

# **Women's Status in Rural Bangladesh: Exploitation and Empowerment**

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## **Abstract**

Using household survey data from rural Bangladesh, we explore determinants of domestic violence. We propose two hypotheses: first, women suffer more domestic abuse as a result of marrying young; and second, women who are empowered suffer less gender-based violence. We isolate the causal effect of marriage timing using age at first menstruation and extreme weather as instruments; and the effect of empowerment using the number of types of informal credit sources as instrument. We find robust evidence contrary to our hypotheses. Our findings highlight that mere empowerment or increasing age at first marriage are insufficient mediums to combat gender-based violence and can in fact be counterproductive to reducing domestic violence against women, if the socio-economic context is not carefully considered.

**JEL: B54, C36, I24, J12, J16, J18**

**Keywords:** Bangladesh, domestic violence, age at first marriage, age at first menstruation, weather shocks, empowerment

## I. Introduction & Motivation

There is a high prevalence of gender-based violence in Bangladesh, a patriarchal society where women do not speak openly of incidents of domestic violence (Bhattacharyya et al., 2018). The United Nations Statistics Division (UNSD) defines violence against women as any act of gender-based violence that results in or is likely to result in physical, sexual, or psychological harm or suffering to women, including threats of acts such as coercion or arbitrary deprivation of liberty, whether occurring in public or in private life.

Domestic violence against women, or violence perpetuated in the home or family environment, is a major social problem in Bangladesh. It is hard to combat as it is typically embedded in a complex web of institutionalized social relations that make women susceptible to violence (Schuler et al., 1998). Despite the Domestic Violence Act of Bangladesh enacted in 2010 and Bangladesh's Ministry of Health and Family Welfare committing to eliminate violence against women by 2015 -- as detailed in Target 6 of the Millennium Development Goal 5 -- violence against women is still prevalent. The Violence against Women (VAW) Survey conducted by the Bangladesh Bureau of Statistics in 2015, in collaboration with United Nations Population Fund, found that partner violence<sup>1</sup> was present in most Bangladeshi households -- only 8% of respondents reported no abuse by their partner. Almost two-thirds (72.6%) of ever-married women experienced one or more forms of violence by their husbands at least once in their lifetime, and 54.7% experienced violence during the previous year. The incidence of violence also differed geographically -- rates of lifetime partner violence (any form) were highest in rural areas (74.8% of ever-married women) but lowest in cities (54.4%).

Violence against women hinders women's socio-economic development and capacity for autonomy (Koenig et al., 2003). It also has potential socio-economic consequences on all of society, and infringes on basic human rights. *Violence against Women* was recognized as a human rights issue in the 1993 World Conference on Human Rights in Vienna, which established that 'human rights of women and of the girl-child are an inalienable, integral and indivisible part of universal human rights'.

Bangladesh also has the fourth highest prevalence rate of child marriage in the world (defined as marriage before age 18) (UNICEF, 2018). UNICEF reported that 59% of girls in Bangladesh were married before their 18th birthday and 22% married before the age of 15. In the Bangladesh Integrated Household Survey (BIHS) 2015 data on rural Bangladesh, 60.10 % of women got married before the age of 18, and 17.28 % married before the age of 15.

Our paper aims to explore strategies to end violence against women in developing countries, using rural Bangladesh as a case study. Using data from the 2015 Bangladesh Integrated Household Survey (BIHS), a large cross-sectional household survey in rural Bangladesh, we explore two relationships: the relationship between age at first marriage and domestic violence; and female empowerment and domestic violence. Interestingly, we find statistically significant positive relationships for both. These positive relationships may be due to the time and context-specific nature of domestic violence against women. More

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<sup>1</sup> Partner violence defined by the United Nations includes physical, sexual, economic, and emotional violence, and/or controlling behaviour.

specifically, the latter may be due to “backlash” from men when their wives become more empowered, who may feel that their economic and household status or roles are threatened, and respond with violence (Bolis & Hughes, 2016; Luke and Munshi 2011). Another explanation is that when women become increasingly economically empowered, men may resort to violence against their wives to disrupt their economic activity, seize their income, and/or exert authority over managing their resources (Bolis & Hughes, 2016). Therefore, changes in laws and policies are needed to create more holistic empowerment that tackles the deep-rooted gender inequality, which contributes to gender-based violence.

The paper is organized as follows. The following section discusses the determinants of domestic violence, implications of age at first marriage on domestic violence and the meaning of empowerment and its implications on domestic violence. Section III presents our research questions, and Section IV details the structured survey data from BIHS 2015 used for this study. Section V continues with our instrumental variables empirical strategy, where we use age at first menstruation and extreme weather shocks as instruments. Section VI contains our results and section VII concludes with a discussion on the relevance and implications of our findings.

## **II. Literature Review**

### *Determinants of domestic violence*

Violence against women is a perennial problem in Bangladesh. Reducing domestic violence is complicated by the varied determinants of domestic violence, which are often intertwined. Koenig et al. (2003) found that domestic violence is manifested by the “interrelated effects of contextual and community-level factors, household and individual-level characteristics, and women’s status/autonomy factors.” Contextual and community-level factors are overall levels of “socio-economic development, gender inequality, norms and sanctions concerning domestic violence, and levels of overall crime.” Household and individual factors are individual’s “socio-economic status, life cycle factors, intergenerational exposure to violence, and risk behaviors such as substance abuse.”

### *Age at first marriage and domestic violence against women*

One individual-level characteristic that potentially affects violence against women is age at first marriage. However, there is confounding evidence on the nature of this relationship, with some papers showing a negative relationship, while some others showing a positive or non-significant relationship.

Kim & Cho (1992), Schuler et al. (1998) lean towards a negative relationship, stating that increasing the age of a husband or wife decreases the risk of domestic violence. In particular, women’s older age at marriage was found to be significantly inversely associated with violence as per Jejeebhoy and Cook’s 1997 study.

Conversely, a small number of studies, including that of Srinivasan & Bedi (2007), find a positive association between a woman’s age at marriage and her risk of experiencing intimate partner violence (IPV). They attribute this positive relationship to the narrow range of socially acceptable age for marriage for women, which therefore places older women at more risk. Women who marry later may experience more violence since they might be more bold and self-assured and hence be subject to additional control-induced violence as they face a stronger backlash from their partners. It is also possible that

women who get married later have some unobserved characteristics which are both correlated with their later age at first marriage and their propensity to face domestic violence (Srinivasan & Bedi, 2007). Moreover, since education is positively correlated to age at marriage and more education likely increases women's economic resources, women who marry late may experience more domestic violence by their husbands who might want to control these resources (Dhamija & Roychowdhury, 2018).

The context is also important in determining the nature of this relationship. Yount et al. (2016) found that the likely protective effect of marrying later (18 or older) could be negated in villages where very early child marriage was prevalent and women might be at a greater risk of experiencing IPV as their behavior deviates from the societal norm practiced in the village on how women are or should be treated (Yount et al., 2016). Similarly, Speizer (2011) found a non-significant relationship between IPV and early marriage in Bihar, India, but significant results for another state, Rajasthan. The authors state that this may be a consequence of a small sample size, or alternatively, IPV may be so deep-rooted in Bihar (50% of women suffer from IPV) such that age at marriage does not affect a woman's propensity to experience IPV. Additionally, if early marriage in Bihar is dominated by economic rather than cultural factors, then the socioeconomic controls may capture the effect of early marriage on IPV in Bihar instead.

### *Women's Empowerment*

Empowerment is a complex concept that is hard to define. There are many definitions of empowerment in the literature; a popular definition by Alsop et al. (2006) describes empowerment as "a group's or individual's capacity to make effective choices, that is, to make choices and to transform those choices into desired actions and outcomes." This definition of empowerment comprises two components. First, the expansion of agency, defined as the ability to act on behalf of what you value and have reason to value (Malhotra & Schuler, 2005). Second, the institutional environment, which allows individuals to practice their agency effectively.

Another definition that has been frequently used to define and measure empowerment is Kabeer's (1999), which states that "empowerment refers to the expansion in people's ability to make strategic life choices in a context where this ability was previously denied to them." (Bartlett, 2004, 57). In Kabeer's definition, three dimensions determine people's ability to make choices -- resources, agency, and achievements (well-being outcomes).

We focus on the "agency" aspect of empowerment, as it is less studied than resources such as income or achievements, such as educational levels (Alkire et al, 2013). Therefore, we contribute to the literature on empowerment through this study, suggesting that *agency* might be a better measure of empowerment since resource proxies may be imperfect measures of empowerment in agriculture areas, such as in rural Bangladesh (Alkire et al, 2013). Alkire et al (2013) ran a pilot study in rural areas of Bangladesh, Uganda and Guatemala and their findings highlighted the failure of some traditional proxies for women's empowerment, including individual characteristics like educational achievements and household characteristics like wealth.

### *Empowerment and domestic violence*

Due to the time and location-specific nature of the relationship between women empowerment and domestic violence, there have been contradictory findings on the effectiveness of measures to combat gender-based violence.

A study by Schuler and Hashemi (1998) reported higher incidence of gender-based violence among women who were members of microcredit groups, an effect later reproduced in a study by Koenig et al (2003) which found that women's empowerment and short-term membership in credit groups were both associated with increased risk of IPV in more culturally conservative areas, whereas in less culturally conservative areas, individual-level women's status indicators were unrelated to the risk of violence.

Women's empowerment in the form of greater income by women may also increase domestic violence as White (1997) and Ahmed (2008) showed that some men perceived their status as family provider demolished through higher income capacity of their wives, which prompted them to resort to violence to regain their so-called power.

Conversely, Schuler et al (2018) theorized that in societies where gender transitions and women's empowerment was still occurring, the prevalence of IPV followed an inverse U-shaped curve -- it would first increase and then decrease -- as women's empowerment shifted from incipient (women's empowerment threatening male power and gender identities) to normative (decreasing violence against women and girls).

Given the uncertain nature of this relationship, we hope to contribute to current literature on the subject, with reference to rural Bangladesh, by using structured survey data from the 2015 Bangladesh Integrated Household Survey (BIHS) to examine how women's empowerment interacts with different circumstances and relations of power and privilege to contribute to or reduce gender-based violence.

### **III. Research Question**

We propose two research questions to better understand the determinants of domestic violence.

1. What is the impact of age at first marriage on the likelihood that a woman suffers from domestic violence after marriage?
2. Is women's empowerment protective against, or instead contributory to, domestic violence against them?

### **IV. Data Description**

Our empirical analysis is driven by the 2015 Bangladesh Integrated Household Survey (BIHS) data, an informative, structured, and nationally representative survey of rural Bangladesh. The survey was designed and supervised by researchers at the International Food Policy Research Institute (IFPRI). It collected individual-level data to measure women's empowerment in agriculture index (WEAI). The BIHS comprises 6500 households in 325 primary sampling units, and was conducted in each of the seven administrative divisions of the country: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, Rangpur, and Sylhet (IFPRI, 2015). The summary of key variables from the BIHS 2015 data can be seen in Table 1 below.

Table 1: Summary of Key Statistics (BIHS, 2015)

	Age at first marriage			Age at first Menstruation		
	All (1)	15 or younger (2)	Older than 15 (3)	11-12 (4)	13-14 (5)	15-17 (6)
Age	33.76	36.06	32.70	33.40	33.90	34.63
Height (cm)	150.74	150.50	150.86	150.49	150.87	151.62
Hindu	0.11	0.095	0.12	0.13	0.12	0.14
Muslim	0.81	0.86	0.79	0.87	0.88	0.86
Electricity (yes/no)	0.61	0.59	0.61	0.59	0.62	0.56
Drinking water at home	0.66	0.67	0.66	0.66	0.67	0.62
Years of father's education	2.87	2.64	2.98	2.71	2.96	3.12
Years of mother's education	1.24	1.05	1.32	1.14	1.29	1.35
Size of father's cultivable land (decimal)	205.48	202.15	207.02	189.99	213.98	243.27
Age at first marriage				16.92	16.962	17.493
Observations	6,258	2,006	4,252	2,419	3,415	340

*Domestic violence and Age at First Marriage*

We use *domestic violence* as the dependent variable and *age at first marriage* as the independent variable. Domestic violence is defined as a wife's report of any form of abuse -- physical or emotional -- in the BIHS 2015 dataset. Questions from BIHS 2015 used to elicit the different types of abuse that a wife had experienced in the past year can be seen in Table 2.

Table 2: Types of abuse and corresponding relevant questions (BIHS 2015)

Type of Abuse	Questions from BIHS 2015
Physical	* Has any of the following happened to you in the past year? - Your husband, another family member, or household resident physically abuse you?
Emotional (verbal abuse and threats)	* Has any of the following happened to you in the past year? - Your husband, another family member, or household resident verbally abused you? - Your husband threatened you with divorce? - Your husband threatened you with taking another wife?

Incidence(s) of abuse reported by wives in BIHS 2015 can be seen in Table 3.

Table 3: Incidence of abuse experienced by married women

Type of Abuse	Rural Bangladesh (% Reported)	Number
Physical Abuse	11.67	6,368
Verbal Abuse	36.84	6,370
Threats of Divorce	4.89	6,243
Threats of taking another wife	4.60	6,242

Whilst Table 3 shows the reported incidence of abuse experienced by married women, it may be an underestimate of the true level of abuse as there is potential under-reporting by women, discussed in section VII.

#### *Domestic violence and female empowerment*

We use *domestic violence* as the dependent variable and analyse its relationship with *female empowerment*. We build the independent variable, *empowerment*, based on five domains and using ten indicators, as seen in Table 4 in the Appendix, since it is a complex and dynamic concept, which cannot be evaluated based on a single dimension. We give each domain equal weight, following the Women's Empowerment in Agriculture Index (WEAI) developed by Alkire et al (2013) in partnership with the International Food Policy Research Institute (IFPRI). IFPRI shared the survey questions, and we identified them in the BIHS 2015 dataset to construct the female empowerment score, as seen in Table 4 in the Appendix.

We compute the final *empowerment score* by summing the weighted scores for the ten different indicators used.

$$\text{Empowerment Score} = \text{Input in productive decision} * 1/10 + \text{Autonomy in production} * 1/10 + \text{Ownership} * 1/15 + \text{Purchase, Sale or Transfer of asset} * 1/15 + \text{Access to and Decision on Credit} * 1/15 + \text{Control over use of income} * 1/5 + \text{Group Membership} * 1/10 + \text{Speak in Public} * 1/10 + \text{workload} * 1/10 + \text{Leisure Time} * 1/10$$

The indicators (which are dummies that take on the value 0 when a woman is disempowered, and 1 when a woman is empowered) listed above are coded as follows:

1. Input in productive decision: A person is considered empowered if she has some input in decisions in at least two out of the eight activities, including food crop farming,<sup>2</sup> cash crop farming<sup>3</sup>, livestock raising, or fishing; and what inputs to buy for agricultural production, what

<sup>2</sup> Food crop farming: crops that are grown primarily for household food consumption

<sup>3</sup> Cash crop farming: crops that are grown primarily for sale in the market

types of crops to grow for agricultural production, when or who would take crops to the market, and inputs for livestock raising.

2. Autonomy in production: A person is considered empowered if her Autonomy score<sup>4</sup> is greater than 1 in at least one production activity<sup>5</sup>.
3. Ownership: A person is considered empowered if she (herself or jointly) owns at least two small assets or one large asset.<sup>6</sup>
4. Purchase, sale, or transfer of assets: A person is considered empowered if she (herself or jointly) can make at least one type of decision in purchasing, selling, or transferring at least one item listed in the small or large assets.
5. Access to and decision on credit: A person is considered empowered if she (herself or jointly) makes at least one decision regarding at least one source of credit.
6. Control over the use of income: A person is considered empowered if she has some input in income decision or feels she can make decisions in at least one activity.<sup>7</sup>
7. Group membership: A person is considered empowered if she is part of at least one group<sup>8</sup>.
8. Speak in public: A person is considered empowered if she feels comfortable speaking in public in at least one context.
9. Workload: A person is considered empowered if she works<sup>9</sup> less than 10.5 hours per day.
10. Leisure Time: A person is considered empowered if she does not express any level of dissatisfaction with the amount of leisure time available. (satisfaction rating of 5 or more)

The mean and standard deviation of the 10 indicators used are shown in Table 5.

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<sup>4</sup> Autonomy score =  $-2 * (\text{Passive behavior}) - 1 * (\text{Recognition behavior}) + 3 * (\text{Active behavior})$

<sup>5</sup> The types of crops to grow for consumption and sale in market, Taking crops to the market (or not), Livestock raising

<sup>6</sup> Total items (14 categories) include small assets (3 categories) and large assets (11 categories). Small assets include Chickens (including Ducks, Turkeys, Pigeons), Farm equipment (non-mechanized) and Small consumer durables (radio, cookware). Large assets have Agricultural land, Large livestock (oxen/buffalo), Small livestock (goats/sheep), Fish pond or fishing equipment, Farm equipment (mechanized), Nonfarm business equipment, House (and other structures), Large consumer durables (fridge, TV, sofa), Cell phone, Other land not used for agricultural purposes, and Means of transportation (bicycle, rickshaw, motorcycles, car)

<sup>7</sup> Income decisions include food crop farming, cash crop farming, livestock raising, or fishing, your own wage or salary employment, major household expenditures. Activities include her own wage or salary employment, major household expenditures, minor household expenditures.

<sup>8</sup> Agricultural / livestock/ fisheries producer's group (including marketing groups), Water users' group, Forest users' group, Credit or microfinance group (incl. ROSCAs/merry-go-round), Mutual help or insurance group (including burial societies), Trade and business association, Civic group (improving community) or Charitable group (helping others), Local government, Religious group, Other women's group (only if it does not fit into one of the other categories), and Others.

<sup>9</sup> Type of work includes being Employed, Own business work, Farming, Construction, Fishing, Shopping/getting service, Weaving/sewing/textile care, Cooking, Domestic work, Care for children/adults/elderly, travelling and Commuting



Table 5: Mean and standard deviation of indicators used in computing the empowerment score

Domain	Indicator	Mean	Standard Deviation
Production	Input in productive decision	0.249	0.433
	Autonomy in production	0.784	0.411
	Ownership	0.195	0.397
Resource	Purchase, Sale or Transfer of asset	0.445	0.497
	Access to and Decision on Credit	0.466	0.499
Income	Control over use of income	0.216	0.412
Leadership	Group Membership	0.697	0.460
	Speak in Public	0.407	0.491
Time	Workload	0.313	0.464
	Leisure Time	0.210	0.408
Overall Empowerment Score		0.627	0.171

## V. Methodology

We employ an instrumental variable approach to examine the following relationships:

1. Impact of age at first marriage on domestic violence  
(Instruments: Age at first menstruation & Extreme Weather Index)
2. Impact of women's empowerment on domestic violence  
(Instrument: Number of types of informal credit sources)

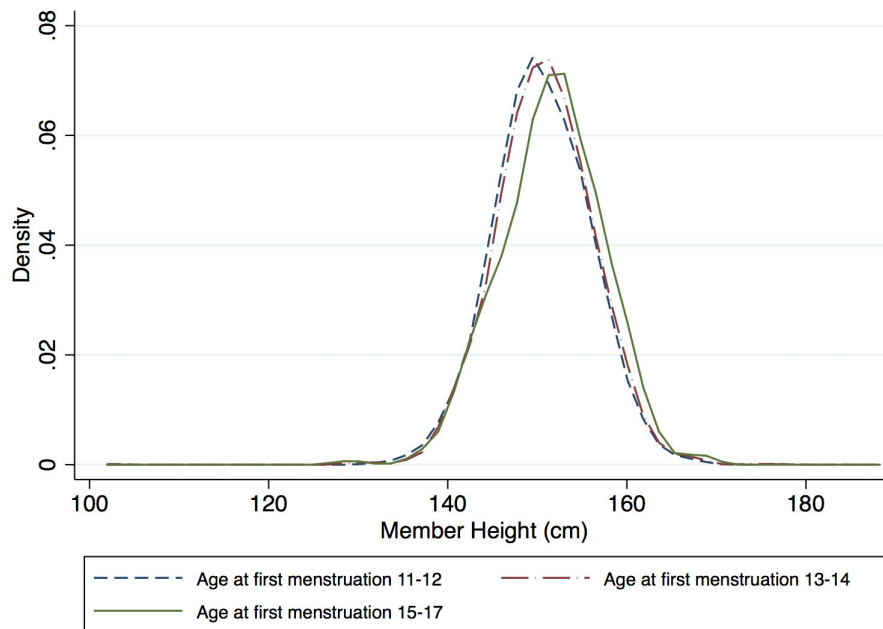
### ***Domestic Violence on Age at first marriage***

*Instrument: Age at first menstruation*

In this identification strategy, we instrument age at first marriage with age at first menstruation to exploit variation in age at first menstruation and obtain exogenous variation in women's age at marriage. This helps us to isolate the *causal* effect of age at first marriage on domestic violence. The exogeneity of age at first menstruation is particularly important in our setting because there are many unobservables which we cannot control for, as the propensity to suffer from domestic abuse is non-random and could be affected by various unobserved socio-economic factors. The *independence* of the instrument relies on the assumption that age of menstruation affects likelihood of domestic abuse only through its impact on age at first marriage. This depends on the absence of potential unobservable differences influencing both age at first menstruation and the likelihood of domestic abuse (Field, et al, 2008). This assumption is plausible since biological research has shown that genetic factors are the strongest predictors of adolescent development, and consequently age of first menstruation (Campbell and Udry 1995). Field et al (2008) also cite a study by Kaprio et al (1996), which found a low correlation of 0.21 in age of onset of puberty among dizygotic twins, but a correlation that was nearly three times as large among monozygotic twins. These differences indicated the importance of genetics on maturation and a minimal role of environmental influences on the onset of puberty (Field et al, 2008).

While these patterns indicate that much of the variation in age at first menstruation is unrelated to family background, we acknowledge that there may be external influences on age at first menstruation that may be particularly relevant in less developed countries. One concern is the potential correlation between age at first menstruation and nutrition, especially since our sample is drawn from rural Bangladesh where 33% of children are underweight (Bangladesh Demographic Health Survey 2014). The extent to which this may affect the independence of our instrument depends on whether differences in nutrition are large enough to delay pubescent development. Studies on age of first menstruation and nutritional status find that only malnutrition severe enough to cause stunting during childhood could cause a delay in age of menstruation (Stathopulu, Hulse, and Canning 2003). The Environmental Protection Agency’s Endocrine Disrupter Screening Program (EDSP) found that only severe malnutrition that reduced childhood weight gain by more than 50% delayed the onset of puberty (Field et al, 2008).

We are therefore able to assess the degree of endogeneity with data on height of women in BIHS 2015, using it as a proxy for nutritional status (Field, et al, 2008). We check if age of menstruation is negatively correlated to height as that would indicate possible stunting during childhood, threatening the exclusion assumption for our instrument. Fortunately, we find *no* statistically significant negative correlation in our sample, as reflected in the height data in row 2 (cols. 4–6) of Table 1, proving that stunting has not affected the age at menstruation in our sample. We also plot the kernel density estimate of women’s adult height with different age groups of age at first menstruation in Figure 1 to illustrate that the population distributions and not just averages are similar across all subgroups of different age at first menstruation.



*Figure 1:* Kernel density of adult height with different subsamples with different age at first menstruation. Data taken from BIHS 2015. The sample includes all women with nonmissing values for age at marriage and age at menarche, who reached menarche between ages 11 and 17.

The instrument of age at menstruation is *relevant* as while many parents are often motivated to marry daughters as young as possible, in Bangladesh as in many developing countries, girls are typically only able to be married off after puberty (Field et al., 2008). Pre-pubescent marriages are rare (Bullough, 1998) and only account for 3.45% of observations in the BIHS 2015 dataset. Parents are motivated to marry their daughters after they have reached puberty as “in Bangladeshi society a teenage daughter reaching menstruation becomes a burden for many parents because preservation of her virginity is the greatest concern for a bride. As a result . . . parents like to get their daughters married as early as possible” (Begum, 2003, 86). In the BIHS 2015 dataset, about 27%, 41.4%, and 55.59% of marriages occur within 2, 3, and 4 years of age of first menstruation respectively. This physical barrier to early marriages, insofar as it is independent of domestic violence, provides exogenous variation that allows us to obtain a causal estimate of the effects of early marriage on domestic violence against women.

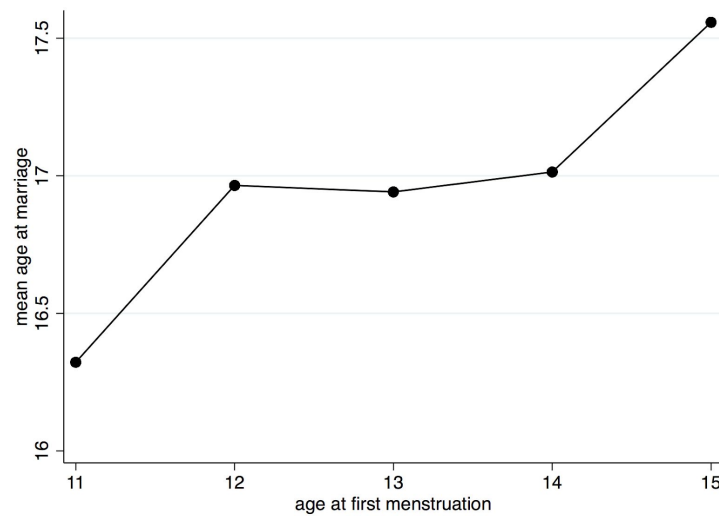


Figure 2: Mean of age at first marriage on mean of age at first menstruation

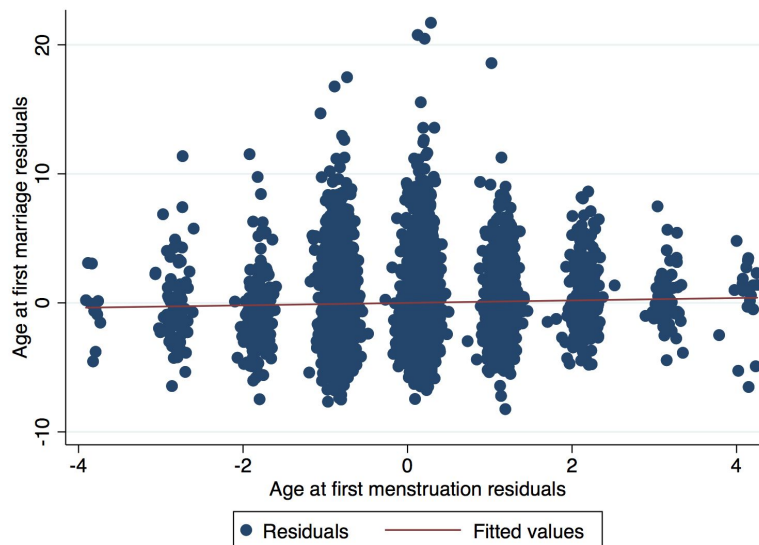


Figure 3: Partial regression scatterplot of age at first marriage and age at first menstruation

The pattern in Figure 2 illustrates a strong positive correlation between the average age at first menstruation and the average age at first marriage<sup>10</sup>, proof of the *relevance* of instrument in the BIHS 2015 data. The fitted line in the partial regression scatterplot of residuals using Frisch-Waugh theorem for the whole sample in Figure 3 also shows a slight positive relationship between age at first marriage and age at first menstruation. To further prove the *relevance* of the instrument, Table 7 shows that age at first menstruation is statistically significant at the 1% significance level with different levels of controls and village fixed effects in the first-stage regression of our model.

Our first-stage regression is as follows:

$$Age\ at\ first\ marriage_{i(v)} = \beta_0 + \beta_1 age\ at\ first\ menstruation_i + \beta_2 X_i + \gamma_v + \varepsilon_{iv}$$

where our dependent variable, *age at first marriage*<sub>*i(v)*</sub>, is the age at first marriage for woman *i* living in village *v*. Our independent variable, *age at first menstruation*<sub>*i*</sub>, is the age at first menstruation for woman *i*. *X*<sub>*i*</sub> is a series of covariates for personal characteristics, husband's socioeconomic status, and family background;  $\gamma_v$  is village fixed effects; and  $\varepsilon_{iv}$  is our error term.

#### *Covariates*

We include the following variables as controls in our model:

1. Age of female respondents (in years)
2. Height of female respondent (in cm)
3. Dummy for whether a woman is pregnant or not
4. Religion of household - dummies for being Hindu or Muslim
5. Socio-economic status of husband, measured by two indicators:
  - a. Dummy, if household has access to electricity
  - b. Dummy, if household's source of drinking water is in their own home
6. Years of father's education
7. Years of mother's education
8. Size of father's cultivable land
9. Village fixed effects

#### *Reasons for covariates*

We controlled for individual female characteristics, such as age of female respondent, as various studies including those by Haj-Yahia (2000) and Naved and Persson (2008), have found that women's age is an important risk factor of domestic abuse.

We also control for height as it may be an indicator of socioeconomic status as a woman may be stunted if she suffers a large enough nutritional deficit during her childhood (Field et al, 2008). Since we do not want the differentials in socio-economic status to bias our results, we control for height. We also control for whether a woman is pregnant or not as that may influence her vulnerability to domestic violence. Pregnant women may be less likely to suffer from domestic violence.

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<sup>10</sup> We restrict the age of first menstruation between 11-15(yrs) in order to remove outliers (4.06% of observations).

Religion of household is controlled for as religion may impact the level of education and incidence of domestic violence due to different cultural beliefs and practices in different religious communities.

We control for the husband's socio-economic status, proxied by household's access to electricity and drinking water, as this may be correlated to domestic violence. These indicators represent the most important assets owned by rural households in Bangladesh (Sraboni et al., 2014).

We also control for the wife's parental background, including her parents' educational attainment and size of cultivable land. These are proxies for her family's socio-economic status, which may in turn influence her propensity to suffer from domestic abuse after getting married.

We also include village fixed effects because culture, values, and norms may vary based on village, all of which influence the treatment of women, such as their likelihood to suffer from domestic abuse. Additionally, village fixed effects account for spatial variation in exposure to environmental factors that may potentially influence the age of menstruation since laboratory experiments have shown that geography and climate can potentially influence puberty. In particular, altitude and cold weather may potentially delay puberty (Field et al., 2008). We are, however, only able to control for the current village of residence of the married woman and not her natal village since the survey does not include comprehensive information on that. But since most marriages in Bangladesh occur either within the same village or between villages with similar characteristics, the lack of data on the latter is not likely a problem. Village fixed effects improves the robustness of our results as they control for time-invariant local unobservable characteristics, such as geographic, economic, and cultural factors, which may differ across villages and affect our results.

*Instrument: Extreme weather index*

For a further robustness check, we use another instrument to estimate our results -- a time-varying extreme weather index that reflects the intensity of the extreme weather events when women are aged 12-17. For this identification strategy to be valid, the extreme weather index must be relevant and independent. It is *relevant* because extreme weather serves as a proxy for local income shocks, and stands to affect marriages through dowries, which are prevalent in Bangladesh. This is similar to the model used by Corno et al. (2017), where they test how droughts, which are a proxy for local economic shocks, affect the age of marriage in India and Sub-Saharan Africa. They find statistically significant results on droughts, which reduce annual crop yields by 10-15% and aggregate income by 4-5%, having opposite effects on marriage behavior depending on whether bride price or dowries are cultural practices. In Sub-Saharan Africa, where bride price is a cultural norm, weather shocks increase the annual hazard of child marriage by 3%, while in India, where dowry exchange is prevalent, droughts reduce such a hazard by 4%. Since marriage payments function as a source of consumption smoothing, weather shocks affect age at first marriage as they are a proxy for income shocks, and can affect a family's decision of when to marry their daughter(s).

Similar to India, Bangladesh practices exchanging dowry at marriage. Despite being forbidden by law since 1980, the dowry system still persists in Bangladesh (Chowdhury et al., 2017) as it is deeply ingrained in the social texture and has become a rigid social custom. A dowry is a substantial monetary or

in-kind transfer from the woman's family to the man's family at marriage (Corno et al., 2017). The dowry system in Bangladesh is a contributory factor to the young average age at first marriage as older and more educated brides are expected to pay more dowry, incentivizing families, especially lower-income ones, to marry off their daughters early (Field et al, 2008). The Voice and Agency report by the World Bank found that girls from poor households were almost twice as likely to marry early as compared to girls from wealthier households (Klugman, Hanmer, et al., 2014), highlighting the influence of household wealth on the decision of when women get married. When aggregate income is temporarily low and marginal utility of consumption is higher, households prefer to delay their daughter's marriage in order to consume the marriage transfer (Corno, et al., 2017). The relevance of the instrument is also backed by the statistically significant positive correlation we obtain in the first-stage regression, reported in Table 8. Therefore, this encourages us to use weather shocks as an instrument for age at first marriage.

The key identifying assumption is that the instrument of extreme weather is *independent*. The exogeneity of rainfall shocks is key in our study of the impact of age at first marriage on domestic violence as there are many unobservables for which we cannot control for. We believe that this assumption is plausible because by defining the shock at a given district as calendar year rainfall of a certain standard deviation from the local mean, all districts are equally likely to experience a shock in any given year. Thus, by construction, this measure of shock should be orthogonal to unobserved local characteristics. Although each district is equally likely to have a weather shock in any given year, rainfall in a given district varies over time, so our identifying variation comes from the random timing of the shocks (Corno, et al., 2017). Therefore, extreme weather shocks should not directly affect a woman's experience with domestic violence.

As droughts are not as prevalent as floods in Bangladesh, we construct an extreme weather index that takes into account both. We obtain rainfall data from Zaman (2018), who published data from the Bangladesh Meteorological Department. We then follow Sekhri et al.'s (2014) paper to calculate the extreme weather index, where different ranges of standard deviation in annual rainfall from the local district mean can be scored on the extreme weather index. In our extreme weather index, calculated at the *district* level, a less than 0.375 standard deviation is scored 0 on the extreme weather index; a standard deviation between 0.375 and 1.125 equals 1; standard deviation between 1.125 and 1.875 equals 2; standard deviation between 1.875 and 2.625 equals 3; and standard deviation greater than 2.625 equals 4. The extreme index for each year ranges from 0 to 4, with 4 being the most extreme as it has the highest standard deviation from the local mean. The range of the sum of the extreme weather index for the six years when a woman is aged 12-17 is thus multiplied by six, giving it a range of 0 to 24. The distribution of observations in the index can be seen in Table 6.

Table 6: Extreme weather index

Extreme weather events ages 12-17	Frequency	Percent
0	15	0.22
1	54	0.81
2	321	4.79
3	845	12.62
4	1301	19.43
5	1088	16.25
6	1095	16.35
7	869	12.98
8	522	7.80
9	287	4.29
10	161	2.40
11	90	1.34
12	24	0.36
13	17	0.25
14	5	0.07
15	2	0.03
16-24	0	0

Our first-stage regression when we use extreme weather index as an instrument is as follows:

$$Age\ at\ first\ marriage_{i(vdk)} = \beta_0 + \beta_1 extremeweather_{kd} + \beta_2 X_i + \gamma_v + \epsilon_{ivdk} ,$$

where our dependent variable  $age\ at\ first\ marriage_{i(vdk)}$  is the age at first marriage for a woman  $i$ , born in cohort  $k$ , living in village  $v$  in district  $d$ .  $extremeweather_{kd}$  is the extreme weather index for a woman living in district  $d$  born in cohort  $k$ .  $X_i$  is a series of covariates for personal characteristics, husband's socioeconomic status, and family background;  $\gamma_v$  is village fixed effects; and  $\epsilon_{ivdk}$  is our error term.

However, a potential threat to our identification strategy is that weather shocks are computed for the female respondent's district at the time of the survey rather than her natal district. But since most marriages in Bangladesh occur within the same district at which we define our weather shocks, the district of residence of the married woman is also likely to be her natal district. As such, using a woman's current residential district is not likely to be a problem, even though this data limitation might introduce some measurement error in our calculation of extreme weather shocks if the female respondent's recorded district is different, and sufficiently far, from her natal district.

Another potential problem is that while there are 64 districts in Bangladesh, there are only 41 weather stations. Therefore, we had to manually match some districts that had no respective weather stations to the closest weather station. For those districts that were in-between two different weather stations, the average values of the weather index from both weather stations was calculated. There were also a few weather stations that lacked data dating back far enough. As such, we had to substitute missing observations with the closest weather station. This creates some noise in our data but is unlikely to create a bias in the results as the measurement errors are likely random.

Our second-stage regression involves running our main equation on the predicted age at first marriage when we use age at first menstruation and extreme weather index as instruments.

$$Domestic\ Violence_{i(vd)} = \beta_0 + \beta_1 \widehat{age\ at\ first\ marriage}_i + \beta_2 X_i + \gamma_v + \varepsilon_{ivdt}$$

where the dependent variable,  $Domestic\ Violence_{i(vd)}$ , is a dummy variable for domestic abuse experienced by woman  $i$ , living in village  $v$  in district  $d$ , in the past year.  $\beta_1$  is our coefficient of interest and measures the effect of age at first marriage on the probability that a woman suffers from domestic violence, including physical and emotional abuse.  $X_i$  is a series of covariates and  $\varepsilon_{ivdt}$  is our error term.

### ***Domestic violence on Empowerment***

We follow the paper by Sraboni et al. (2014) and instrument women's empowerment with the number of types of informal credit sources present in each community.<sup>11</sup> This relies on the assumption that the number of types of informal credit sources affects a woman's experience with domestic violence only through its impact on empowerment. Data on the types of informal credit sources available in BIHS 2015 include moneylender within/outside village, shopkeepers who offer credit, agricultural input dealers who sell on credit, and large farmers/traders who buy crops at a fixed forward price. We do not include formal credit sources as these may require collateral or other constraints which women lack. The number of types of informal credit sources is a *relevant* instrument as it influences the size of the informal credit market, which in turn influences a woman's access to capital and their decision making power concerning credit, especially for women who may not have access to credit otherwise. For instance, if a woman wishes to buy consumer durables such as refrigerators or cookware, but lacks the financial means to purchase these items, she will have less decision-making power and her empowerment score, which we computed, will decrease. Access to informal credit can also allow her to accumulate more assets, and score higher in the resource domain. Additionally, informal credit sources can be viewed as a sign of greater social capital and can influence women's participation in the community, which is also one of the measures we used for female empowerment. This instrument is *independent* as it is only women's interaction with informal credit sources, which might impact incidence of domestic violence against them.

Our first-stage regression is as follows:

$$Empowerment_{i(cv)} = \beta_0 + \beta_1 informalcredits_c + \beta_2 X_i + \gamma_v + \varepsilon_{icv}$$

where our dependent variable is the empowerment of a woman  $i$  of community  $c$ , in village  $v$ . The empowerment score is on a scale of 0 to 1, with 1 being the most empowered. Our independent variable is the number of types of informal credit sources in each community  $c$ , where there are a few communities in each village.  $X_i$  is a series of covariates and  $\gamma_v$  is village fixed effects.  $\varepsilon_{icv}$  is our error term.

For the regression between domestic violence and female empowerment, we use the same covariates as in the first specification, with the exception of height, since it is not relevant to the female empowerment variable.

Our second-stage regression involves running the main equation on the predicted empowerment score.

$$Domestic\ Violence_{i(cv)} = \beta_0 + \beta_1 \widehat{empowerment}_{i(cv)} + \beta_2 X_i + \gamma_v + \varepsilon_{icv}$$

where the dependent variable is a dummy variable for whether a woman  $i$  of community  $c$ , living in village  $v$ , experienced domestic violence in the past year.  $\beta_1$  is our coefficient of interest and measures the

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<sup>11</sup> Community is a further subdivision of village. There are usually few communities per village.



effect of female empowerment on the probability that a woman suffers from domestic violence.  $X_i$  is a series of covariates and  $\gamma_v$  is village fixed effects.  $\varepsilon_{icv}$  is our error term.

## VI. Results

### *Domestic Violence on Age at first marriage*

The results of the first-stage regression when we use age at first menstruation as an instrument for age at first marriage can be seen in Table 7.

Table 7: First-stage regression - Age at first marriage on age at first menstruation

VARIABLES	(1) Age at first marriage	(2) Age at first marriage	(3) Age at first marriage	(4) Age at first marriage
Age at first menstruation	0.106*** (0.035)	0.105*** (0.034)	0.095*** (0.035)	0.097*** (0.03)
Age	-0.015*** (0.004)	-0.015*** (0.004)	-0.014*** (0.004)	-0.014*** (0.004)
Height (cm)	0.012* (0.007)	0.0113 (0.007)	0.011 (0.007)	0.010 (0.007)
Hindu	-1.037 (0.901)	-0.987 (0.890)	-0.867 (0.890)	-0.904 (0.892)
Muslim	-1.834** (0.893)	-1.797** (0.882)	-1.623* (0.882)	-1.675* (0.885)
Pregnant	0.580*** (0.185)	0.585*** (0.185)	0.591*** (0.184)	0.586*** (0.183)
Electricity		0.141* (0.077)	0.101 (0.077)	0.076 (0.078)
Drinking water at home		-0.074 (0.078)	-0.080 (0.078)	-0.050 (0.079)
Years of father's education			0.022* (0.011)	0.022* (0.011)
Years of mother's education			0.063*** (0.019)	0.061*** (0.019)
Size of father's cultivable land (decimal)			0.000 (0.000)	0.000 (0.000)
Village Fixed Effects	No	No	No	Yes
Constant	16.00*** (1.437)	16.03*** (1.430)	15.93*** (1.428)	16.11*** (1.429)
Observations	6,258	6,258	6,238	6,238
R-squared	0.015	0.016	0.021	0.029
F-Statistic	9.485	9.293	7.597	8.058

Robust standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* Data are taken from BIHS 2015. Dependent variable for OLS regression is age at first marriage. Standard errors are in parentheses.

In Table 7, we report the base specification with different levels of controls. In the first column, we control for individual characteristics; in the second column, we include controls for a husband's socio-economic status; in the third column, we include controls for the wife's parents' characteristics; and in the fourth column we include village fixed effects. For the base specification with the full set of controls (col. 3), on average, every additional year that menstruation is delayed is associated with an increase in the age at first marriage by 0.0950 years, *ceteris paribus*, with a standard error of 0.034. It is significant at the 1% significance level. However, one risk is the potentially weak instrument, reflected by the relatively low F-statistic of 7.597. The results are also robust to village fixed effects (col. 4), with a slightly stronger effect of age at menstruation on age at first marriage.

Table 8: First-stage regression - Age at first marriage on extreme weather index

VARIABLES	(1) Age at first marriage	(2) Age at first marriage	(3) Age at first marriage	(4) Age at first marriage
Extreme weather events ages 12-17	0.028 (0.019)	0.028 (0.019)	0.034* (0.019)	0.040** (0.019)
Age at first menstruation	0.068* (0.036)	0.066* (0.036)	0.058 (0.036)	0.060* (0.036)
Age	-0.018*** (0.004)	-0.018*** (0.004)	-0.018*** (0.004)	-0.019*** (0.004)
Height (cm)	0.014* (0.007)	0.014* (0.007)	0.013* (0.007)	0.012* (0.007)
Hindu	-1.512* (0.831)	-1.455* (0.823)	-1.340 (0.834)	-1.371 (0.836)
Muslim	-2.268*** (0.822)	-2.225*** (0.815)	-2.057** (0.826)	-2.101** (0.827)
Pregnant	0.754*** (0.194)	0.762*** (0.194)	0.746*** (0.193)	0.740*** (0.193)
Electricity		0.142* (0.0798)	0.100 (0.080)	0.071 (0.082)
Drinking water at home		-0.061 (0.082)	-0.074 (0.082)	-0.047 (0.082)
Years of father's education			0.027** (0.012)	0.028** (0.012)
Years of mother's education			0.052*** (0.019)	0.049** (0.019)
Size of father's cultivable land (decimal)			0.000 (0.00)	0.000 (0.00)
Village Fixed Effects	No	No	No	Yes
Constant	16.64*** (1.429)	16.65*** (1.426)	16.49*** (1.430)	16.65*** (1.431)
Observations	5,778	5,778	5,759	5,759
R-squared	0.017	0.017	0.022	0.029
F-statistic	2.058	2.095	3.186	4.321

Robust standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: Data are taken from BIHS 2015 and weather data from Zaman (2018). Dependent variable for OLS regression is age at first marriage. Standard errors are in parentheses.

We also report the first-stage regression results when we use extreme weather as an instrument. Similar to Table 7, in Table 8 we report the base specification with different levels of controls. For the base specification with full set of controls (col. 3), on average, every additional 1 unit increase in the extreme weather index is associated with an increase in age at first marriage by 0.0345 years, ceteris paribus, with a standard error of 0.019. This is similar to what Corno et al. (2017) found in India, where the dowry system increased age at first marriage when families suffered an income shock. However, the F-statistic of this regression is relatively low at 4.321 (col. 4) when we include village fixed effects, indicating a risk of a weak instrument. The results are robust to village fixed effects (col. 4), with a slightly stronger effect of extreme weather on age at first marriage. It is significant at the 5% significance level, indicating the *relevance* of the instrument.

Table 9: IV regression - Domestic violence on age at first marriage for females

VARIABLES	(1) OLS	(2) IV – age at first menstruation	(3) IV – age at first menstruation	(4) IV – extreme weather	(5) IV – extreme weather
Age at first marriage	0.001 (0.002)	0.097 (0.072)	0.105 (0.071)	0.213 (0.144)	0.212* (0.125)
Age	-0.002*** (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.001 (0.003)	0.001 (0.002)
Height (cm)	-0.003** (0.001)	-0.004** (0.002)	-0.004** (0.002)	-0.006** (0.003)	-0.006** (0.002)
Hindu	0.023 (0.123)	0.104 (0.198)	0.120 (0.205)	0.355 (0.326)	0.364 (0.313)
Muslim	0.014 (0.122)	0.170 (0.221)	0.191 (0.228)	0.503 (0.395)	0.512 (0.369)
Pregnant	-0.063** (0.030)	-0.121** (0.056)	-0.125** (0.056)	-0.228* (0.121)	-0.226** (0.107)
Electricity	-0.060*** (0.013)	-0.066*** (0.017)	-0.068*** (0.016)	-0.081*** (0.026)	-0.079*** (0.024)
Drinking water at home	0.002 (0.013)	0.007 (0.016)	0.008 (0.016)	0.006 (0.024)	0.003 (0.023)
Years of father’s education	-0.008*** (0.002)	-0.010*** (0.003)	-0.010*** (0.003)	-0.014*** (0.005)	-0.014*** (0.005)
Years of mother’s education	-0.005 (0.003)	-0.011* (0.006)	-0.011** (0.006)	-0.015 (0.009)	-0.014* (0.008)
Size of father’s cultivable land (decimal)	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)	0.000** (0.000)
Village Fixed Effects	Yes	No	Yes	No	Yes
Constant	0.892*** (0.211)	-0.764 (1.253)	-0.902 (1.260)	-2.790 (2.522)	-2.793 (2.210)
Observations	6,238	6,238	6,238	5,759	5,759
R-squared	0.027				

Robust standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* Data are taken from BIHS 2015. Domestic violence (dependent variable) is defined as physical or/and emotional abuse suffered by a woman.

Our results are robust to village fixed effects. We can see in Table 9 that ceteris paribus, on average, every additional year in age at first marriage of females increases the likelihood that a woman reports domestic violence by 10.5 percentage points (col. 3) and 21.2 percentage points (col. 5), when we instrument for age at first marriage with age at first menstruation and extreme weather respectively, and include village fixed effects for both specifications. The OLS estimate of the effect of marriage on education carries the same sign as the IV estimates but is much smaller. However, while all the estimates are positive, only the estimate when using extreme weather as an instrument is significant at the 10% significance level.

This positive relationship between age at first marriage and domestic violence shows the time and location-specific nature of the latter. In our sample, adolescent marriage is highly prevalent, with 73.93% of women marrying before or at the age of 18. As such, the socially acceptable age for marriage for women may be very narrow and women who marry later may be at greater risk of violence, as explained in Section II.

While we do not control for years of education of females themselves because of the potential direct correlation with the extreme weather index, controlling for parent’s education reduces the endogeneity

problem because it controls for the exogenous part of the education, without capturing part of the effect of early marriage on domestic violence. The strong statistically significant correlation between a woman's and her parents' education can be seen in Table 10. This education concern only casts some doubt about the weather shocks instruments, but is not likely to be a huge issue as the estimated effect using age at first menstruation and weather shocks as instruments give similar results.

*Table 10: Relationship between female education and her parent's (mother and father) education*

VARIABLES	(1) Years of female's education
Years of father's education	0.105*** (0.013)
Years of mother's education	0.319*** (0.019)
Constant	4.661*** (0.055)
Observations	4,382
R-squared	0.141

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

#### *Domestic violence on empowerment*

We run an IV regression of domestic violence on the empowerment of women, using the number of types of informal credit sources as an instrument. The results of the first-stage regression of empowerment score on the number of types of informal credit sources in the community is seen in Table 11.

Table 11: First stage regression - Empowerment score on the number of types of informal credit sources in community

VARIABLES	(1) Empowerment score	(2) Empowerment score	(3) Empowerment score	(4) Empowerment score
Types of informal credit sources in community	0.016*** (0.002)	0.016*** (0.002)	0.016*** (0.002)	0.015*** (0.002)
Age	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Hindu	-0.162*** (0.046)	-0.164*** (0.046)	-0.167*** (0.046)	-0.168*** (0.0459)
Muslim	-0.115** (0.045)	-0.119*** (0.045)	-0.122*** (0.045)	-0.121*** (0.0454)
Pregnant	0.004 (0.012)	0.00383 (0.012)	0.003 (0.012)	0.00302 (0.0119)
Years of education	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Electricity		0.001 (0.006)	0.002 (0.006)	0.002 (0.006)
Drinking water at home		0.007 (0.005)	0.006 (0.006)	0.005 (0.005)
Years of father's education			0.000 (0.001)	0.000 (0.001)
Years of mother's education			-0.001 (0.001)	-0.001 (0.001)
Size of father's cultivable land (decimal)			0.000 (0.000)	0.000 (0.000)
Constant	0.675*** (0.047)	0.673*** (0.047)	0.677*** (0.047)	0.679*** (0.047)
Village Fixed Effects	No	No	No	Yes
Observations	4,391	4,391	4,377	4,377
R-squared	0.038	0.038	0.038	0.048
F-statistic	108.1	107.6	106.6	91.63

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: Data are taken from BIHS 2015. Dependent variable for OLS regression is empowerment score, which ranges from 0 to 1, with 1 implying the highest level of empowerment. Standard errors are in parentheses.

In Table 11, we report the base specification of the first-stage regression with different levels of controls, similar to Table 7 and 8. For the base specification with full set of controls (col. 3), on average, one additional type of informal credit source in the community increases women's empowerment score by 0.016, ceteris paribus, with a standard error of 0.001 and a high F-statistic of 83.88, dismissing the risk of a weak instrument. The results are also robust to village fixed effects (col. 4), with a slightly lower effect (0.015) of the number of types of informal credit sources in the community on the empowerment score. The results for the different specifications are all significant at the 1% significance level, showing the *relevance* of the instrument.

Table 12: IV regression - Domestic violence on empowerment score

VARIABLES	(1) OLS	(2) IV	(3) IV
Empowerment score	-0.0270 (0.043)	1.296*** (0.297)	1.125*** (0.316)
Age	-0.003*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
Hindu	0.136 (0.118)	0.363*** (0.140)	0.330** (0.138)
Muslim	0.137 (0.116)	0.307** (0.134)	0.282** (0.132)
Pregnant	-0.038 (0.032)	-0.051 (0.036)	-0.046 (0.035)
Years of education	-0.005* (0.003)	-0.005 (0.003)	-0.00479* (0.003)
Electricity	-0.051*** (0.016)	-0.053*** (0.018)	-0.055*** (0.017)
Drinking water at home	0.012 (0.016)	0.001 (0.018)	0.006 (0.017)
Years of father's education	-0.006*** (0.002)	-0.007*** (0.002)	-0.007*** (0.002)
Years of mother's education	-0.004 (0.003)	-0.002 (0.004)	-0.003 (0.003)
Size of father's cultivable land (decimal)	0.000** (0.000)	0.000* (0.000)	0.000* (0.000)
Constant	0.424*** (0.125)	-0.538** (0.252)	-0.401 (0.263)
Village Fixed Effects	Yes	No	Yes
Observations	4,377	4,377	4,377
R-squared	0.032		

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* Data are taken from BIHS 2015. Empowerment score ranges from 0 to 1, with 1 implying the highest level of empowerment. Domestic violence (dependent variable) is defined as physical or/and emotional abuse suffered by a woman.

For ease of interpretation, we calculate the effect of moving the empowerment score from the median (0.633) to the 90<sup>th</sup> percentile (0.833). We multiply the IV coefficient with the difference (0.2) between the empowerment score of the median and 90<sup>th</sup> percentile, and obtain the following results: 0.225 (col. 3). This implies that moving empowerment from the median to the 90<sup>th</sup> percentile increases the likelihood of domestic violence by 22.5%, when we include village fixed effects. This result is statistically significant at the 1% significance level. This inverse relationship between empowerment and domestic violence may be because of the dominating 'backlash' effect by men who retaliate when their wives are empowered. This inverse relationship is not seen in the OLS regression because there are likely unobserved endogenous variables that caused a downward bias on the estimated effect of female empowerment on the likelihood of domestic violence.

## VII. Limitations and Conclusion

### *Limitations*

A source of potential bias is systematic differential reporting of domestic violence by women in the survey data. Less empowered women may be less willing to report domestic violence or vice versa, and if systematic differences in reporting exist, then they stand to bias our estimates. It is possible that the reported relationship between women's empowerment and higher risk of domestic violence may be a function of a greater willingness by more empowered women to report domestic violence, rather than true differences in levels of violence across empowerment levels. However, this is likely to not be a concern as experienced survey enumerators and supervisors administered the BIHS and female enumerators were also assigned to survey women to make them feel more comfortable (Ahmed, 2016). Additionally, given that domestic violence against women is widespread and even normative in Bangladesh, and is therefore less likely to have significant social stigma, pressures to underreport or differentially report its occurrence is less likely (Koenig et al., 2003).

We also cannot rule out the possibility of systematic differences in reporting age at first marriage, where women who marry when they are older may under-report their age at first marriage, resulting in inconsistent estimates. This is a concern because women may not wish to disclose her correct age at marriage fearing backlash from her community since paying a dowry is a prevalent practice in Bangladesh and older brides are expected to pay more dowry compared to their counterparts who married younger. Yount et al. (2016) mentions systematic misreporting of age at first marriage as a significant limitation to their study on child marriages and IPV in Bangladesh. It mentions that using data from the Matlab Health and Demographic Surveillance System (HDSS), Streatfield et al. (2015) found that two-thirds of the sample of 1766 women aged 15-29 misreported their age at marriage, with 56% underreporting and 7% over-reporting their age.

Age at first menstruation may also contain systematic measurement error and result in inconsistent estimates, if women use their age at first marriage (which is systematically misreported) as a reference point to recollect information on the latter, especially since a close link between them exists as young girls in Bangladesh usually only enter the marriage market after they attain puberty (Field et al., 2008).

Additionally, random measurement error may attenuate our estimates in the case of underreporting of domestic violence. Women may under-report actual experiences of violence when asked if they have experienced domestic violence by a person unfamiliar to them in a structured interview. Women might find it difficult to speak about the sensitive topic of domestic violence because of shame or fear (Simister & Mehta, 2010). Moreover, in some cases, physical violence might be interpreted to include only very severe abuse, particularly when nonsevere violence is endemic and women think it unremarkable (Jejeebhoy and Cook, 1997). However, since this measurement error is likely to be random, it is not likely to be a huge concern.

The empowerment index constructed for our study might also be narrowly focused on agriculture, and not capture other aspects of empowerment. Additionally, questions addressing the different domains may not entirely capture the finer nuances behind female empowerment.

We are also aware of the potential limited extrapolability of our results beyond rural Bangladesh since impact of empowerment on violence is rather context-specific. However, the BIHS 2015 data are representative of rural Bangladesh and our findings may be extrapolable to other countries/areas with characteristics similar to rural Bangladesh.

### *Conclusion*

Interestingly, we find a positive relationship between age at first marriage and domestic violence; and empowerment and domestic violence. This highlights the complexity of the nature of domestic violence against women in a highly conservative setting like rural Bangladesh.

Violence against women continues to be a social and economic problem Bangladesh struggles with. Although the government had aimed to eliminate gender based violence in the country by 2015, their efforts have not achieved the desired results. However, if the empowerment of women (an improvement in their economic and social status) and violence against them follows an inverted U-shaped curve, it is possible that Bangladesh is still adjusting to egalitarian gender norms and expectations, and is stationed somewhere on the positive slope of the curve, wherein increase in empowerment initially would increase violence against women, before reducing it.

In order to design successful policies to combat violence against women, our study highlights the importance of understanding traditional cultural norms -- especially prevailing gender norms --, economic conditions, and how the interplay of various socio-economic factors contribute to domestic violence against women. Ultimately, actions and practices aimed at improving women's condition in societies should work towards confronting existing circumstances and environments that underlie women's risk of experiencing domestic violence.



## Appendix

Table 4: Domains and questions used to construct the female empowerment score

Domain	Indicator	Questions	Number of Activities
Production	Input in productive decision	“How much input did you have in making decisions about [ACTIVITY]?”	4
		“To what extent do you feel you can make your own personal decision regarding [ACTIVITY] (these aspects of household life) if you want(ed) to?”	4
	Autonomy in production	Show three types of stories about [ACTIVITY] and ask “Are you like this person?” [Three types of stories] <ol style="list-style-type: none"> <li>(1) She does what they tell her to do (Passive behavior)</li> <li>(2) She wants her family or community to approve of her (Recognition behavior)</li> <li>(3) If she changed her mind, she could act differently (Active behavior)</li> </ol>	3
Resource	Ownership	Who would you say owns most of the [ITEM]?	14
	Purchase, Sale or Transfer of asset	Who contributes most to decisions regarding a new purchase of [ITEM]?	14
		Who would you say can decide whether to sell [ITEM] most of the time?	14
		Who would you say can decide whether to give away [ITEM] most of the time?	14
		Who would you say can decide to mortgage or rent out [ITEM] most of the time?	14
	Access to and Decision on Credit	Who made the decision to borrow from [SOURCE]?	5
		Who makes the decision about what to do with the money/ item borrow from [SOURCE]?	5

Income	Control over the use of income	How much input did you have in decisions on the use of income generated from [ACTIVITY]?	6
		To what extent do you feel you can make your own personal decision regarding these aspects of household life if you want(ed) to?	3
Leadership	Group Membership	Are you an active member of any [GROUP]?	11
	Speak in Public	Do you feel comfortable speaking up in public in [CONTEXT]?	3
Time	Workload	Record a log of the activities in the last complete 24 hours	-
	Leisure Time	How satisfied are you with your available time for leisure activities like visiting neighbors, watching TV, listening to the radio, watching movies or playing sports? (On a scale of 1 to 10, with 1 being the least satisfied, and 10 being the most).	-

Source: Questions from BIHS 2015; Domains and indicators from Alkire et al (2013).

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