Estimating the causal relationship between extreme climate events and early female marriage in Bangladesh

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Extended abstract

1. Background and Literature Review

Natural disasters have strong and negative effects on the survival of populations living in vulnerable areas. Their effects go beyond the biophysical impact on the local environment. They tend to affect demographic, economic, institutional and socio-cultural dimensions of human living as well, exacerbating the general level of population vulnerability and mainly affecting poorer social classes (Jiang and Hardee, 2011; Otto et al., 2017).

Scientific studies in multiple fields have ascertained that climate change and extreme weather events interact with human health through various channels of economic and social development, particularly for poor people and families.

Focusing on their demographic consequences, natural disasters like heat waves, floods and cyclones have been found to impact especially mortality patterns—mainly in terms of child mortality—but also fertility and marriage. One of the aspects that captured the scholarly interest recently concerns the relationship between extreme weather events and early female marriage (Ahmed et al., 2019; Alston et al., 2014).

Early marriage in developing countries is usually associated with poverty, low levels of education, low women's employment status, religion, dowry practice, and rural residence (Alston et al., 2014; Hossain et al., 2016; Islam et al., 2016a, b; Kamal et al., 2014; Streatfield et al., 2015). Such practice is strengthened by the presence of poverty, demonstrated by the evidence that early marriage is more common among the poorest families (Hoq, 2013; Hossain and Islam, 2013; ICRW, 2006; Otoo-Oyortey and Pobi, 2003; Parsons et al., 2015).

As a consequence of extreme weather events, in presence of exacerbated poverty and higher risks of sexual violence towards women due to chaotic and unsafe situations caused by disasters, parents may decide to adopt suboptimal coping strategies by marrying their daughters at younger ages, in order to both reduce household consumption and their daughters' risk of becoming unmarriageable as a result of sexual violence. This strategy is especially likely in contexts where early marriage is perceived as the optimal choice for a young girl (Bajracharya and Amin, 2012).

Another reason that boosts early girls' marriages is that a marriage during or after an extreme weather event costs less because all households suffer from the same crisis.

Bangladesh is one of the most vulnerable countries to extreme whether events in the world and is experiencing major challenges due to climate change. The country is among the six most flood-prone countries worldwide (UNDP, 2004) and is also regularly exposed to other extreme weather events such as cyclones. This situation makes the population vulnerable to many undesirable outcomes, including early female marriage.

In Bangladesh the legal age for marriage is 21 for boys and 18 for girls. This was established with the national Child Marriage Restraint Act in 1929. However, the authorities rarely intervene to stop child marriages and parents continue to marry off their daughters secretly. Despite this legislation, the Bangladesh Demographic and Health Survey has found that the average age for marriage of girls is 16.4 years. The BDHS 2014 show that age at first marriage among women has risen slowly over the past two decades. The median age at first marriage among women age 20-49 increased from 14.4 years in 1993-94 to 16.1 years in 2014, still 18 months below the legal minimum age, indicating that laws or policies alone do not guarantee implementation. The proportion of women aged 20-49 that are married by age 15 years is 34.4% in BDHS 2014. Nevertheless, the proportion of women marrying in their early teens continues to decline with time. For example, the proportion of

women marrying by age 15 has declined by more than two-thirds over time, from 46 percent among women now age 45-49 to 16 percent among women age 15-19. Similarly, the proportion of women marrying by age 18 and age 20 decreases substantially from the oldest to the youngest cohort.

This paper focuses on the effect of natural disasters on the practice of early marriage in Bangladesh. Its aim is to evaluate the relationship between environmental vulnerability and high rates of early marriage. Our approach is novel for two main reasons. First, we construct a pooled database starting from all the available editions of the DHS Bangladesh, spanning from 1993-94 to 2014. From such database, we reconstruct the mean age at first marriage for all the ever-married cohorts of women interviewed in the different surveys.

Second, by using appropriate time series analysis techniques, we establish the existence of a causal relationship between the age at first marriage and the occurrence of natural disasters.

Due to geographical and regional variability of both the age at first marriage and the exposure to natural disasters, our analysis is also carried out at sub-national area level.

2. Data and Methods

To carry out the analysis we relied on the standard Demographic and Health Survey data (DHS) on ever married women in Bangladesh. Seven waves of the survey contain information on women year of birth and age at marriage. The final pooled sample is composed of 87,452 women.

Information on marriage is available for 56 birth cohorts (from 1944 to 1999). The median age at marriage is 15, while the mode is 13 (Figure 1).

Table 1. Number of ever-married women, DHS Bangladesh 1993-1994, 1996-97, 1999-00, 2004, 2007, 2011 and 2014 (pooled sample)

Bangladesh DHS Survey Years	*Number of sampled ever married women*
1993-1994	9,640
1996-1997	9,127
1999-2000	10,544
2004	11,440
2007	10,996
2011	17,842
2014	17,863

Figure 1. Mean age at first marriage by year of marriage, DHS Bangladesh DHS 1993-1994, 1996-97, 1999-00, 2004, 2007, 2011 and 2014 (pooled sample)

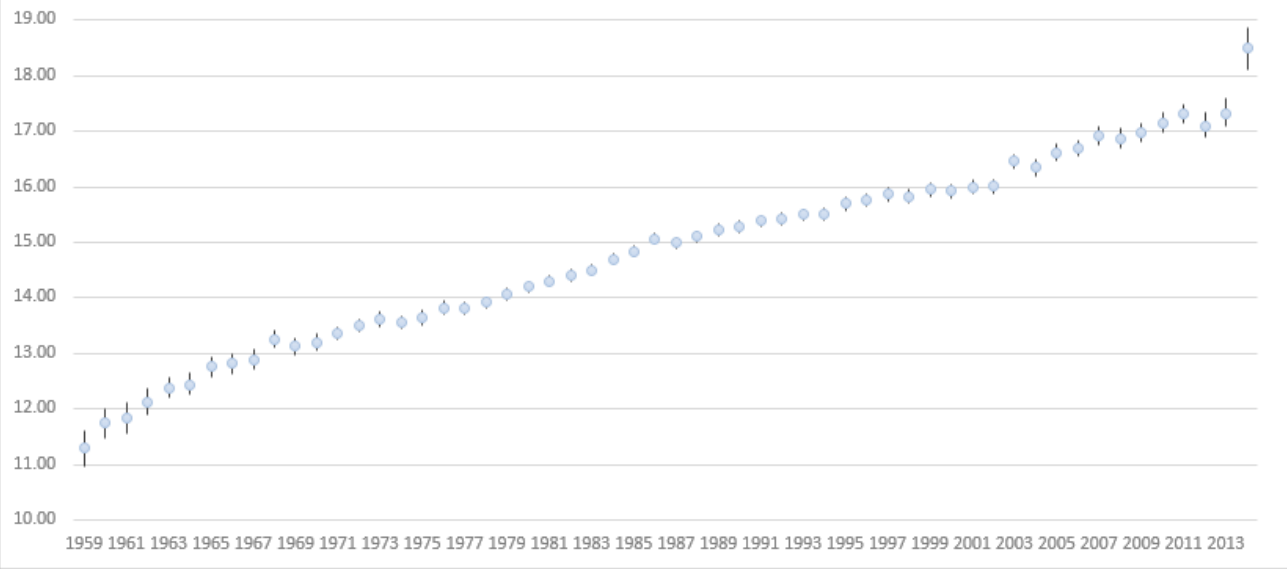
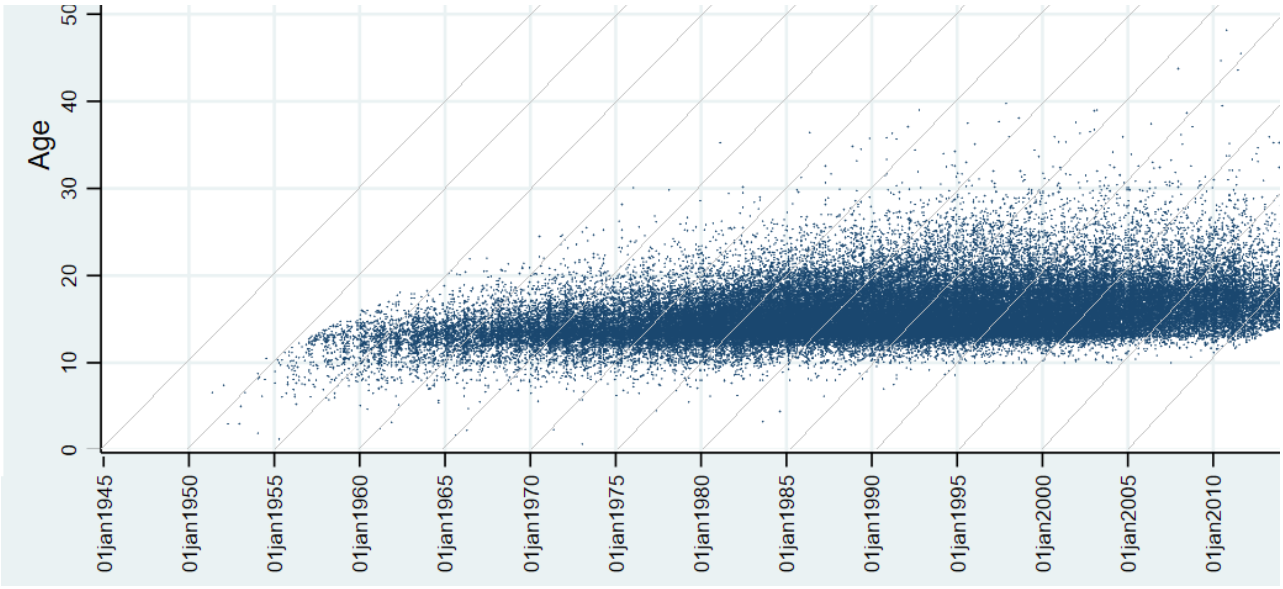


Figure 2. Lexis diagram of age at first marriage by birth cohort, DHS Bangladesh 1993-1994, 1996-97, 1999-00, 2004, 2007, 2011 and 2014 (pooled sample)



The second main source of statistical information is the Emergency Events Database (EM-DAT) maintained by the Centre for Research on the Epidemiology of Disasters and sponsored by the World Health Organization (WHO) and the Belgian Government. The EM-DAT contains information on the occurrence and the effects of mass disasters in the world from 1900 to the present day and is compiled from various sources, including UN agencies, non-governmental organizations, insurance companies, research institutes and press agencies. Bangladesh is classified as one of the world countries where most fatalities occur due to natural disasters (Figure 3). It experienced as many as 350 natural disasters since 1900, especially storm- and flood-driven ones (Table 2).

Figure 3. Countries by Fatality Rate Index 1980-2018. NatCatService, MunichRE

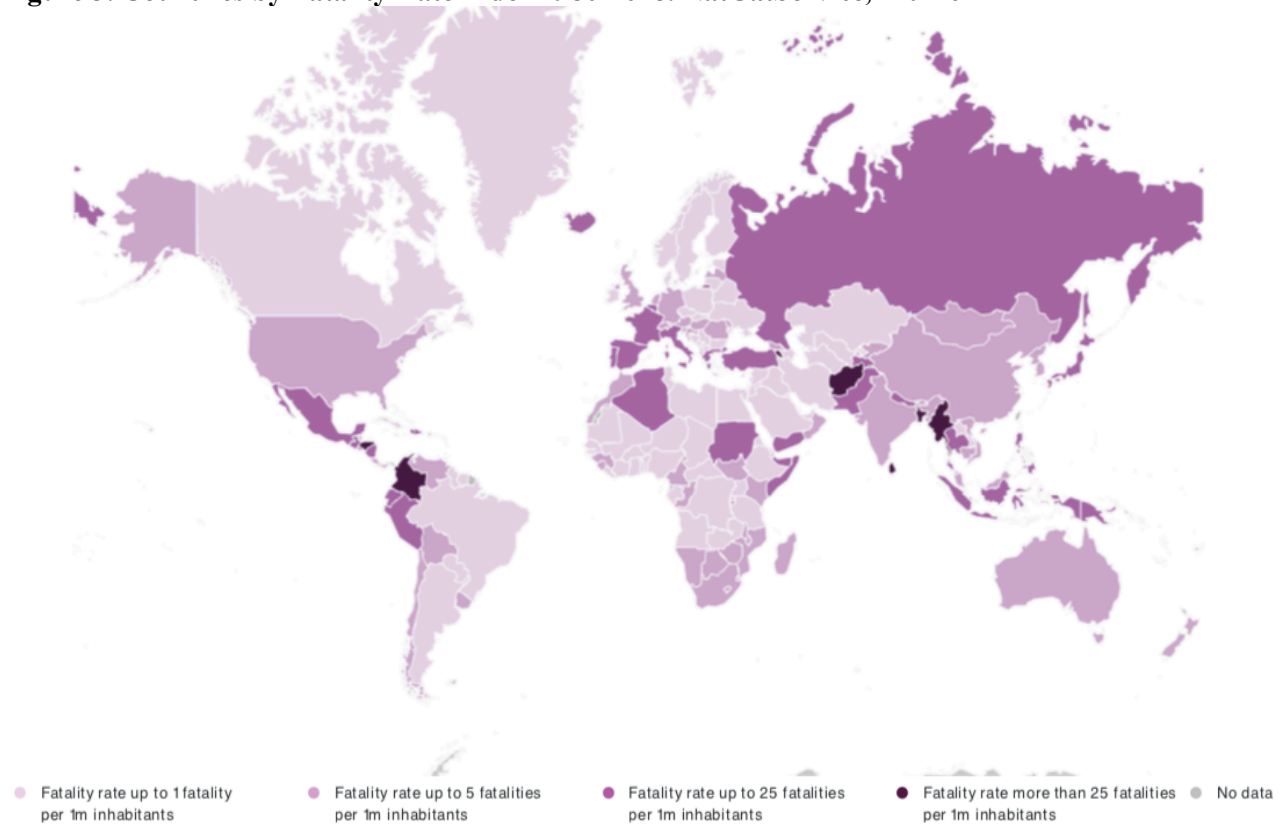


Table 2. Natural disasters occurred in Bangladesh from 1900 to 2019. EM-DAT

Disaster type	*Events count*	*Total deaths*	*Total affected*
Storm	178	634,816	86,005,727
Flood	95	52,676	337,243,089
Epidemic	31	403,203	3,043,218
Extreme temperature	23	2,474	414,200
Earthquake	9	45	19,395
Drought	7	1,900,018	25,002,000
Landslide	6	265	154,486

Using this data, we assess the relationship between the occurrence of natural disasters and early female marriage by implementing the following empirical strategy.

As a first step, we estimate an AR(p) model with appropriate lags for the mean age at first marriage. To test the hypothesis that extreme natural events are interconnected with changes in the tendency to early female marriage, we mix a statistical approach (e.g., testing for multiple breakpoints in the series using the Bai-Perron test) with a narrative one, consisting in retrieving the relevant information on natural, political and economic events that may be important in informing the analysis. For instance, to account for natural disasters we construct on or more continuous dummy variables assuming non-zero values on dates selected based on information contained in the EM-DAT and zero otherwise. The dummy variables are tied to both the type of event and its strength.

As a second step, we will try and ascertain whether natural disasters predict a decrease in the mean age at first marriage by estimating a Granger causality. The method is based on the notion of linear predictability developed by Granger (1969) which calls a variable y2t causal for a variable y1t if the information in past and present values of y2t helps reduce in expectation the prediction error for y1t.

3. Results

Results will be presented at the conference.

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