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The Causal Effect of Early Marriage on Women's Bargaining Power: Evidence from Bangladesh

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Abstract

Early marriage restrains women's agency and bargaining strength in postmarital households, impairing their ability to make meaningful contributions to household decision making. This paper employs a comprehensive measure of women's empowerment in the domestic and productive spheres, and isolates the causal effect of age at marriage, instrumented by age at menarche, on their bargaining strength, using nationally representative data from Bangladesh. Results suggest that delayed marriages result in significantly higher empowerment scores and probability of being empowered for women, because of higher likelihood in achieving adequacy in their autonomy in agricultural production, control over income, ownership of assets and rights in those assets, and ability to speak in public. Favorable impacts of delayed marriage are also found on women's freedom of mobility, fertility choices, and their ability to decide on household expenses and investments, with the impacts likely coming via improvements in education and labor market outcomes when women married later.

JEL classification: J12, J16, O12, O15

Keywords: early marriage, bargaining power, women's empowerment, Bangladesh

1. Introduction

Early marriage continues to be a bane in developing countries, disproportionately burdening girls, with an estimated 650 million women alive today who were married before the age of 18 (UNFPA 2019). Bangladesh has the highest percentage of child marriage in the South Asian region at 59 percent, which also constitutes the fourth-highest prevalence of child marriage in the world, with 22 percent married before the age of 15 (UNFPA 2019). This amounts to be the second-highest absolute number of women married, or in a union, before the age of 18 globally, a worrying 4,382,000 women. Previous studies

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have shown early marriage to negatively affect the young brides' schooling attainment (Field and Ambrus 2008; Sekhri and Debnath 2014; Hicks and Hicks 2019), labor market participation (Joshi and Schultz 2007; Sunder 2019; Dhamija and Roychowdhury 2020), incidence of domestic violence (Roychowdhury and Dhamija 2021), and their health and the health of their children (Steer 2000; Goli, Rammohan, and Singh 2015; Chari et al. 2017). However, there is lack of substantial empirical evidence on the impact of age at marriage on marital quality in later life, in particular on women's agency in decision making within marriage. This study argues that premarital parental decisions to marry girls early restrain their bargaining strength and increase gender inequality in the households, impairing their abilities to make useful contributions to household decision making. This paper examines this relationship by isolating the causal effect of early marriage of young brides in rural Bangladesh on their agency and decision making. The analysis relies on the natural variation in age at menarche to instrument for women's age at marriage and estimates its effect on women's decision making capabilities in both the productive and domestic spheres, using a comprehensive set of indicators from a recently collected nationally representative dataset from rural Bangladesh.

Gender inequality is high in developing countries which can, at least partially, be explained by low bargaining power of women in influencing household decision making (Jayachandran 2015; Calvi 2020). In contrast, sufficient rigorous evidence exists on women's agency and decision making to affect outcomes through favorable intrahousehold allocation of resources. An abundance of studies reaffirm the role of women's agency, bargaining power and overall empowerment in creating a multifaceted impact on overall household well-being with respect to household, maternal, and child diet diversity; household, maternal, and child nutrition; infant and young child feeding (IYCF) practices; and poverty alleviation (see, e.g., Malapit and Quisumbing 2015; Malapit et al. 2015; Alaofe et al. 2017; Diiro et al. 2018; Sinharoy et al. 2018; Holland and Rammohan 2019; Ahmed and Tauseef 2022). Further, there exists evidence that women's decision-making capabilities may, in addition, affect many aspects of household production as well as the allocation of labor to activities such as housework, agricultural work, and wage work (Doss 2013; Sraboni et al. 2014). Therefore, the lack of ability of women to advocate for their preferences would impede the health and education of children and the general well-being of women and girls in the household (Goli et al. 2015; Malapit et al. 2015; Alaofe et al. 2017) and expose them to increased exploitation and violence (Doss 2013).

Despite its importance and relevance, empirical evidence on the impact of early marriage on women's decision making within the marriage remains largely understudied. Studies such as Field and Ambrus (2008), Chari et al. (2017), and Sunder (2019) briefly explore the nature of this relationship by relying on limited measures of agency in the marriage like women's mobility and their say in household decisions, and find mixed results, suggesting challenges in measuring women's agency and bargaining strength. Hence, there exists potential for more in-depth research on this hypothesis with use of more comprehensive measures of women's agency.

This paper attempts to bridge this gap in the literature by making several key contributions in examining this critical relationship. First, the paper uses nationally representative data from Bangladesh, where early marriage crises remain pervasive, and presents rigorous evidence that later marriage favorably affects agency and bargaining strength of women in the marriage. Second, the analysis employs holistic and validated assessments of women's agency in both the productive and domestic spheres in the household. It uses the Women's Empowerment in Agriculture (WEAI)[1] index to explore the productive sphere, which includes broad sets of measures across five domains of empowerment: production, resources, income, leadership, and time. Furthermore, using the subgroup decomposability of the WEAI, the study presents

1 The Women's Empowerment in Agriculture Index (WEAI) is jointly created, piloted, and validated by the Oxford Poverty and Human Development Initiative (OPHI) and the International Food Policy Research Institute (IFPRI). See Alkire et al. (2013) for further details.

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findings of differential impacts of delaying marriage on different dimensions of agency. Additionally, it uses measures of decision making on expenditure and control over money for expenses as well as decisions on fertility, mobility, and work to examine agency in the domestic sphere. Third, the analysis unpacks the channels that likely mediate the impact of early marriage on women's agency in the marriage. The paper postulates that curtailed education and employment opportunities are both by-products of early marriage, which give women lesser say in household decisions. Additionally, lower-valued assets are brought to the spousal households by younger brides, which adversely affects their bargaining strength in the marriage. Finally, the article provides evidence to both the internal and external validity of an econometric methodology, previously used in South Asian and Sub-Saharan African countries, by using a most recently collected nationally representative survey and presents some comparison with previous literature on the impact of early marriage.

The endogenous nature of the age at which parents marry their daughters in Bangladesh poses several econometric challenges in identifying its causal impact on women's agency in the marriage. Natal households' characteristics, such as bride's family wealth, parental education, and so on are all factors that determine both the timing of marriage (Kumari and Shekhar 2023) and contribute to women's agency and decision making capabilities. Moreover, gender norms that propagate the custom of early marriage in contexts such as those in Bangladesh, are likely to affect women's relative bargaining strength in the spousal households. Thus, a standard OLS estimation of the relationship would entail the results to be confounded by omitted variables bias. Furthermore, there exists potential for bias from reverse causality between women's agency and timing of marriage. It may be argued that an intrinsically empowered girl would delay the timing of her marriage to fulfill her educational and career aspirations. To address these identification concerns, an empirical strategy is employed, first proposed by Field and Ambrus (2008), where the natural variation of the age at which girls experience their first menstrual cycle, or their age at menarche, is used as an instrument for their age at marriage. The onset of menarche triggers concerns among parents in rural Bangladesh, as in other South Asian countries, to preserve their daughter's virginity, and by extension their perceived value in the marriage market. Therefore, menarche being a constraint on marriage prospects of young girls, its onset provides an exogenous quasi-random variation in the age at which a girl is married off by her parents, by creating a lower bound of entry into the marriage market.

Women's agency in the marriage is largely an unobservable characteristic and, therefore, poses econometric challenges when attempting to studying it. Therefore, an array of indices is used as proxies of women's bargaining strength, created from self-reported ability to make strategic life decisions in the household. For the analysis, the WEAI methodology is employed, which adopts a multidimensional approach to measuring women's empowerment, constructed to assess their decision making capabilities in the productive sphere. For a comprehensive measure of agency, the analysis further includes women's ability to decide on matters pertaining to the domestic sphere, including decisions on fertility, mobility, decision to work, and control over income, and decisions on, and control over, household expenses.

The findings suggest that a delay in marriage favorably affects a majority of the key indicators of women's agency that are considered in the analysis, both in the productive and domestic spheres. Among the indicators of agency in the productive sphere, the study finds that a one-year delay in marriage increases women's weighted empowerment score in agriculture by 3.9 percentage points or 0.27 standard deviations, in addition to an increase in the probability of her achieving empowerment status by 6.7 percentage points. Moreover, across the 10 subdomains of productive agency that were assessed, the study finds increased likelihood of women's autonomy in household production, ownership of, and rights in, assets, control over household income and public speaking abilities for a one-year increase in the women's age at marriage. Finally, results suggest a favorable impact of delaying marriage on women's agency in the domestic sphere, indicated by increased freedom of mobility and higher likelihood of making her own decisions to use birth control as well as in making important decisions of household investments on food, housing, education, and healthcare. To account for the channels that likely mediate these observed

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impacts, impacts of age at marriage on women's education attainment, ability to work outside home for pay, and the assets she brought to marriage are explored. Findings suggest positive and significant relationships between age at marriage and all three variables stated. A delay in marriage is found to increase the likelihood of women completing primary school (5.3 percent) and working for pay (5.8 percent) as well as increasing the likelihood of bringing assets to the spousal household, augmenting their agency in the husband's family.

The rest of the paper is structured as follows: section 2 outlines the early marriage context in Bangladesh and presents the conceptual framework. Section 3 presents the sample used in this paper, descriptions of the selected outcomes of interest, and the summary statistics. Section 4 outlines the empirical strategy and provides evidence towards the validity of the instrument. Section 5 presents the results, including robustness. Section 6 explores the possible channels of impact, and section 7 offers some concluding remarks.

2. Background and Conceptual Framework

2.1. Early Marriage Crises in Bangladesh

The prevalence of child marriage in South Asia is significantly higher than in other parts of the world with one-third of women between the ages of 20 and 24 married before the age of 18. Bangladesh has the highest percentage of child marriage in the region at 59 percent,[2] the second-highest absolute number of women married or in a union before the age of 18 globally. In comparison, only about 5 percent of boys are married before the age of 18 (NIPORT et al. 2013). Not much difference exists in the rate of prevalence of child marriage by location of residence, with child marriage moderately more common in rural areas where 60 percent of girls are married before age 18, compared to 55 percent in urban areas. According to UNICEF (2020), married girls in Bangladesh are over four times more likely to be out of school than unmarried girls with nearly 5 in 10 child brides giving birth before the age of 18 and 8 in 10 giving birth before the age of 20. Girls residing in rural areas and from poorer households are more at risk of child marriage and are less likely to have more than a secondary level of education. Ending child marriage can hold significant economic promise for Bangladesh. Wodon et al. (2017) estimated that ending child marriage in Bangladesh could result in a 12 percent increase in earnings and productivity for Bangladeshi women who married early.

The rate of decline in child marriage is slow in Bangladesh, decreasing from 73 percent in 1993–1994 to 65 percent in 2011 and, worryingly, has somewhat stagnated in recent years remaining constant at 59 percent in 2014 and 2017–2018 (NIPORT et al., 2020).[3] This is despite remarkable improvements in access to and cost of secondary schools for girls and increasing returns to female education in the labor market due to the growth of the ready-made garments sector (Heath and Mobarak 2015; Asadullah and Wahhaj 2019). At the same time, existing laws in place to curb early marriage have not been fruitful. The Government of Bangladesh have recently passed the Child Marriage Restraint Act (2017) as well as the National Plan of Action to End Child Marriage (2018–2019) in line with the government's commitment to eradicating child marriage altogether by 2041. However, such laws are not being enforced effectively and provisions such as allowing child marriage in "special cases" without defining what constitutes a special case have raised widespread concern.

2 Nepal follows at 40 percent. Similar rates prevail in other regions such as Africa, for example, where 49 percent girls are married by the age of 18 in Uganda (Sunder 2019).

3 The Covid-19 pandemic has further exacerbated the conditions related to child marriage with school closures, isolation from friends and support networks, service disruptions, economic stress, and parental deaths due to the pandemic putting vulnerable girls at increased risk of child marriage (UNICEF 2021).

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2.2 Conceptual Framework

Keeping within the context of rural Bangladesh, the causal link between age at marriage and women's bargaining power in the spousal household is conceptualized in the following ways. First, delaying marriage enables women to attain essential premarital resources. Evidence suggests that early marriage limits a girl's long-term welfare by disrupting her attainment of premarital enabling resources, for example, lost knowledge and skills from leaving school prematurely (UNICEF 2020). Evidence suggests that delay in the age at first marriage improves years of schooling (Field and Ambrus 2008; Hicks and Hicks 2019; Roychowdhury and Dhamija 2021), labor market outcomes (Yount, Crandall, and Cheong 2018; Sunder 2019), accumulation of economic assets (Amin and Al-Bassusi 2004), and expands her social networks beyond her kin group (Weinreb 2008). Additionally, early marriage increases the likelihood of economic impoverishment with Dahl (2010) estimating that women who marry earlier are 31 percentage points more likely to be in poverty when they are older. Wilson (2022) finds that raising the legal minimum age of marriage to 18 increases age at marriage, age at first birth, and the likelihood of employment in 17 low- and middle-income countries. The adverse impacts of early marriage on education outcomes and ability to be employed after marriage fail to equip the girls to advocate their preferences in household decision making, limiting their agency and overall bargaining strength in the spousal household.

Second, girls who marry early make smaller dowry payments to the groom's family. This is primarily because younger brides are valued more in conservative and rural communities in Bangladesh, as they have higher childbearing years remaining relative to older women. Wahhaj (2018) finds a negative relationship between the age and perceived quality of women on the marriage market, implying older brides make higher net marriage payments. Additionally, women's bargaining power in their relationship with their spouse and in-laws often arise out of conformity to social norms and expectations of dowry payments (Schuler et al. 1996; Rao 1997; Srinivasan and Bedi 2007), with a larger dowry reflecting greater social status (Srinivasan and Bedi 2007). On the other hand, smaller dowries can be met with dissatisfaction from in-laws and inability to fulfill post-marriage dowry requests can result in incidences of violence (Jejeebhoy and Cook 1997; Verma and Collumbien 2003). Therefore, women who marry early enter the marriage with low economic resources, making smaller dowry payments and, hence, enjoy limited decision making abilities in the household matters.

Third, women who marry younger are less likely to have control over fertility decisions and to avoid unwanted and terminated pregnancies (Raj et al. 2009). They are likely to bear children early, thereby increasing the risk of maternal mortality and other pregnancy-related complications, such as maternal anemia and preterm labor (Clark, Bruce, and Dude 2006; Nour 2006). These complications have negative consequences for the health of both the mother and child (Steer 2000; Goli, Rammohan, and Singh 2015). Delaying marriage improves health outcomes for women, such as weight-for-height, as seen in previous studies (McGavock 2021).

Finally, early marriage hampers key physical, cognitive, and psychosocial developments that occur during adolescence which are required for complex behavioral performance such as self-control, decision making, emotions, and risk-taking behaviors (Arain et al. 2013; John, Edmeades, and Murithi 2019). Further, young girls do not develop the ability to deal with adult roles and responsibilities, early pregnancy and related mortality and morbidity, as well as child-care issues, causing major physiological and psychological problems, resulting in isolation and loss of confidence, and ability to maintain a healthy relationship (Ahmed et al. 2013; Adekola, Akanbi, and Olawole-Isaac 2016). Women who marry later will have the time to attain self-esteem, self-efficacy, and a sense of entitlement and rights that enable them to negotiate on their own behalf in family economic decisions and decisions about work (Dixon-Mueller 2008; Taylor and Pereznieto 2014).

In sum, early marriage, being grounded in patriarchal notions of family honor, preservation of "purity," and women's "respectability" (Begum 2003; McDougal et al. 2018), may constrain the human, economic,

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and social resources that a woman brings to marriage, thus hampering her bargaining power in the spousal household.

3. Data

3.1 Sample

The data used in this paper come from the third round of the Bangladesh Integrated Household Survey (BIHS) conducted by the International Food Policy Research Institute (IFPRI). The BIHS is a multipurpose nationally representative survey that collects data from households in 325 randomly selected villages with probability proportional to their size. The sample is designed to be statistically representative of rural Bangladesh at the national level, and at the level of each of the nation's seven administrative divisions. The third round was conducted from January to June 2019 and covered 5,604 households throughout rural Bangladesh. The survey administered separate modules of questions to calculate various indicators of women's status as well as modules to estimate the Women's Empowerment in Agriculture Index (WEAI). Data are collected separately from a primary male respondent and a primary female respondent situated in two separate rooms to reduce bias in answering sensitive questions, such as the questions on empowerment and women's status.

From the 5,604 households who participated in the survey, the sample is restricted to ever-married women who answered the women's status and WEAI modules, that is, the primary female respondent from the household, which leaves a sample of 5,433 women. Furthermore, some households were dropped because the primary female respondent did not respond to all of the WEAI survey questions. Taking these cases of missing responses into account, the study arrived at a sample size of 4,899 women for the WEAI analysis. On the other hand, for indicators of education, assets brought to marriage, decision making and control over money in the domestic sphere, mobility, fertility, and ability to work, the full sample of 5,433 women who responded to the women's status modules is used. Finally, to test for associations between age at menarche and age at marriage, as a test of validity of the instrument for this paper, data was used from 7,143 women from the 5,604 households, which included multiple women from the same household answering the module on menstruation.

3.2 Outcomes of Interest

Chari et al. (2017) attribute challenges in measuring bargaining power as the main reason for the limited and mixed findings on the impact of delaying marriage on women's status in the household. The study addresses this concern by resorting to a comprehensive and validated measure of empowerment of women in the productive sphere (that is, agricultural activities of the household) using the WEAI, coupled with indicators of agency in decision making concerning household matters. Overall, the study's choice of outcomes reflects women's agency in both the productive and domestic spheres in their spousal households and, therefore, provides a more well-rounded observation of the variation in women's bargaining strength with timing of marriage compared to earlier studies. The analysis examines the following indicators of women's bargaining strength in marriage for two broad categories:

(a) ***Agency in the productive sphere:*** To quantify women's empowerment in the productive sphere, the study relies on the Women's Empowerment in Agriculture Index (WEAI). The WEAI is based on the agency aspect of Kabeer's (1999) definition of empowerment, which is relatively understudied compared to resources (such as income) or achievements (such as education), since it directly relates to issues of choice and decision making, which are difficult to measure (Quisumbing et al. 2020). In addition, the WEAI focuses on decision making in the productive and economic spheres, thus differing from other measures of empowerment, such as those available in the DHS, which typically focuses on the domestic spheres. Furthermore, the WEAI module administers identical questions for men and women which allows estimation of the gender gap of empowerment in the household (Alkire et al. 2013).

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The WEAI is an aggregate index based on individual-level data from primary male and primary female decision makers within the same households and is generated as a weighted average of two subindices: (1) the five domains of women's empowerment (5DE) score, and (2) the Gender Parity Index (GPI). The 5DE subindex measures the extent of individuals' engagement in the agricultural sector across five domains: (1) decisions over agricultural production, (2) access to and decision making power over productive resources, (3) control over use of income, (4) leadership in the community, and (5) time use. It assesses the degree to which women are empowered in these domains, and for those who are not fully empowered, the percentage of domains in which they are empowered. The 5DE empowerment score ranges between [0,1]. The five domains are weighted equally, each given a weight of 1/5. Across the five domains, there are 10 binary indicators, which are also weighted equally within each domain as described in table S2.1 in the supplementary online appendix: namely, Input in productive decisions; Autonomy in production; Ownership of assets; Purchase, sale, or transfer of assets; Access to and decisions on credit; Control over use of income; Group membership; Speaking in public; Workload; and Leisure. Specific thresholds are used for each indicator to create 10 binary indicators to determine whether an individual has "achieved adequacy." Consequently, a weighted average of the indicators yields an individual level 5DE score. An individual with a 5DE score above 0.8 is considered to be empowered: that is, she is empowered in roughly 4 out of the 5 domains included in the WEAI. Details regarding the construction and validation of the index can be found in Alkire et al. (2013).

Using the WEAI methodology, the primary indicators of empowerment used to reflect women's agency in the productive sphere are: (i) Individual **empowerment scores (5DE)**: the weighted average empowerment scores across the five domains of empowerment. This measure is continuous, increasing in empowerment, and ranges between [0,1]; (ii) **Women's Empowerment status**: binary indicator variable identifying the overall empowerment status, where a woman is defined as empowered (=1) if she has adequate achievements in four of the five domains: that is, she secures an individual score equal to or above 0.8; and (iii) **Empowerment gap**: Difference in the individual empowerment scores (5DE) of the primary male and the primary female in the same household. The gap is set to 0 for women who are identified as empowered, regardless of the status of the man, and missing if either respondent's score is missing. Low empowerment gap means low inequality in the household.

A vital axiomatic property of this multidimensional index is its subgroup decomposability: that is, it can highlight how many domains women are empowered in, and subsequently reveal the connections among areas of disempowerment. The study, therefore, further includes all 10 indicators that compose WEAI as dependent variables in the analysis, to gauge the relative impact of early marriage on woman's bargaining strength in 10 different dimensions.

(**b**) ***Agency in domestic sphere:*** The article includes additional indicators of agency of women in the domestic sphere in the analysis to better assess women's overall bargaining strength in the marriage. It looks at (i) whether the women can solely make decisions regarding expenditures on food, housing, healthcare, education, and clothing. In addition, it also looks at (ii) whether the women control the money needed to buy food from market, clothes, medicine, and toiletries/cosmetics for herself. These questions are similar to those presented in Sunder (2019) in the context of Uganda.

Impeding a woman's freedom of mobility is not only an infringement on her basic individual rights but also limits her economic and social capabilities which, in turn, affects her bargaining power. The analysis follows Chari et al. (2017) closely to construct two indices of freedom of mobility: namely, (iii) whether the women can go to places such as friends/family outside community, marketplace, hospital/doctor, cinema/fair, or NGO training program as well as (iv) whether she needs permission to go to the aforementioned places.

Family/societal pressure can restrict a woman's ability to work outside her house and spending her earnings which will limit her bargaining power. For labor market outcomes, similar to Chari et al. (2017), the analysis constructs a variable of (v) whether the woman can decide herself whether to work outside

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the house for cash. However, in many instances, even though women are engaged in productive activities outside of work, they may not have control over their own income and give it up to their husbands or in-laws. Therefore, the study constructs and explores an indicator of (vi) women's decision to work combined with self-reported control over income earned through activity.

Fertility choices through decision on use of contraceptives also has similar effects on the ability to engage in productive activities because of competing childcare responsibilities. To reflect the women's agency in the said decision making, the analysis constructs a binary indicator of (vii) whether the woman can decide by herself to use birth control.

3.3 Summary Statistics

Table 1 provides descriptive statistics used in the analysis for the full sample. The data reflect the national patterns for women in rural Bangladesh of early marriage and in most of the indicators shown in the table. The mean age of first marriage is 16.8 years, which is below the minimum age at marriage established by the state law, and the sample has extremely low levels of education with average years of schooling only around 3.7 years. The mean age at menarche in the full sample is 12.8 years. Over 60 percent of first marriages take place within four years of menarche. Less than 4 percent of women report prepubescent marriages, and the majority (63 percent) of these cases are those in which marriage precedes menarche by 1 year.

Using the WEAI methodology, described in the previous section, the analysis computes both the composite empowerment scores and the individual indicators of agency in the productive sphere. Specifically, it is found that around 47 percent of the women in the sample are empowered with an average score 0.75 on a scale of 0 to 1 (to be categorized as empowered, one has to have a score of 0.8 or higher). It is also found that the average empowerment gap between men and women in the same household, that is, the mean difference in empowerment scores of the primary men and women, is 0.041.[4] Further analysis of empowerment in subdomains reveals that nearly all women report having ownership of assets (96 percent) and some form of control over use of income (95 percent) generated by the household. Similarly, most women (91 percent) report being able to contribute to productive decisions of the household. Noticeably, 89 percent also report having autonomy in production, suggesting that their decisions regarding agricultural productions of the household reflected their own values, and not submission to any coercion from family members. However, nearly one-third of the women in the sample struggled in spheres of public speaking, group membership, and managing their workloads.

Figure S2.3 in the supplementary online appendix highlights the contributions of each of the five domains to the overall disempowerment of the women in the sample. The study finds that the leadership and time domains form the biggest sources of disempowerment for the women in the sample, each contributing nearly 35 percent and 27 percent respectively, followed by resource domain with a contribution of nearly 22 percent. As the analysis further decomposes the five domains, it finds that, of the 10 the subdomains, access to and decisions on credit, speaking in public, active membership in groups, and workload contribute the most to the disempowerment of women in the sample (see fig. S2.4 in the supplementary online appendix).

Among the decision making indicators of interest in the domestic sphere, the study finds that of the 89 percent of women who reported using some form of contraception, only 23 percent made the decision themselves. Only about 20 percent of women in the sample reported making decisions pertaining to basic

4 When compared with other findings from rural Bangladesh, Malapit et. al. (2015) report the mean empowerment gap to be 0.15 in a nationally representative sample from 2011, thus showing significant reduction in the gap over the decade. This can be expected given the improvements observed in multiple indicators in Bangladesh over the last decade (WEF 2021). On the other hand, when compared to empowerment gaps in other countries, one finds higher gaps in Nepal (0.25) and Ghana (0.20), and a lower gap in Cambodia (0.01) based on subnational samples in these countries (Quisumbing et al. 2020).

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Table 1. Descriptive Statistics

Variables	N	Mean	SD	Min	Max
Woman characteristics					
Age	5433	40.80	12.36	15	86
Height (cm)	5433	150.19	5.50	129.1	170.9
Age at marriage	5433	16.80	2.93	7	38
Age at menarche	5433	12.81	0.98	8	18
Age at first child	5305	19.24	3.16	12	37
Years of education	5433	3.73	3.65	0	16
Mother's years of education	5433	1.28	2.55	0	16
Father's years of education	5433	2.45	3.74	0	17
Number of sisters	5433	3.00	1.48	1	12
Number of siblings	5433	5.15	2.20	1	21
Asset brought to marriage (yes = 1)	5433	0.21	0.41	0	1
Value of asset brought to marriage (log)	5433	0.79	0.40	0	1
Female-headed household	5433	7.41	4.03	0	15.07
Empowerment variables					
Empowerment status (empowered = 1)	4899	0.47	0.50	0	1
Empowerment score (5DE)	4899	0.75	0.14	0.07	1
Empowerment gap	3827	0.04	0.11	−0.47	0.73
Empowerment status by indicators (empowered=1)					
Input in productive decisions	4899	0.91	0.29	0	1
Autonomy in production	4899	0.89	0.31	0	1
Ownership of assets	4899	0.96	0.20	0	1
Purchase, sale, or transfer of assets	4899	0.74	0.44	0	1
Access to and decisions on credit	4899	0.68	0.47	0	1
Control over use of income	4899	0.95	0.21	0	1
Group member	4899	0.66	0.47	0	1
Speaking in public	4899	0.65	0.48	0	1
Workload	4899	0.62	0.49	0	1
Leisure	4899	0.88	0.32	0	1
Other variables					
Self-decision to use birth control	3616	0.23	0.42	0	1
Number of places can visit alone	5433	3.68	1.59	0	5
Do not need permission to go places	5433	1.07	1.57	0	5
Works for pay	5433	0.73	0.45	0	1
Self-decision to work	5433	0.45	0.50	0	1
Self-decision to work + control over income earned	5433	0.33	0.47	0	1
Woman decides on food expenditure	5433	0.22	0.41	0	1
Woman decides on housing expenditure	5433	0.17	0.37	0	1
Woman decides on healthcare expenditure	5433	0.18	0.39	0	1
Woman decides on education expenditure	5433	0.14	0.35	0	1
Woman decides on clothing expenditure	5433	0.20	0.40	0	1
Woman controls money to buy food	5433	0.88	0.32	0	1
Woman controls money to buy her clothes	5433	0.90	0.30	0	1
Woman controls money to buy her medicines	5433	0.93	0.25	0	1
Woman controls money to buy her toiletries	5433	0.93	0.26	0	1

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: The table presents the mean and standard deviation of selected household and woman-specific variables. A household is defined as a group of people who live together under the same roof for at least six months and at least half of the week in each week in those months and take food from the "same pot." The full sample includes ever-married women who answered the Women's Empowerment in Agriculture Index (WEAI) module, that is, the primary female respondent from the household.

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household expenditure, with the lowest being in expenditures on education and health care. For labor market participation, about 45 percent women reported being able to decide on their own whether to work outside home to earn income, and 33 percent said they could retain control over the income they earned.

4. Empirical Strategy

4.1 Empirical Model

The goal of the empirical analysis is to identify the causal effect of women's age at marriage on their bargaining power in the spousal household. To identify the true nature of the relationship, the analysis requires age at marriage to vary exogenously, which poses several critical empirical challenges. Estimation of the relationship is likely to suffer from omitted variables bias, since there are many key confounding variables that are likely to determine the women's bargaining power and agency in her spousal household. Assortative matching in the marriage market causes poorer brides to be married to similar income households (Deolalikar and Rao 1998) and to spouses that may be worse than the average (Becker 1973; Anderson 2007), and have little say in their marriage (Jensen and Thorton 2003). Therefore, the natal family's wealth at the time of the marriage, information on which is not present in the data, is likely to have a strong bearing on the eventual bargaining strength of the women in the marriage and can lead to biased estimations if not factored in. Moreover, it can be argued that girls who were more empowered to begin with did not surrender to the social pressures of early marriage, and, therefore, could successfully delay their marriage. Such instances of bias stemming from reverse causality are also likely to affect the true identification of the postulated relationship. In addition, fear of potential violation of marriage-age laws can lead to measurement errors because age at marriage is self-reported at the time of survey (Sekhri and Debnath 2014).

To address these identification concerns, the analysis uses an instrumental variable (IV) strategy to isolate the causality of timing of marriage on indicators of women's agency and decision making, by using their age at menarche as an instrument for age at marriage, taking advantage of the natural and hence random variation of the onset of menarche. Since menarche is largely biologically determined (Adair 2001; Jahanfar, Lye, and Krishnarajah 2013), it is plausibly exogenous and affects later-life outcomes only through its impact on marriage age. The two-stage IV model used in this study is specified as follows:

$$A_j = \alpha_0 + \alpha_1 Z_j + \alpha_2 W_j + \mu_j \tag{1}$$

$$Y_j = \beta_0 + \beta_1 A_j + \beta_2 W_j + \varepsilon_j \tag{2}$$

The first stage estimation is given by equation 1, where A_j is the age at marriage of woman j, which is instrumented by Z_j, her age at menarche. In the structural equation, depicted in equation 2, Y_j are the outcome variables of interest (discussed in "Outcomes of interest" in section 3), and W_j is a set of control variables required to ensure validity of the instrument (to be discussed in detail in "Validity of the instrument" in section 4), namely, women's age, height, and agro-ecological region fixed effects as well as additional controls pertaining to the women's natal family background and family composition: namely, women's, mother's, and father's education, number of siblings, and number of sisters. The study also includes a dummy variable for female-headed households to account for women in female-headed households exercising more power in the decision making process. The choice of control variables was to reinforce the validity of the instrument, Z_j, as well as to account for confounding factors likely to affect the relationship of age at marriage and bargaining power. The study uses an IV Probit model for binary outcome variables, like empowerment status and adequacies in subdomains of WEAI, and a standard

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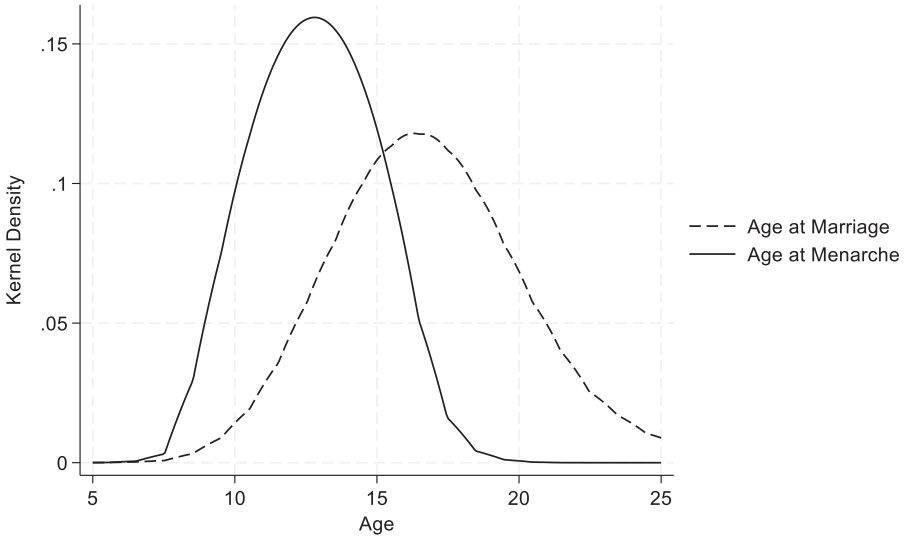
Figure 1. Relationship between age at First Marriage and Age at Menarche



Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

two-stage estimation procedure for the continuous variable: namely, the 5DE empowerment score. The analysis clusters standard errors at the PSU (village) level for all estimations. For all probit models, the analysis presents the marginal effect *(dy/dx)* since the coefficients of the estimations cannot be interpreted directly.

4.2 Validity of the Instrument

The instrumental variable (IV) methodology requires that the IV meet two criteria: (1) the inclusion and (2) the exclusion restrictions. The inclusion restriction requires that the instrument, that is, the menarche age, be a strong predictor of the potentially endogenous variable, that is, the marriage age. In the conservative and rural communities of Bangladesh, the timing of marriage of a girl is traditionally bounded below by the onset of menarche, since preservation of virginity and premarital pregnancy become major concerns that can affect the young women's worth in the marriage market. This theoretical relationship is also reflected in the data acquired from the sampled group of women. While just about 4 percent of the women in the sample reported being married before the onset of their menarche, nearly 46 percent of the marriages took place within three years of menarche. Figure 1 which is a kernel density plot of age at marriage and age at menarche reinforces the idea that timing of marriage follows the onset of puberty with the peak of the former being to the right of the highest point of the latter. These findings are consistent with observations made in previous studies, such as Field and Ambrus (2008) or Sekhri and Debnath (2014), who postulate that parents become anxious to marry off their daughter once she reaches menarche.

In contrast, adherence to the exclusion restriction requires that the instrument, that is, menarche age, can only affect the outcomes of interest through no channels apart from the endogenous variable, that is, marriage age, for it to be a valid instrument. However, this condition is not directly testable (Bound, Jaeger, and Baker 1995; Angrist and Krueger 2001). Nevertheless, this study's argument for exogeneity depends on the fact that age of menarche is largely biologically determined from random genetic factors (Kaprio et al. 1995; Jahanfar, Lye, and Krishnarajah 2013) and is, therefore, plausibly exogenous. The exclusion restriction, however, can potentially be violated in various ways, which are discussed below as well as the strategies to mitigate the effect on the study's estimates.

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Medical literature postulates that high altitude and cold weather can defer the onset of menstruation. Conversely, exposure to environmental pollutants and toxic substances may also result in lower age at menarche. This study addresses the variation in women's exposure to these environmental factors by controlling for regional fixed effects in the final empirical model, which is computed using agro-ecological zone land areas that are recognized on the basis of hydrology, physiography, soil types, tidal activity, cropping patterns, and seasons. These zones indicate an area characterized by homogeneous agricultural and ecological characteristics. This homogeneity is more prominent at the subregion and unit levels. The agro-ecological zones of Bangladesh have been identified based on four elements such as physiography, soils, land levels in relation to flooding and agro-climatology, and has been tentatively divided into 30 agro-ecological zones.

Another concern addressed in previous studies, such as Bronson (1987) and Pellerin-Massicotte et al. (1987)e, is the possible effect of extreme physical labor on timing of menarche. Strenuous physical labor is often associated with poverty and, therefore, to the natal family's economic status, which in turn can affect the woman's empowerment in her spousal household. But as discussed in Field and Ambrus (2008), this is unlikely to vary within the population of concern because customarily very few adolescent girls in rural areas in Bangladesh are employed outside their households.

Among other external factors, acute malnutrition is argued to delay the age at which menstruation first occurs. Potential correlation between age at menarche and nutrition is a concern since chronic health conditions or severe nutritional deficiencies before marriage is likely to impact empowerment and decision making capabilities of a woman in more ways than one. Her perceived worth and relative status in her spousal household is likely to suffer if she enters a marriage with health issues and is, therefore, likely to jeopardize the validity of this study's instrument. To address this concern, the analysis first graphically examines the relationship of women's height, to proxy for their health conditions, and age at menarche in the data in two ways. First, kernel density estimates are observed of height across three age menarche samples, exhibited in fig. 2(A), which depict overlapping distributions invalidating the discussed concern for the sample. In addition, fig. 2(B), which plots height on age at menarche, shows that the variation is mostly flat up to 16 years, and counter-intuitively, age at menarche then increases with height. The study also finds no significant difference in the average height among subsamples of menarche groups. For any remaining concerns, the analysis controls for woman's height in the final empirical model as an indicator of early health status, with the assumption that poor diet quality or malnutrition, only severe enough to affect height, that is, cause stunting, will cause delay in menarche.

Bias may also arise if the IV, age at menarche, is correlated with omitted family characteristics, a good example of which is the socio-economic status (SES) of family (Asadullah and Wahhaj 2019). Women coming from low SES families are more likely to have adverse health problems that may affect the timing of menarche and, thus, have impact on her fertility and labor-market prospects, which could in turn affect her bargaining power in the family. The study, therefore, includes controls for women's father's and mother's educational attainment (that is, years of schooling) as well as the number of siblings and number of sisters of the women in all regressions. The study considers that these family characteristics are likely to serve as good proxies for SES of the women's natal family.

Finally, recall bias of age at menarche is a potential measurement error, as respondents can approximate age at menarche with age at marriage, which can result in spurious correlations and convolute the estimates. But this may not be concerning in this context since many studies have declared recall of age menarche as highly reliable (e.g., Field and Ambrus 2008; Sunder 2019). According to a survey by Ellis (2004, 921), "both adolescent girls and adult women are generally willing and able to report accurately on their ages at menarche." Furthermore, the onset of menstruation, especially in rural societies in Bangladesh, marks various significant lifestyle changes for adolescent girls, ranging from restrictions in religious activities to controlled mobility, and many more. Further, the study does not find any heaping at key ages, such as at round numbers or school-leaving age, which would indicate significant recall

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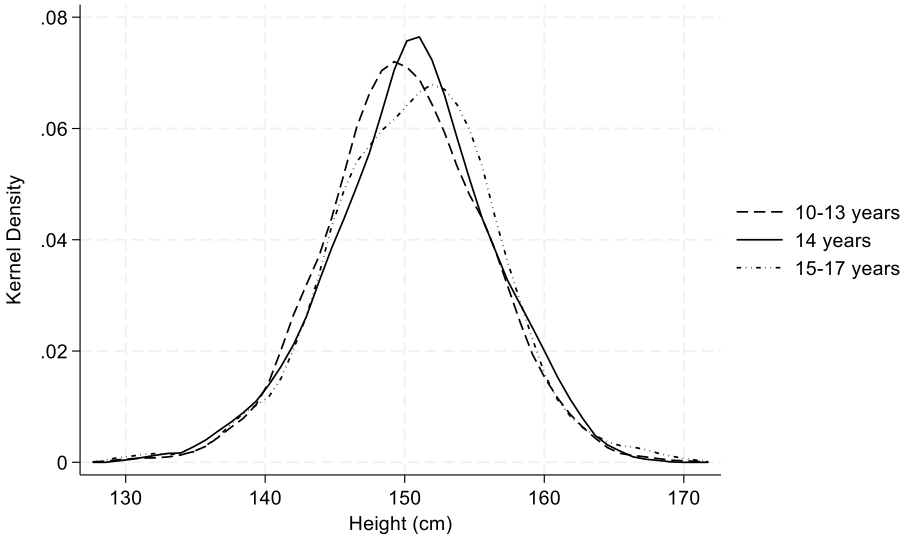
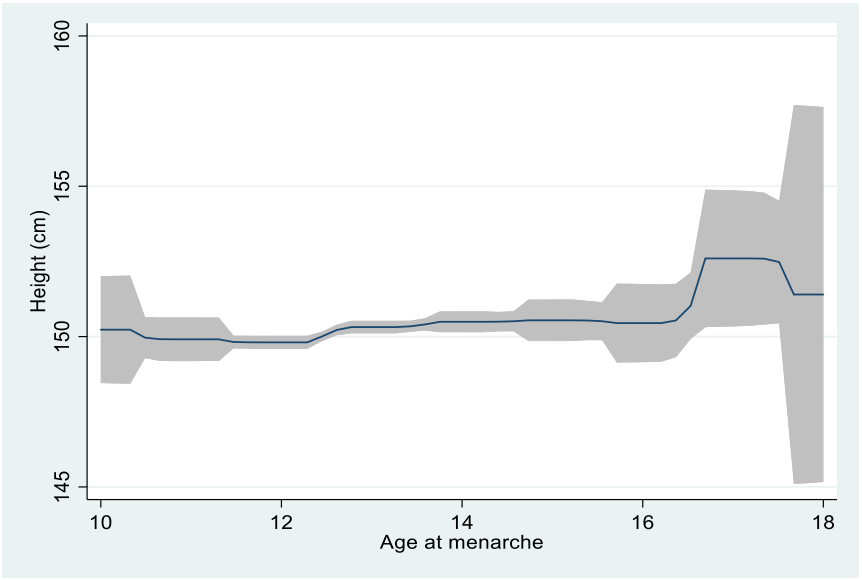
Figure 2. Relationship between Height and Age at Menarche. **Panel A:** Kernel density plot of height for menarche groups; **Panel B:** Adult height and age at menarche



Panel A



Panel B

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

error - see the distribution of reported age at menarche (fig. S2.1 in the supplementary online appendix). Mean age at menarche in the sample (12.8 years) is also comparable to other studies in similar contexts, for e.g., 13.6 years (Chari et al. 2017) and 13.5 years (Roychowdhury and Dhamija 2021) in India, and 12.6 years (Asadullah and Wahhaj 2019) and 12.9 years (Field and Ambrus 2008) in Bangladesh.

Validity of the instrument and identification of the IV model require a strong correlation between age at menarche and age at first marriage. To explore this, first, the study graphically explores the relationship of

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Table 2. The Effect of Age at Menarche on Age at Marriage

	(1)	(2)	(3)	(4)
Age at menarche	0.143***	0.146***	0.148***	0.138***
	(0.040)	(0.039)	(0.035)	(0.035)
Height		0.016**	0.015**	0.013**
		(0.007)	(0.006)	(0.006)
Age		−0.027***	−0.028***	−0.027***
		(0.002)	(0.002)	(0.002)
Regional fixed effect	*No*	*No*	*Yes*	*Yes*
Additional controls	*No*	*No*	*No*	*Yes*
Observations	7,143	7,143	7,143	7,143
R-squared	0.002	0.024	0.068	0.073
F-stat	12.96	52.14	57.32	24.78

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.
Note: The table shows first-stage OLS regressions for the sample of ever-married women. In all columns, the dependent variable is the woman's age at marriage. column 4 displays the full specification, which (additional) controls for the woman's mother's and father's education, number of siblings, number of sisters, and female-headed households in addition to the woman's age, height, and agro-ecological region fixed effects. Cluster robust standard errors are presented in parenthesis. Standard errors are clustered at the village level. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

age at menarche with age at first marriage (see fig. S2.2 in the supplementary online appendix). The study finds a positive relationship, that is, age at first marriage increases closely with age at menarche. There is a slight downward-sloping relationship below age 12 years, but this represents less than 4 percent of the observations. The majority of women are within the 11-to-16 years range, which is the normal range of age at menarche with 1.5 percent of observations beyond the age of menarche of 16 years. Next, the analysis explores the relationship econometrically and presents the results from the first-stage regression in table 2. Column 1 regresses age at marriage on age at menarche without controlling for any additional variables. In the subsequent columns, the analysis adds control variables discussed previously to address the validity concerns of the instrument. Column 4 shows results for the base specification with the full set of controls; namely, age, height and the agro-ecological region fixed effects and additional controls of women's mother's and father's education, number of siblings, number of sisters, and female-headed households. The coefficient of 0.138 is highly statistically significant and positive, and the F statistic of 24.78 is well above 10 based on the rule of thumb, eliminating concerns about weak instruments (Stock, Wright, and Yogo 2012). A one-year delay in onset of menarche is likely to increase the age at marriage by 0.14 years. Throughout the rest of the analysis, the study presents results with the specification of column 4.

5. Results

5.1 Impact on Women's Agency in the Productive Sphere

Table 3 presents the results from IV regressions on the primary outcomes of interest, namely, empowerment status, 5DE empowerment score, and empowerment gap. Since empowerment status is a binary indicator, that is, whether an individual achieves a 5DE empowerment score of 0.8 or above, the analysis estimates the effect of the timing of marriage with IV-Probit model (column 5). Since it is not possible to interpret the coefficients of the Probit models directly, the analysis presents the marginal effects or *dy/dx* in braces for columns 1 and 5. Conversely, a standard 2SLS (IV) estimation has been used to identify coefficient for 5DE score (column 6 and 7) and empowerment gap (column 8), since both are continuous variables depicting the total empowerment score achieved by a respondent and the gap in empowerment scores of men and women of the same household, respectively.

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Table 3. The Effect of Age at Marriage on Women's Empowerment in the Productive Sphere

	(1) Probit	(2) OLS	(3) OLS	(4) OLS	(5) IV Probit	(6) IV	(7) IV	(8) IV
	Empowerment status	5DE score	5DE standard deviations	Empowerment gap	Empowerment status	5DE score	5DE standard deviations	Empowerment gap
Age at marriage	−0.022***	−0.002***	−0.015**	0.001	0.191*	0.039*	0.270*	−0.030
	(0.006)	(0.001)	(0.005)	(0.001)	(0.101)	(0.023)	(0.161)	(0.021)
	{−0.009***}				{0.067**}			
Height	0.006*	0.001***	0.008**	−0.000	0.002	0.001	0.004	0.000
	(0.003)	(0.000)	(0.003)	(0.000)	(0.004)	(0.001)	(0.004)	(0.001)
	{0.002*}				{0.001}			
Age	−0.002	0.000	0.000	0.000	0.002	0.001*	0.006*	−0.000
	(0.002)	(0.000)	(0.001)	(0.000)	(0.003)	(0.000)	(0.003)	(0.000)
	{−0.001}				{0.001}			
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional fixed effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,899	4,899	4,899	3,827	4,899	4,899	4,899	3,827

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data. *Note:* The table presents results from the instrumental variable (IV) specification where the binary dependent variable of empowerment status is estimated using a Probit model, and the continuous dependent variable of the empowerment (5DE) score is estimated using a standard OLS model. In Columns 5, 6, 7 and 8, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female headed households, and agroecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) presented in braces {}. * p<0.1; ** p<0.05; *** p<0.01.

The study finds that, after controlling for a woman's age, height, mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects, estimates of age at marriage from IV regressions (columns 5 and 6) has a positive and statistically significant effect on empowerment. For each year delay in a woman's marriage, the probability of her achieving empowerment status increases by 6.7 percentage points. On the other hand, a one-year delay in marriage for a woman is likely to increase her 5DE empowerment score by 3.9 percentage points (column 6) or by 0.27 standard deviations (column 7). Although there is no statistical significance, the study finds that increase in a woman's age at marriage decreases the empowerment gap between the woman and the primary male respondent ($p = .165$) which in almost all cases is her husband (column 8). This is suggestive of some weak evidence that the empowerment gap between men and women is likely to increase when girls are married off early. The instrumental variable results (columns 5 to 8) are also larger in magnitude than Probit and OLS results (columns 1 to 4), suggesting that Probit and OLS coefficients of marriage are attenuated due to omitted variable bias, which the IV approach eliminates by instrumenting age at marriage by age at menarche. Thus, results from the analyses reaffirm the importance of timing of marriage for adolescent girls, as it has a long-term impact on her empowerment and agency in her spousal household, which in turn has an effect on the overall well-being of her household.

It is also imperative to examine the relative effect timing of marriage has on the different dimensions of empowerment, to diagnose the critical areas that are more likely to suffer from early marriage decisions of girls in rural areas. This is done by using IV regressions to estimate coefficients for the 10 subdomains of empowerment, which contribute to the overall empowerment or disempowerment of a woman. Since the subdomains are all binary variables, the IV Probit model is run to estimate the coefficients of interest. All regressions have the same set of controls as before. Table 4 presents estimates from Probit and IV Probit regressions for the 10 indicators. All estimations control for woman's age and height, and agro-

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Table 4. The Effect of Age at Marriage on the Subdomains of Women's Empowerment in the Productive Sphere.

Panel A PROBIT	Input in productive decisions (1)	Autonomy in production (2)	Ownership of assets (3)	Purchase, sale, or transfer of assets (4)	Access to and decisions on credit (5)	Control over use of income (6)	Group member (7)	Speaking in public (8)	Workload (9)	Leisure (10)
Age at marriage	−0.007	−0.013	−0.009	−0.007	−0.015**	0.004	−0.018***	−0.016**	−0.029***	−0.002
	(0.010)	(0.010)	(0.010)	(0.007)	(0.006)	(0.011)	(0.007)	(0.006)	(0.007)	(0.008)
	{−0.001}	{−0.002}	{−0.001}	{−0.002}	{−0.005**}	{0.000}	{−0.007***}	{−0.006**}	{−0.011***}	{−0.000}
Height	0.014***	0.004	0.007	0.012***	0.004	0.004	−0.001	0.015***	−0.002	0.007
	(0.005)	(0.005)	(0.006)	(0.004)	(0.004)	(0.006)	(0.004)	(0.003)	(0.003)	(0.004)
	{0.002**}	{0.001}	{0.001}	{0.004***}	{0.001}	{0.000}	{−0.001}	{0.005***}	{−0.001}	{0.001}
Age	0.005**	0.001	−0.010***	−0.002	−0.008***	−0.007**	−0.006***	−0.006***	0.015***	−0.003
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
	{0.001**}	{0.000}	{−0.001***}	{−0.000}	{−0.003***}	{−0.001**}	{−0.002***}	{−0.002***}	{0.006***}	{−0.001}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional fixed effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,739	4,832	4,793	4,899	4,899	4,840	4,899	4,899	4,899	4,890
Panel B IV PROBIT	**(11)**	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**	**(20)**
Age at marriage	0.192	0.297***	0.310***	0.240***	0.013	0.298***	0.024	0.231***	0.055	−0.106
	(0.157)	(0.045)	(0.049)	(0.084)	(0.163)	(0.075)	(0.172)	(0.082)	(0.161)	(0.207)
	{0.042}	{0.082***}	{0.080***}	{0.075***}	{0.005}	{0.072*}	{0.008}	{0.076***}	{0.020}	{−0.021}
Height	0.008	−0.003	−0.002	0.005	0.003	−0.003	−0.002	0.007	−0.003	0.008*
	(0.008)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.004)	(0.005)
	{0.002}	{−0.001}	{−0.000}	{0.002}	{0.001}	{−0.001}	{−0.001}	{0.002}	{−0.001	{0.002}
Age	0.007***	0.006***	0.001	0.003	−0.008**	0.002	−0.005	−0.000	0.017***	−0.005
	(0.003)	(0.002)	(0.004)	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)	(0.004)
	{0.002}	{0.002***}	{0.000}	{0.001}	{−0.003**}	{0.000}	{−0.002}	{−0.000}	{0.006***}	{−0.001}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional Fixed Effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,899	4,899	4,899	4,899	4,899	4,899	4,899	4,899	4,899	4,899

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: The table presents results from the instrumental variable (IV) specification where all dependent variables are binary and are estimated using a Probit model. In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors are presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) are presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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ecological region fixed effects, and cluster standard errors at the village level. As before, the tables present the marginal effects or *dy/dx* in braces for all estimations.

The results demonstrate that the impact of timing of marriage on the empowerment subcomponents is intriguingly nonmonotonic. Women's age at marriage has a positive and highly statistically significant effect on a selection of subdomains of empowerment that, in essence, yield a statistically significant impact on the holistic status and empowerment score. The study finds that an increase in age at marriage by one additional year increases the probability that a woman will achieve adequacy in her autonomy in production by 8.2 percentage points (column 12). This strengthens the conclusion that girls who were married later are now more likely to be driven by their own values and judgment when making household agricultural-production decisions, rather than attempting to please, or fearing, other household members or external stakeholders.

The study also finds an increase in the probability of a woman's agency in both her ownership of assets and the decision in purchase, sale, or transfer of household assets by 8 percentage points and 7.5 percentage points as seen from columns 13 and 14 respectively, with a one-year increase in age at marriage. This is not only likely to augment her overall empowerment, but also support improved asset management of the household, since earlier studies show that women's empowerment plays a crucial role in moving a household out of poverty (Ahmed and Tauseef 2022).

The estimations also reveal an increase of 7.2 percentage points in the probability of a woman having more control over use of household income if her age at marriage is delayed by a year (column 16). This further reinstates the significance of the timing of marriage because more control over income by women is likely to further augment the overall health of the members of their household, as concluded by earlier studies, which reveal that women's empowerment can positively impact the household's diet diversity and children's health measures (Sraboni et al. 2014; Holland and Rammohan 2019).

Women's ability to raise their voice in public for community interests and conflict resolutions is also found to be significantly affected, as delayed marriage is seen to increase the probability to achieve adequacy in speaking in public by 7.6 percentage points (column 18). This finding is particularly interesting as it is found that women's age at marriage not only impacts their decision making and empowerment in enhancing the well-being of her spousal household; it also is likely to expand their agency to influence their community.

Finally, even though age at marriage has a statistically significant impact on the overall empowerment score and status for women, the study observes no causal effect on some of its components. It finds no significant impact of the timing of marriage on the women's adequacy in input in productive decisions, and access to and decisions on credit (columns 11 and 15 respectively). It is, however, noteworthy that the "access to and decisions on credit" indicator can be misleading in assessing whether a woman identified as not having adequacy is truly credit constrained or is voluntarily a nonborrower because of having sufficient liquidity. The study also finds no significant impact of age at marriage on women's subscription to groups in their community (column 17). Finally, it observes no causality of early marriage on the time domain of empowerment for women, as the change in probability of achieving adequacy in women's workload or leisure is not statistically significant with a year delay in marriage (columns 19 and 20 respectively). Similar to estimates from table 3, Probit estimates for the subdomains (columns 1–10) in table 4 are also smaller in magnitude than the corresponding IV Probit estimates (columns 11–20), suggesting the presence of omitted variables underestimating the coefficient estimates by the Probit model.

5.2 Impact on Women's Agency in the Domestic Sphere

This section looks at the impact of delayed marriage on women's agency in the domestic sphere. It starts by examining women's decisions on fertility, which has important consequence on female labor supply. It finds a strong statistically significant impact, with a one-year delay in marriage increasing the likelihood that a woman can decide herself on the use of birth control by 8 percentage points (see table 5, column 6).

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Table 5. The Effect of Age at Marriage on Indicators of Women's Agency in the Domestic Sphere

Panel A OLS/Probit	Woman's ability to decide on use of birth control (1)	Can go places alone (index) (2)	Do not need permission to go places (index) (3)	Self-decision to work (4)	Self-decision to work + control over income earned (5)
Age at marriage	0.009	−0.010**	−0.000	0.003	0.003
	(0.010)	(0.005)	(0.004)	(0.006)	(0.006)
	{0.003}			{0.001}	{0.001}
Height	0.003	0.003	0.002	0.011***	{0.012***
	(0.005)	(0.003)	(0.002)	(0.003)	(0.004)
	{0.001}			{0.004***}	{0.004***}
Age	0.010***	0.008***	0.008***	0.008***	0.010***
	(0.003)	(0.001)	(0.001)	(0.001)	(0.002)
	{0.003***}			{0.003***}	{0.003***}
All controls/FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	3,616	5,433	5,433	5,433	5,433
Panel B IV	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Age at marriage	0.283***	0.012	0.239*	0.055	0.223***
	(0.063)	(0.113)	(0.127)	(0.146)	(0.084)
	{0.079***}			{0.020}	{0.068***}
Height	−0.000	0.002	−0.001	0.010**	0.006
	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)
	{−0.000}			{0.004**}	{0.004}
Age	0.008***	0.009***	0.013***	0.009***	0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
	{0.002***}			{0.003***}	{0.004***}
All controls/FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	3,616	5,433	5,433	5,433	5,433

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: Dependent variables in columns (1)/(7), (5)/(11), and (6)/(12) are binary and are estimated using a Probit model. "Can go to places alone index" includes whether respondent is allowed to go alone to visit friends/family outside community, marketplace, hospital/doctor, cinema/fair, or NGO training program. "Do not need permission to go to places index" includes whether the respondent has to ask permission to visit the aforementioned places. Each index is constructed by normalizing a series of binary indicators pertaining to decision to visit each location to have mean zero and standard deviation one and then summing the normalized variables to generate the final index, and then renormalizing it again to have standard deviation one. Indices have been estimated using an OLS model. In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors are presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) are presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

The analysis also finds positive impacts of delay in marriage on the probability of the women's freedom of mobility and control over her own income earned through work outside home. The mobility indicators are constructed similarly to Chari et al. (2017), and consistent results are found. Although a statistically significant result is not observed for the index on whether she can go to certain places alone (namely, the local health center, local store, and relatives/friends), later marriage is found to increase the likelihood that a woman can go to these same places without permission by an average of 0.239 standard deviations (columns 7 and 8, table 5). On the other hand, although the study does not find a statistically significant effect on self-decision to work, it does find an increase in the probability of women who are working to retain control over their income by 6.8 percentage points (column 10).

An increase in decision making ability would likely increase the women's well-being as well as their ability to allocate more resources for their children (Ashraf, Karlan, and Yin 2010; Doss 2013). At the same time, women with more autonomy may have more power to make decisions regarding contraceptive use and might thus have lower fertility rates (Beegle, Frankenberg, and Thomas 2001). A lower number of children may enable higher investment per child and, hence, improve the quality of children (Björkman

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Nyqvist and Jayachandran 2017). The study, therefore, explores if delaying marriage generates favorable outcomes of women's decision making ability in household matters. Table 6 (columns 12–16) shows the findings that later marriage leads to increase in the likelihood of women being the sole decision maker on household investments in food (6.4 percentage points), housing (5.8 percentage points), and health care (5.3 percentage points) with 0.16 standard deviations increase in a decision-making index (column 17) constructed from the above items. These are comparable to increases in decision making abilities in other contexts, such as Sunder (2019) in Uganda and Field and Ambrus (2008) in Bangladesh, although estimates were not statistically significant in the latter case. At the same time, women also experience an increase in decision making abilities related to purchases of personal items such as clothes, medicines, and toiletries (table 6, columns 15–18) as well as an index constructed from the above (column 22). Such findings lend support to the literature showing delayed marriage improving post-marital economic empowerment, decision making power, and more equitable gender relations (see, e.g., Crandall et al. 2016; Yount, Crandall, and Cheong 2018), but dispute that of Chari et al. (2017), who find delay in marriage reducing woman's say in household decisions (namely, expensive household purchases, what to cook, how many children to have, what to do when children are ill, and whom the children should marry).

There may be two possible reasons causing the divergence of this study's findings from that of Chari et al. (2017) from rural India. First, although both countries are struggling with low levels of women's welfare, Bangladesh is somewhat ahead on several fronts. For example, data compiled by the World Economic Forum for its "Gender Gap Report", which focuses on measuring gaps between men and women in accessing resources and opportunities, shows Bangladesh in 65th position while all other South Asian countries have ranks beyond 100 (WEF 2021). Bangladesh has consistently outperformed its neighbors in many indicators, for example, in labor force participation where Bangladesh has a female-male ratio of 0.46 compared to 0.28 in India, while in estimated earned income per capita, the female-male ratio is 0.21 for India and 0.40 for Bangladesh. This means that, compared to India, a greater percentage of women are participating in paid work in Bangladesh with their wages closer to the wage of Bangladeshi men for similar work, and the relative contribution of women workers in the Bangladeshi economy is greater. In addition, Bangladesh generally outperforms its South Asian neighbors in health as well as in primary education indicators. Second, this study's indicators making up the household decision-making index are different from that of Chari et al. (2017) who looks at decisions surrounding expensive household purchases, what to cook, how many children to have, what to do when children are ill, and whom the children should marry while this article's index consists of household decisions in broad indicators of food, housing, health care, education, and clothing. In addition, even though the women of the household often have some say in household decisions, the money required to make these purchases is controlled by men, who ultimately make the decision. Therefore, the study further explores impacts on control over use of money needed to buy food, clothes, medicines, and toiletries.

5.3 Robustness Checks

The study runs a battery of robustness tests to examine whether the observed effects of delay in the age at marriage on indicators of women's agency in the productive and domestic sphere of the household are robust to these tests. First, the analysis tests for any effect of controlling for women's educational attainment on the results. The data used in this paper does not contain the level of education leading to marriage and only has information on total educational attainment, some of which is possibly attained after marriage. Since the study believes age at marriage causally affects education, it is an outcome and would be a "bad control" that leads to selection bias (Angrist and Pischke 2009). Nonetheless, the analysis examines whether the results are robust to controlling for respondent's years of education. The results are found to be robust as seen in table S2.2 in the supplementary online appendix.

Second, the analysis tests by controlling for an indicator of whether the respondent ever attended school. An indicator for ever attended school is possibly more exogenous than years of schooling, given

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Table 6. The Effect of Age at Marriage on Women's Decision Making in Household Expenses

	Who decides how to spend money on the following items?						Do you [woman] yourself control the money needed to buy the following?				
Panel A	Food (1)	Housing (2)	Health care (3)	Education (4)	Clothing (5)	Index on decisions (1) to (5) (6)	Food from the market (7)	Clothes for yourself (8)	Medicine for yourself (9)	Toiletries/ cosmetics for yourself (10)	Index for control over money (7) to (10) (11)
Age at marriage	0.015*	0.012	0.011	0.014	0.009	0.006*	0.010	−0.006	−0.005	0.010	0.001
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.003)	(0.010)	(0.009)	(0.010)	(0.011)	(0.005)
	{0.003*}	{0.163}	{0.002}	{0.002}	{0.002}		{0.002}	{−0.001}	{−0.001}	{0.001}	
Height	0.009**	0.011**	0.008*	0.009*	0.008**	0.004**	0.015***	0.021***	0.020***	0.022***	0.009***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.002)	(0.005)	(0.005)	(0.006)	(0.005)	(0.002)
	{0.002**}	{0.002**}	{0.001*}	{0.001*}	{0.001**}		{0.003***}	{0.003***}	{0.003***}	{0.003***}	
Age	0.012***	0.019***	0.014***	−0.008***	0.011***	0.005***	−0.002	−0.008***	−0.005*	−0.009***	−0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)
	{0.002***}	{0.003***}	{0.002***}	{−0.001***}	{0.002***}		{−0.000}	{−0.001***}	{−0.001*}	{−0.001***}	
All controls/FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433
Panel B IV	**(12)**	**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**(19)**	**(20)**	**(21)**	**(22)**
Age at marriage	0.271***	0.269***	0.248***	0.115	0.213*	0.155*	0.075	0.305***	0.298***	0.274***	0.193*
	(0.075)	(0.073)	(0.087)	(0.178)	(0.115)	(0.09)	(0.192)	(0.038)	(0.047)	(0.070)	(0.114)
	{0.064**}	{0.058**}	{0.053*}	{0.020}	{0.047}		{0.014}	{0.084***}	{0.078***}	{0.065**}	
Height	0.002	0.004	0.003	0.007	0.004	0.002	0.014**	0.006	0.006	0.011	0.007**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.003)	(0.006)	(0.006)	(0.007)	(0.008)	(0.003)
	{0.001}	{0.001}	{0.001}	{0.001}	{0.001}		{0.003***}	{0.002}	{0.002}	{0.003*}	
Age	0.014***	0.019***	0.015***	−0.006	0.013***	0.008***	−0.000	0.003	0.004*	−0.000	0.001
	(0.002)	(0.003)	(0.002)	(0.005)	(0.002)	(0.002)	(0.005)	(0.003)	(0.002)	(0.004)	(0.003)
	{0.003***}	{0.004***}	{0.003***}	{−0.001}	{0.003***}		{−0.000}	{0.001}	{0.001}	{−0.000}	
All controls/FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: The table presents results from the instrumental variable (IV) specification where dependent variables in all columns are binary and are estimated using a Probit model. In all specifications, the age at marriage is instrumented by the age at menarche. Each index is constructed by normalizing a series of binary indicators to have mean zero and standard deviation one and then summing the normalized variables to generate the final index, and then renormalizing it again to have standard deviation one. Indices have been estimated using a linear model. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors are presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) are presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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that it is unlikely that a girl who never attended school before marriage will start schooling after she got married. Table S2.3 in the supplementary online appendix presents the results, which are robust to the earlier findings.

Third, the study includes, in its original specification, birth year fixed effects as additional controls. In rural Bangladesh, where the majority of households depend on some agricultural activities, being born in a year with extreme weather events may adversely affect household income, which may lead to a fall in consumption resulting in malnutrition. Therefore, girls born during these extreme weather events may experience a delay of their first menstruation, as they are more likely to be malnourished. The analysis finds that results are robust to inclusion of birth year fixed effects (see table S2.6 in the supplementary online appendix).

Finally, the analysis tests for nonlinearities in the relationship between age of respondent and the study's measures of bargaining power by including the squared value of women's age as an additional control to the specifications. Our results (reported in table S2.5 in the supplementary online appendix) are robust to inclusion of this additional control.

Further, to assess the validity of the instrument, the analysis also performs a falsification test following Roychowdhury and Dhamija (2021), where it tests the reduced form effect of age at menarche on measures of bargaining power among the subsample of women who got married before attaining menarche. If the instrument is valid, there should not be any effect of age at menarche on the outcome measures for this subsample if age at menarche affects the outcome measures through age at marriage. Indeed, the study finds no such effect for this subsample of women (see table S2.4 in the supplementary online appendix), which suggest that the instrument (age at menarche) is likely to satisfy the exclusion restriction and, therefore, is a valid instrument for age at marriage.

6. Possible Underlying Mechanisms

In this section, the article explores the hypothesized mechanism linkages, presented previously in "Conceptual Framework" in section 2, by examining the association of age at marriage with education and employment outcomes as well as the value of assets brought to the marriage by the women. Results are presented in table 7. In all regressions, woman's age at marriage is instrumented by her age at menarche, and the full set of controls, including regional fixed effects, are used. It is found that age at marriage has a positive effect on women's years of schooling and on the likelihood of her completing primary level of education. A delay in marriage by one year increases her years of education by 0.629 years (column 6) and the likelihood of her completing primary education by 5.3 percent (column 7). The effect on schooling found in this study is nearly threefold larger compared to estimates obtained by Field and Ambrus (2008) (0.22 years using data from 1996) but closer to that of Asadullah and Wahhaj (2019) (0.726 years using data from 2014). This is likely a result of government incentives through tuition and stipend programs for girls, which significantly improved access to female secondary schooling[5] and, therefore, has a larger effect on recent cohorts compared to older ones (Asadullah and Wahhaj 2019).

Next, the study examines the role assets brought to marriage (dowry) play in shaping a woman's bargaining strength in the marriage. It explores this effect in two ways; first, it examines the relationship of timing of marriage with the dowry payments. It finds that a one-year delay in marriage increases both the likelihood that women bring assets to the marriage (by 6.8 percentage points, column 8) as well as the log of the value of the assets she brings (by 1.1 percentage points, column 9). These findings

5 Bangladesh has a female secondary school stipend program (FSSSP), which was designed as a conditional cash transfer program and targeted girls in grades 6–10 residing in rural areas with cash stipends to cover educational expenses that vary by grade level. Conditions to retain program eligibility include 75 percent school attendance rate, satisfactory academic achievement with a test score of at least 45 percent in annual exams, and *remaining unmarried*. The program greatly increased access to secondary education for females.

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Table 7. Associations of Age at Marriage with Mediating Outcomes

Panel A OLS/PROBIT	Years of schooling (1)	Completed primary education (2)	Asset brought to marriage (3)	Value of asset brought to marriage (log) (4)	Works for pay (5)
Age at marriage	0.134***	0.039***	0.013*	0.077***	−0.015**
	(0.017)	(0.007)	(0.007)	(0.019)	(0.007)
		{0.011***}	{0.003*}		{−0.005**}
Height	0.052***	0.021***	−0.000	0.009	0.006*
	(0.007)	(0.004)	(0.004)	(0.009)	(0.003)
		{0.006***}	{−0.000}		{0.002*}
Age	−0.121***	−0.053***	−0.029***	−0.131***	−0.004**
	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)
		{−0.015***}	{−0.007***}		{−0.001**}
Observations	5,433	5,433	5,433	5,433	5,433
Panel B IV	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Age at marriage	0.629*	0.189*	0.241***	1.107**	0.180*
	(0.372)	(0.116)	(0.085)	(0.531)	(0.109)
		{0.053*}	{0.068**}		{0.058*}
Height	0.045***	0.017***	−0.003	−0.005	0.002
	(0.010)	(0.006)	(0.004)	(0.014)	(0.004)
		{0.005***}	{−0.001}		{0.001}
Age	−0.110***	−0.044***	−0.017**	−0.110***	0.001
	(0.009)	(0.011)	(0.008)	(0.012)	(0.003)
		{−0.012***}	{−0.005**}		{0.000}
Observations	5,433	5,433	5,433	5,433	5,433

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: The table presents results from the instrumental variable (IV) specification where dependent variables in columns (2)/(7), (3)/(8), and (5)/(10) are binary and are estimated using a Probit model (years of schooling and log of value of asset brought to marriage are continuous variables and has been estimated using an OLS model). In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors are presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) are presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

resonate with earlier studies that suggest that the older brides make higher net marriage payments (see, e.g., Wahhaj 2018). Second, the analysis checks if higher-valued assets brought to marriage correlate with higher bargaining strength of women, to test the speculation of the mediating path. The results suggest that if women brought assets to the marriage, she is 6.9 percentage points more likely to be empowered according to the WEAI (results available on request). Results are consistent for value of assets as well as use of continuous empowerment score as outcome indicator. This finding aligns with prior research that women with higher dowries see favorable effects on their welfare (Srinivasan and Bedi 2007; Doss 2013).

Finally, the analysis looks at whether there is any effect of delayed marriage on women's labor-market participation. It finds that a one-year delay in marriage increases the likelihood that a woman works for pay by 5.8 percentage points (column 5). This result contrasts with findings by Chari et al. (2017) and Dhamija and Roychowdhury (2020) in India where they find a negative and null result, respectively, for impact on labor-market participation of women but consistent with Sunder (2019) for findings from Uganda.

7. Conclusion

Timing of marriage is a key premarital parental decision that is likely to affect women's marital quality, particularly their agency and decision making capabilities in the spousal household. On the contrary to its importance, there is little empirical evidence that isolates the impact of early marriage of young

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girls on their bargaining strength, agency, and decision making capabilities post marriage. This study postulates that the age at which women marry is likely to affect their standing in the husband's family and, thus, have a bearing on their empowerment in the spousal household. The power imbalance between young brides and their husbands, who in most cases are significantly older than the brides, make the girls more susceptible to living a life under subjugation and keeps young brides from reaching their full physical, economic, and social potential. Therefore, if the timing of marriage is a key determinant of women's bargaining strength, early marriage can hinder her agency and participation in the productive and household decision making which, as several studies indicate, is crucial to the welfare of a family. Utilizing the natural and random variation of age at menarche and an instrumental variable strategy, first done by Field and Ambrus (2008), this study provides empirical evidence that biologically driven delay in marriage augments women's bargaining power and status post marriage in rural Bangladesh. This article uses data from a nationally representative household survey conducted in 2019 and instruments age at menarche for age at marriage for the analyses. The outcomes of interest span indicators of women's agency in both the productive and domestic sphere. The study relies on the Women's Empowerment in Agriculture Index (WEAI) methodology outlined in Alkire et al. (2013) to understand how the decision to marry early might affect the empowerment, agency, and inclusion of women in the productive sphere. The study develops individual empowerment scores and indicators to determine whether a woman achieved adequacies in 10 indicators of empowerment in agriculture and was empowered overall or not. For a well-rounded assessment of the impact of early marriage on women's agency post marriage, the analysis also includes measures of women's agency in the domestic sphere identified by the extent of her freedom of mobility, fertility choices, decision to work outside the home and ability to control the income she generates, and her input in decisions pertaining to important household expenses and investments.

The findings suggest that a delay in marriage favorably affects a woman's bargaining strength in her spousal household. A one-year delay in marriage increases woman's weighted empowerment score by 3.9 percentage points or 0.27 standard deviations, in addition to an increase in the probability of her achieving empowerment status by 6.7 percentage points. Further diagnostics into the subdomains of empowerment reveal that woman who delay marriage are likely to experience more empowerment in household decision making; by assuming more control over use of household income; more agency in ownership of household assets; and increased involvement in the purchase, sale, and transfer of household assets, with boosted self-sufficiency in making agricultural production decisions for the household. Additionally, the study finds an increase in woman's empowerment, not only within the household, but also in the impact she can potentially make in her community—a one-year increase in age at marriage increases woman's probability of achieving adequacy in speaking in public for community interests and conflict resolutions by 7.6 percentage points. In decision making pertaining to the domestic sphere, the study finds positive and significant impacts of delaying marriage on women's freedom of mobility, their control over own income from working outside the home, and their freedom to make their own decisions on household expenses and investments. Possible mechanisms of the impact likely stem from significant effects of a delay in marriage on the increased likelihood of women completing primary education (5.3 percent), working for pay (5.8 percent), and bringing assets to the marriage (6.8 percent). The results are robust to a range of robustness and falsification tests.

The results, thus, fill an important gap in the literature by isolating the causality of the age at marriage on women's status and bargaining power which, as were found, have a significant bearing on their household decision making across many spheres. Although earlier studies like Field and Ambrus (2008) and Chari et al. (2017) briefly explore the nature of this relationship, their analyses were limited to only a few indicators of agency in the marriage, such as women's mobility and their say in household decisions, and found mixed results. Chari et al. (2017) identifies challenges in measuring women's agency and bargaining strength as the core reason for the inconclusive findings. This study addresses such concerns in its analysis

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with a holistic assessment of women's agency, not just in the domestic sphere, as explored in previous studies, but with a comprehensive measure of women's empowerment in the productive sphere.

This study's findings, coupled with the existing evidence on the substantial impact of women's empowerment on household well-being, indicate that authorizing a minimum marriage age and strictly enforcing it is overall key to women and social welfare. Wilson (2022) found an increase in age at marriage, age at first birth, and labor-market participation in 17 low- and middle-income countries as a result of increasing the legal minimum age at marriage to 18. Bangladesh recently passed the Child Marriage Restraint Act 2017, which sets the minimum age at marriage for girls at 18 and increases penalties for child marriage. However, lax enforcement and provision allowing child marriage in "special cases," such as with parent's permission or when it is in the "best interest" of the child, have raised widespread concerns. Moreover, analogous to similar restrictions, such as a ban on child labor, these restrictions disproportionately affect families from the poorer sections of the population—who then resort to hiding such marriages and, thus, become more vulnerable to exploitation. Therefore, to be successful in preventing child marriages, laws should be coupled with other initiatives that incentivize parents to not marry off their daughters, maybe by reducing the opportunity cost of going to school. Therefore, more emphasis should be placed on conditional programs, such as the Female Secondary School Stipend Program (FSSSP), that incentivize parents with financial support in order to prevent their daughters from dropping out of school and getting married. Evaluations of such programs like the FSSSP in Bangladesh and PROGRESA/*Oportunidades* in Mexico has shown to improve women's education and well-being. This study's findings provide motivation for more inclusive programs, such as expanding support even for families with unmarried girls who are not going to school, to incentivize families to abide by marriage laws and, thereby, help more girls to benefit from delayed marriages.

Data Availability Statement

The data underlying this article are available in Harvard Dataverse, at https://doi.org/10.7910/DVN/NXKLZJ.

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Supplementary Online Appendix

The Causal Effect of Early Marriage on Women's Bargaining Power: Evidence from Bangladesh

Salauddin Tauseef and Farha Deba Sufian

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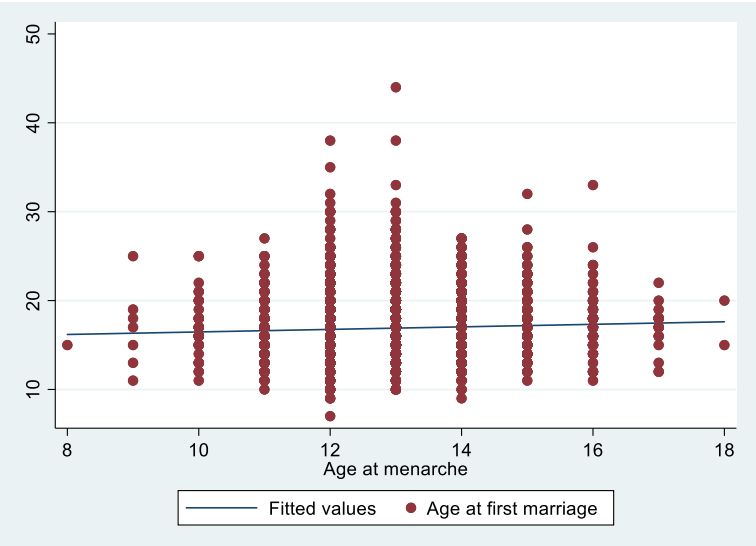
S1. Heterogenous Analysis by Different Groups of Age of Menarche

There may be concern regarding the particular LATE being estimated by this study's instrumental strategy—specifically, the effect of age at marriage on marital quality for girls whose marital-timing decisions are influenced by age of menarche. It may be the case that girls who have either very late or very early menarche onset are driving the results. Therefore, to explore whether girls who have either late or very early onset of menarche are driving the results, the analysis looked at the literature to see what can be considered as early and late menarche. Typically, early menarche is defined as < 11 years, and late menarche as more than 16 years with typical mean age being around 13 years (Lee 2021; Gaudineau et al. 2010). Therefore, the analysis truncates the sample to separate the extremes and look at what is happening with the extreme observations and the sample without the extremes.

Results are presented in table S2.7 in the supplementary online appendix. The analysis finds that for extreme values of menarche—for example, early menarche, that is, less than 11 years, or delayed menarche, that is, greater than 16 years, there was no impact on empowerment status (empowered $= 1$) or empowerment score (FiveDE continuous variable). However, for ages of menarche in the normal range, it does find impact on empowerment status and score. So, identification seems to be coming from girls who had menarche in the normal age range.

S2. Additional Figures and Tables

Figure S2.1. Distribution of Reported Age at Menarche



Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

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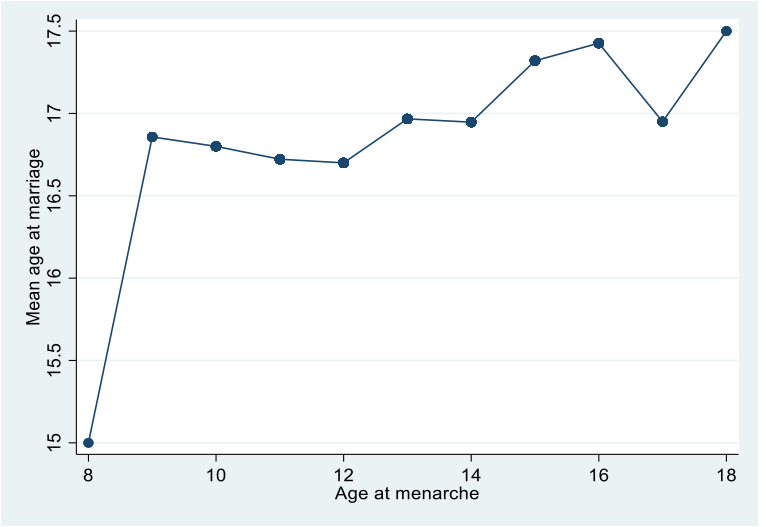
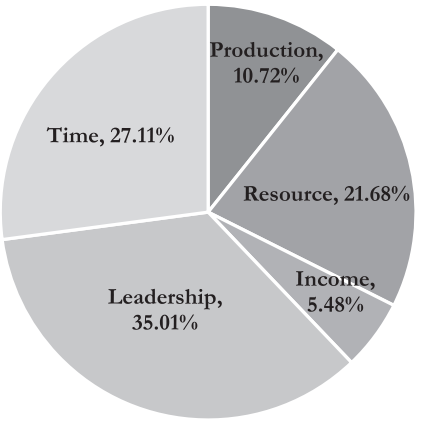
Figure S2.2. Plot of Age at Marriage against Age at Menarche



Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Figure S2.3. Contribution of Each of the Five Domains to the Disempowerment of Women



Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

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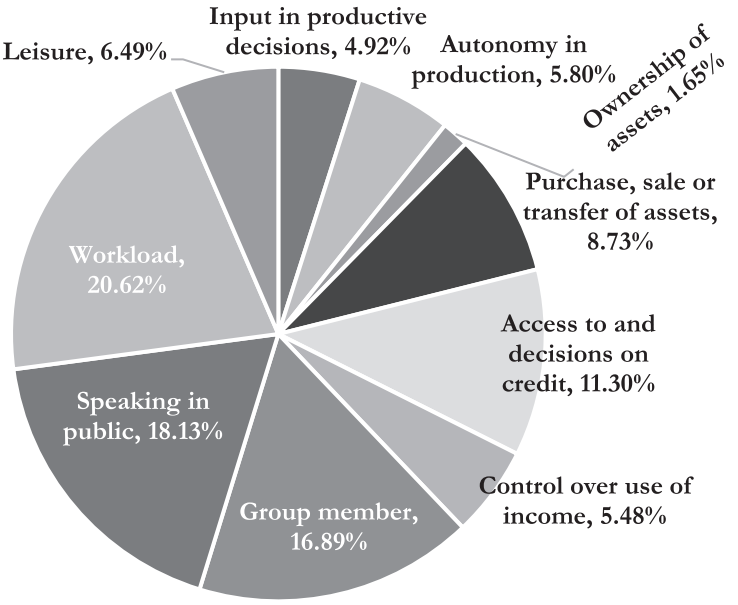
Figure S2.4. Contribution of Each of the Ten Domain Indicators to the Disempowerment of Women



Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

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Table S2.1. The five domains of empowerment in the Women's Empowerment in Agriculture Index (WEAI)

Domain	Indicator	Adequate if . . .	Indicator weight
Production	Input in productive decisions	Respondent has or feels she could have inputs in household agricultural decision making over food and cash-crop farming, livestock, and fisheries.	1/10
	Autonomy in production	Respondent's motivation for decision making regarding agricultural productions, such as what to grow, how much to grow, marketing of productions etc., reflects her own values rather than a desire to please others or avoid harm.	1/10
Resources	Ownership of assets	Respondent jointly or fully owns at least two small assets or one large asset	1/15
	Purchase, sale, or transfer of assets	Respondent participates in decisions to buy, sell, or transfer her owned (self or jointly) assets	1/15
	Access to, and decisions on, credit	Respondent who has at least one source of credit, makes some household credit decisions solely or jointly	1/15
Income	Control over use of income	Respondent has some input in decision making of use of income generated from household's agricultural productions	1/5
Leadership	Group membership	Respondent is an active member in at least one economic or social group, if there exist groups in her proximity	1/10
	Speaking in public	Respondent is comfortable speaking in public concerning various issues such as intervening in a family dispute, ensure proper payment of wages for public work programs, etc.	1/10
Time	Workload	Respondent worked less than 10.5 hours a day	1/10
	Leisure	Respondent expresses any level of dissatisfaction with the amount of leisure time available to her	1/10

Source: Alkire et al. (2013).

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Table S2.2. IV Estimates of the Effect of Age at Marriage Controlling for Years of Education

Panel A IV PROBIT	Empowerment status	Empower-ment (5DE) score	Empowerment gap	Ability to decide on birth control	Can go places alone (index)	Do not need permission to go places (index)	Self-decision to work	Self-decision to work + control over income earned
Age at marriage	0.204**	0.042*	−0.028	0.298***	0.020	0.268*	0.061	0.236***
	(0.103)	(0.025)	(0.020)	(0.062)	(0.123)	(0.141)	(0.159)	(0.085)
	{0.070**}			{0.084***}			{0.022}	{0.071***}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional fixed effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,899	4,899	4,297	3,616	5,433	5,433	5,433	5,433

	Who decides how to spend money on the following items?					Do you yourself control the money needed to buy the following?			
Panel B IV PROBIT	**Food**	**Housing**	**Healthcare**	**Education**	**Clothing**	**Food from the market**	**Clothes for yourself**	**Medicine for yourself**	**Toiletries/ cosmetics**
Age at marriage	0.285***	0.285***	0.265***	0.129	0.230**	0.069	0.310***	0.303***	0.280***
	(0.070)	(0.067)	(0.081)	(0.185)	(0.112)	(0.210)	(0.039)	(0.047)	(0.071)
	{0.068***}	{0.063**}	{0.058**}	{0.022}	{0.052*}	{0.013}	{0.086***}	{0.080***}	{0.068**}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional Fixed Effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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Table S2.3. IV Estimates of the Effect of Age at Marriage Controlling Whether Respondent Ever Attended School

Panel A IV PROBIT	Empowerment status	Empowerment (5DE) score	Empowerment gap	Ability to decide on birth control	Can go places alone (index)	Do not need permission to go places (index)	Self-decision to work	Self-decision to work + control over income earned
Age at marriage	0.191*	0.039*	−0.025	0.285***	0.019	0.250*	0.058	0.227***
	(0.103)	(0.023)	(0.019)	(0.063)	(0.115)	(0.131)	(0.149)	(0.084)
	{0.067**}			{0.080***}			{0.021}	{0.069***}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional fixed effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,899	4,899	4,297	3,616	5,433	5,433	5,433	5,433

	Who decides how to spend money on the following items?					Do you yourself control the money needed to buy the following?			
Panel B IV PROBIT	**Food**	**Housing**	**Healthcare**	**Education**	**Clothing**	**Food from the market**	**Clothes for yourself**	**Medicine for yourself**	**Toiletries/ cosmetics**
Age at marriage	0.274***	0.276***	0.253***	0.115	0.217*	0.061	0.304***	0.296***	0.272***
	(0.074)	(0.068)	(0.084)	(0.181)	(0.115)	(0.201)	(0.040)	(0.049)	(0.074)
	{0.065**}	{0.060**}	{0.055*}	{0.019}	{0.048*}	{0.011}	{0.084***}	{0.077***}	{0.064**}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional Fixed Effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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Table S2.4.i. FAIsification Test

Panel A married before menarche	Empowerment status (1)	Empowerment (5DE) score (2)	Empowerment gap (3)	Ability to decide on birth control (4)	Can go places alone (index) (5)	Do not need permission to go places (index) (6)	Self-decision to work (7)	Self-decision to work + control over income earned (8)
Age at marriage	−0.171	−0.016	−0.001	0.274	−0.093	0.073	0.056	0.117
	(0.113)	(0.013)	(0.009)	(0.439)	(0.069)	(0.072)	(0.116)	(0.115)
	{−0.060}			{0.056}			{0.018}	{0.035}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional Fixed Effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	198	198	168	54	220	220	220	220
Panel B married not before menarche	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Age at marriage	0.100*	0.019**	−0.008	0.197***	0.026	0.086*	0.004	0.105*
	(0.060)	(0.008)	(0.007)	(0.066)	(0.049)	(0.046)	(0.065)	(0.061)
	{0.038*}			{0.055***}			{0.001}	{0.033*}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional fixed effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,701	4,701	4,129	3,515	5,213	5,213	5,213	5,213

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: Regressions reported in columns (1)–(9) are based on the subsample of women who got married before attaining menarche. Regressions reported in columns (10)–(18) are based on the rest of the women. In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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Table S2.4.ii. Falsification Test

	Who decides how to spend money on the following items?					Do you yourself control the money needed to buy the following?			
	Food	Housing	Healthcare	Education	Clothing	Food from the market	Clothes for yourself	Medicine for yourself	Toiletries/ cosmetics
Panel A married before menarche	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age at marriage	0.067	0.002	−0.213	0.245	−0.030	0.376**	0.214	0.330	0.134
	(0.184)	(0.175)	(0.160)	(0.160)	(0.160)	(0.153)	(0.165)	(0.239)	(0.082)
	{0.010}	{0.000}	{−0.038}	{0.051}	{−0.005}	{0.083**}	{0.010}	{0.041}	{0.021}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional Fixed Effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	220	220	220	220	220	220	220	220	220
Panel B married not before menarche	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Age at marriage	0.163**	0.150**	0.137*	0.020	0.092	0.010	0.197***	0.178**	0.428***
	(0.073)	(0.076)	(0.075)	(0.091)	(0.084)	(0.088)	(0.060)	(0.072)	−0.164
	{0.032*}	{0.024}	{0.023}	{0.003}	{0.017}	{0.002}	{0.052**}	{0.031**}	{0.075**}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional Fixed Effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,213	5,213	5,213	5,213	5,213	5,213	5,213	5,213	5,213

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: Regressions reported in columns (1)–(9) are based on the subsample of women who got married before attaining menarche. Regressions reported in columns (10)–(18) are based on the rest of the women. In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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Table S2.5. IV Estimates of the Effect Of Age at Marriage Controlling for Nonlinear Effects of Women's Age

Panel A IV PROBIT	Empowerment status	5DE score	Empowerment gap	Ability to decide on birth control	Can go places alone (index)	Do not need permission to go places (index)	Self-decision to work	Self-decision to work + control over income earned
Age at marriage	0.186*	0.037*	−0.024	0.284***	0.009	0.239*	0.054	0.223***
	(0.104)	(0.021)	(0.018)	(0.065)	(0.112)	(0.127)	(0.147)	(0.085)
	{0.064**}			{0.080***}			{0.019}	{0.068***}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional Fixed Effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,899	4,899	4,297	3,601	5,433	5,433	5,433	5,433

	Who decides how to spend money on the following items?					Do you yourself control the money needed to buy the following?			
Panel B IV PROBIT	**Food**	**Housing**	**Healthcare**	**Education**	**Clothing**	**Food from the market**	**Clothes for yourself**	**Medicine for yourself**	**Toiletries/ cosmetics**
Age at marriage	0.270***	0.268***	0.245***	0.094	0.211*	0.068	0.305***	0.297***	0.275***
	(0.076)	(0.074)	(0.089)	(0.187)	(0.117)	(0.199)	(0.038)	(0.047)	(0.069)
	{0.063**}	{0.057**}	{0.052*}	{0.015}	{0.046}	{0.012}	{0.084***}	{0.077***}	{0.065**}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional fixed effect	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, age squared, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) are presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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Table S2.6. IV Estimates of the Effect of Age at Marriage with Birth Year Fixed Effects

Panel A IV PROBIT	Empowerment status	Empowerment (5DE) score	Empowerment gap	Ability to decide on birth control	Can go places alone (index)	Do not need permission to go places (index)	Self-decision to work	Self-decision to work + control over income earned
Age at marriage	0.191*	0.037	−0.025	0.283***	0.006	0.246*	0.068	0.240***
	(0.112)	(0.023)	(0.021)	(0.071)	(0.115)	(0.134)	(0.147)	(0.082)
	{0.066**}			{0.079***}			{0.024}	{0.072***}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Birth year FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	4,899	4,899	4,297	3,568	5,433	5,433	5,433	5,433

	Who decides how to spend money on the following items?					Do you yourself control the money needed to buy the following?			
Panel B IV PROBIT	**Food**	**Housing**	**Healthcare**	**Education**	**Clothing**	**Food from the market**	**Clothes for yourself**	**Medicine for yourself**	**Toiletries/ cosmetics**
Age at marriage	0.283***	0.279***	0.253***	0.084	0.204	0.079	0.319***	0.310***	0.286***
	(0.074)	(0.075)	(0.093)	(0.208)	(0.133)	(0.206)	(0.034)	(0.042)	(0.064)
	{0.066**}	{0.059**}	{0.053*}	{0.014}	{0.043}	{0.014}	{0.089***}	{0.082***}	{0.069**}
Other controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Birth year FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Regional FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433	5,433

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.

Note: In all specifications, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, birth year fixed effects and agro-ecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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Table S2.7. Heterogenous Analysis by Age of Menarche

	Age of menarche between 11 and 16 (inclusive)		Age of menarche less than 11 or more than 16	
	Empowerment status	Empowerment (5DE) score	Empowerment status	Empowerment (5DE) score
Age at first marriage	0.182**	0.032*	0.275	0.002
	(0.086)	(0.017)	(0.337)	(0.056)
	{0.064}**		{0.056}	
Observations	4,849	4,849	50	50

Source: Authors' calculations using Bangladesh Integrated Household Survey (BIHS) 2019 data.
Note: In all columns, the age at marriage is instrumented by the age at menarche. All estimations control for the woman's age, height, woman's mother's and father's education, number of siblings, number of sisters, female-headed households, and agro-ecological region fixed effects. Cluster robust standard errors presented in parenthesis (). Standard errors are clustered at the village level. Marginal effects (dy/dx) are presented in braces {}. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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