocation within the household, they can have important consequences for household members including investment in children and economic participation of adults. We find that early marriage increases agreement with statements supportive of gender bias in the allocation of resources and traditional gender roles. 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 of and interviews of sisters of a subset of respondents. This approach allows us to control for beliefs and attitudes that are transmitted from parents to children.

The onset of menstruation 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 their groom/husband, and, potentially, socialisation within the parental household (from the time of 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 the 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. Our analysis also suggests that schooling is a complement and better quality social networks a substitute of marriage postponement in shaping attitudes towards traditional gender norms. We find no evidence that early onset of menstruation directly leads to increased agreement with traditional gender norms, implying that our estimated effects are due to the socialisation of young girls within the marital household rather than the parental household.

References

Amin, S., S. Ainul, F. Akhter, M.M. Alam, M. I. Hossain, J. Ahmed, U. Rob (2014). From Evidence to Action: Results from the 2013 Baseline Survey for the Balika Project. Population Council.

Amin, S., S. Mahmud, and L. Huq (2002). Kishori Abhijan: Baseline Survey Report on Rural Adolescents in Bangladesh. Ministry of Women and Children Affairs, Dhaka, Government of the People's Republic of Bangladesh.

Asadullah, M.N. and N. Chaudhury. (2009). "Reverse Gender Gap in Schooling in Bangladesh: Insights from Urban and Rural Households", Journal of Development Studies, Vol. 45(8), pp. 1360-1380.

Asadullah, M.N. and Z. Wahhaj. (2016). "Missing from the Market: Purdah Norm and Women's Paid Work Participation", IZA Discussion Paper Series, #10463, December 2016.

Chari, A.V., R. Heath, A. Maertens, F. Fatima (2017). "The Causal Effect of Maternal Age at Marriage on Child Wellbeing: Evidence from India", Journal of Development Economics, Vol. 127, pp. 42-55.

Drèze, J. and A. Sen (2013). An Uncertain Glory: India and Its Contradictions. Princeton University Press.

Dube, L. (1997). Women and Kinship: Comparative Perspectives on Gender in South and South-East Asia. United Nations University Press Ltd. Tokyo.

Eriksson, L. (2015). "Social Norms Theory and Development Economics", Policy Research Working Paper 7450, Background Paper to 2015 World Development Report, World Bank Group.

Fafchamps, M. (2011). "Development, Social Norms, and Assignment to Task." Proceedings of the National Academy of Sciences, Vol. 108 (Supp. 4), pp. 21308-21315.

Field, E. and A. Ambrus. (2008). "Early Marriage, Age of Menarche and Female Schooling Attainment in Bangladesh", Journal of Political Economy, Vol. 116(5), pp. 881-930.

Filmer, D., and L. H. Pritchett. (2001) "Estimating wealth effects without expenditure data or tears: an application to educational enrollments in states of India." Demography 38(1), pp. 115-132.

Gani. Md. S. (2007) Geographical and Socio-economic Differences and Determinants in Knowledge and Occurrence of Sexually Transmitted Infections of Adolescents in Bangladesh, Masters Thesis in Public Health, Ume University, Ume , Sweden. (Accessed at http://dataportal.popcouncil.org/CatalogandDownload.aspx?CID=32)

Glick, P., C. Handy and D. Sahn, (2015). Schooling, Marriage and Age of First Birth in Madagascar, Institute for the Study of Labor (IZA) working paper no No 8795.

Heath, R., & Mobarak, A. M. (2015). "Manufacturing growth and the lives of Bangladeshi women", Journal of Development Economics, Vol. 115, pp. 1-15.

Hicks, J. H., & Hicks, D. L. (2015). "Lucky Late Bloomers? The Consequences of Early Marriage for Women in Western Kenya. The Consequences of Early Marriage for Women in Western Kenya" (June 23, 2015), mimeo, University of Oklahoma.

Jensen, R. and R. Thornton (2003). "Early Female Marriage in the Developing World", Gender and Development, Vol. 11(2), pp. 9-19.

Mabsout, R. and Van Staveren, I. (2010). "Disentangling Bargaining Power from Individual and Household Level to Institutions: Evidence on Women's Position in Ethiopia". World Development, Vol. 38(5), pp.783-796.

Maertens, A. (2013). "Social norms and Aspirations: Age of Marriage and Education in Rural India." World Development, Vol. 47, pp. 1-15.

NIPORT (2013). Bangladesh Demographic and Health Survey 2011. NIPORT, Mitra and Associates and ICF International. Dhaka, Bangladesh, and Rockville, Maryland, USA.

Ortner, S.B. (1978). "The Virgin and the State", Feminist Studies, Vol. 4(3), pp. 19-35.

Raj, A., L. McDougal, M. Rusch. (2012). "Changes in Prevalence of Girl Child Marriage in South Asia", American Medical Association, Vol. 307(19), 16 May 2012.

Schurmann, A. T. (2009). "Review of the Bangladesh Female Secondary School Stipend Project using a social exclusion framework", Journal of Health, Population, and Nutrition, Vol. 27(4), pp. 505-517.

Sekhri, S. and Debnath, S. (2014): Intergenerational Consequences of Early Age Marriages of Girls: Effect on Children's Human Capital, Journal of Development Studies, Vol 50, No 12, pp 1670-1686.

Streatfield, P.K., N. Kamal, K. Z. Ahsan & Q. Nahar (2015). "Early Marriage in Bangladesh", Asian Population Studies, Vol. 11(1), pp. 94-110.

Sunder, N. (2015). "Marriage Age, Social Status and Intergenerational Effects in Uganda. Social Status and Intergenerational Effects in Uganda", (November 29, 2015). Available at SSRN: http://ssrn.com/abstract=2655757

UNFPA (2012). Marrying Too Young: End Child Marriage. United Nations Population Fund.

Unicef (2001). Early Marriage: Child Spouses. Innocenti digest 7. Florence, Unicef. Innocenti Research Centre.

Vogl, T. (2013). "Marriage institutions and sibling competition: evidence from South Asia." Quarterly Journal of Economics, Vol. 128(3), pp. 1017-1072.

World Bank (2006). World Development Report. The World Bank, Washington DC.