

Female Labor Force Participation with Adverse Shocks: The Case of Rural Households in Bangladesh

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The rural households in Bangladesh are vulnerable to several adverse shocks, whose impacts might depend on the socio-economic status, and other regional and physical factors. In this paper, utilizing micro econometric techniques and a rich dataset, the Bangladesh Integrated Household Survey (BIHS) 2015, we investigate how adverse shocks impact female labor force participation in rural areas of Bangladesh. Results obtained from the analyses show households with larger household size, outstanding loans, less education, assets, productive lands, and income, are more vulnerable. Econometrically estimated results suggest that the female household members are significantly more likely to participate in the labor force if the household is adversely affected by a hazard, and such impact is the largest for natural shocks. Additionally, we conclude the likelihood of female labor force participation declines with household-heads' employment. This paper contributes to the existing literature providing a better understanding of the linkages between adverse shocks and female labor force participation in rural Bangladesh. Results obtained in this paper have important implications for improving shock resilience and poverty alleviation of the vulnerable rural population in Bangladesh.

Keywords: Labor force participation, Coping strategies, Shocks, Probit model,

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1. Introduction

Bangladesh has made spectacular strides forward in its economic and social development in recent years. Between 2010 and 2017, the annual average growth rate of GDP has been 6.5 percent, which reached at a stellar rate of 7.9 percent in 2018*. The headcount poverty incidence declined from 48.9 percent in 2000 to only 24.3 percent in 2016.† Despite these impressive achievements, close to 40 million people in Bangladesh still live under the poverty line and another 30 million are considered “vulnerable” given the risks they face in slipping back to poverty due to a modest loss of income from any sudden negative economic, social, and natural or climactic shock‡. According to the most recent Household Income and Expenditure Survey (HIES) 2016, about 43 percent of the population in Bangladesh is considered as poor and vulnerable. In addition, the poverty rate in rural Bangladesh is much higher at 26.4 percent compared to the national headcount incidence of poverty of 24.3 percent. However, the

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rural population is much more vulnerable to any adverse shocks compared to their urban counterparts.

A plethora of economic, social, and natural shocks contribute to the poverty incidence of rural households in Bangladesh. While most improvements in terms of graduation from poverty in rural areas happen slowly, declines induced by negative shocks are often more sudden. Not only these stresses cause immediate hardship but also, they have serious long term consequences. The short-run and long-term impacts of these shocks on rural households depend on myriad types of economic, geographical, social, and demographic factors. Both the nature of shocks and the resilience of households against stresses play a crucial role in shaping the dynamics of rural poverty and vulnerability. In this paper, “*Vulnerability*” of the rural population is characterized as the reduced ability of an individual or a group to forecast, cope with, resist, and recover from the adverse effects of natural or man-made hazards[§]. The “*shocks*” in this research refer to an actual event that may result in income and non-income losses for households and associated with uninsured risk.

Poverty and coping capacity of households are intertwined. While poverty might be induced from a sudden shock faced by the households, the coping capacity of such hazards is also dictated by the level of household poverty. Hence, one crucial aspect of shocks is that its adverse impacts do not affect different groups of population in the same way. Secure livelihoods and higher incomes increase resilience and enable people to recover more quickly from a hazard. In the absence of sufficient productive assets and financial resources, labor is often the major and only endowment of poor and vulnerable rural households in Bangladesh. Besides, poorer households are usually characterized by a higher dependency ratio, meaning a smaller number of working-age people compared to the more affluent households. The scenario is even worse for the rural households in Bangladesh, as most of them depend on on-farm agricultural activities, which is more vulnerable to climactic and natural shocks. In this context, being labor the primary resource of impoverished households, often female members of adversely affected households participate in the labor force or increase their labor supply. Hence, for these households in addition to many other coping mechanisms to weather man-made or natural hazards, female labor force participation contributes to recovery from shocks and improved households-resilience. Female labor force participation also leads to women’s empowerment, which is one of the key factors for rural households in graduating from persistent poverty (Ahmed and Tauseef, 2019). Hence, in addition to its role as a coping mechanism against adverse shocks, understanding the impacts of several hazards on women's labor force participation hold promise for sustained poverty reduction in Bangladesh.

Research Gap and Motivation:

A wide range of adverse idiosyncratic shocks is experienced by individuals and households in rural Bangladesh. Even though such shocks mostly experienced at the individual level, the economic effects and responses can encompass the whole household. In the backdrop of a large portion of the population (43 percent of the population) being vulnerable in Bangladesh, there exists a high risk of downward

mobility into poverty caused by the idiosyncratic adverse hazards. Hence, accurate estimation of the shock-induced effects and effective coping mechanisms are essential to analyze the resilience and steady graduation of rural households from the poverty trap.

Several research papers have explored the impacts of economic shocks and the effectiveness of the coping mechanisms adopted by the adversely affected households (Ahmed and Tauseef 2019, Chaudhury 2017, Osmani et al. 2015, Olalekan et al. 2011, Mckenzie 2003). One of the most important coping mechanisms that have been often stated in the literature (Garcia-Gomez et al. 2013, Houtven and Coe 2010, Siegel 2006, Coile 2004) and is yet to be rigorously studied in the context of Bangladesh, is the female labor force participation (FLFP). Most research papers that explore the FLFP as a coping mechanism do so from the perspective of only health-related shocks. In contrast, other research works explore the household-level impacts and female labor supply decisions that are induced by macro-economic shocks (Lahoti and Swaminathan 2016, Johnson 2014; Mckenzie 2003). Despite the empirical evidence suggesting the importance of FLFP in the face of health-related income-reducing shocks, almost no research paper addresses the effectiveness of such measures in the context of rural Bangladesh. In the absence of any insurance mechanism against abrupt shocks such as climatic vulnerabilities, higher frequencies of natural hazards, and pressing socio-economic issues, it is of enormous importance to empirically study how income reducing shocks can affect the labor force participation of women in the rural areas of Bangladesh.

This paper adds and expands on existing literature, which has examined the impact of multifaceted hazards on household labor supply decisions and income. Additionally, this paper also contributes to both the literature on female labor force participation as well as to the effective coping mechanisms in the face of a wide range of economic, social, and natural hazards that adversely affect rural households in Bangladesh. This research paper also has important policy implications for the Government of Bangladesh in terms of improving female labor force participation opportunities and supporting the poor and vulnerable rural populations. The policy recommendations suggest ways to increase the household-resilience against shocks, which can ultimately help them recover from shock-induced poverty. The effects of different types of shocks on the female-labor force participation in rural Bangladesh are rigorously investigated using robust econometric techniques utilizing a very rich rural representative dataset, the Bangladesh Integrated Household Survey (BIHS 2015)** .Some of the crucial results obtained in this research paper are consistent with the findings obtained in the literature of FLFP, namely García-Gómez et al. (2013), Coile (2004), Van Houtven and Coe (2010), and Cullen and Gruber (2000). However, other robust findings contradict the conclusions of the existing literature (Halla Zweimuller 2013, and Siegel 2006), where the impact of the shocks on the FLFP likelihood was conditional on several other aspects.

Objective and Research Questions:

Different types of adverse shocks are prevalent, which affects the poor and vulnerable^{††} population of Bangladesh in many ways. In this paper, we classify a wide range of shocks in three categories: economic shocks, social shocks, and natural shocks. The shocks are defined as sudden negative events causing a significant adverse impact on the local community or on a household that may result in income and non-income losses (Besser et al. 2008). This research tries to answer the following research questions;

- How do economic impacts of different types of adverse shocks differ for households with different income levels, demography?
- How do different negative shocks affect female-participation in the labor force?
- Do the female-labor force participation impacts differ across different types of shocks experienced by households?

In order to answer the research question mentioned above, in this paper we have attempted to achieve the following key objectives.

- a. Explore the socio-economic background of the households who are subject to vulnerability and experiences adverse shocks
- b. Better understand the nature and types of shocks as well as how these impacts the households from different socio-economic backgrounds
- c. Investigate if several shocks faced by households increases the likelihood of female labor force participation (FLFP) and estimate the impacts
- d. Policy recommendations based on the empirical findings obtained in this paper in order to improve the resilience of the impoverished and vulnerable-female population.

To achieve the objectives mentioned above, this paper has made use of empirical approaches that include undertaking a comprehensive review and analysis of existing studies and data from secondary sources. To obtain an in-depth understanding of the research questions, quantitative and econometric analyses have been conducted in this paper utilizing a representative credible dataset, the Bangladesh Integrated Household Survey (BIHS 2015), administered by the International Food Policy Research Institute (IFPRI).

The paper is structured as follows. After this introduction, section 2 presents an in-depth review of the literature on different types of shocks and their impact on the poverty afflicted population in developing countries. We have also discussed the impacts of shocks and different coping mechanisms adopted by the poor people in Bangladesh, focusing on the female population. This section is followed by a discussion on the methodology in section 3. Section 3 discusses the methodologies followed in this paper, including a description of the BIHS 2015 dataset, the survey methods followed in collecting the dataset, and the econometric techniques utilized in this paper. This section also includes an economic model showing the linkage between female labor force participation and negative household-specific shock proposed in Haurin (1989)

and corresponding implications for our paper. Section 4 presents the descriptive statistics of the dataset at hand as well as provides results obtained from the econometric analysis conducted to estimate the effects of adverse socio-economic and natural shocks on the household choice of female labor force participation. Lastly, section 5 presents concluding remarks, which are followed by some recommendations.

2. Literature Review

In this paper, we have reviewed the relevant existing literature on household-specific negative shocks, coping mechanisms of vulnerable households, and the subsequent impacts on female labor force participation (FLFP) from several perspectives. Linkages between negative shocks and transitioning from poverty, a coping mechanism of poor and vulnerable households in the face of such shocks to improve resilience against man-made and natural hazards, or recovery from the induced damages of shocks have been carefully investigated from the literature. In addition to these, how women respond to several economic, societal, and natural shock and how their participation in the labor force, as well as the labor supply, is affected by such shocks are also investigated in detail from the existing research papers and reports.

Several studies identify the key factors contributing to households' poverty persistence and their movements into and out of poverty. Among many other socio-economic, demographic, and regional factors, negative shocks are considered as one of the vital proponents of causing poverty. While improvements in livelihoods and graduation from poverty occur gradually, decline into poverty can happen abruptly due to a wide range of hazards, among which one of the most important is the sudden sickness of the main income earner (Davis and Baulch 2011). Other important negative shocks for the rural households in Bangladesh that are studied in the literature include sudden medical expenses due to illness, loss of livestock, a major loss to crop or productive assets due to natural disaster, cost of wedding or dowry, etc. Vulnerable households can fall back under the poverty line with a significant reduction in the family income if they are exposed to natural shocks such a flooding, storms, or economic shock resulting from ill-health or death of the main earning member of the household (Sen 2003). Similar results can also be found in Nargis and Hossain (2006) and Hossain and Bayes (2009). Additionally, the frequency and intensity of natural disasters associated with climate change disproportionately reduces the ability of the poor compared to the non-poor to cope with disasters because of their more vulnerability to climate shocks, lack of finance and alternative livelihoods, limited access to social safety nets and technologies to help them adapt natural shocks (Chaudhury 2017).

Ahmed and Tauseef (2019) explore important factors that can improve the resilience of the vulnerable population in rural Bangladesh. Their results suggest that women's empowerment is one of the key factors in escaping chronic poverty incidence. Other factors they found to important in alleviating poverty, preventing poor people from sliding back to poverty, and improving the resilience of marginal households against negative shocks, including savings, education, off-farm activities, and access to social safety net programs. Sen (2003) also analyzes factors that can help poor population escape poverty and indicate poverty afflicted households can graduate from poverty by

pursuing several strategies such as crop intensification meaning increasing the number of crops in the same land per year, diversification of agricultural production, engaging in more off-farm activities, and livelihood migration. The coping strategies may also include borrowing, sale of assets, remittances, adjustment of food intake, and drawing of savings if available. Impacts from shocks also may depend on the educational status of household head, household size, per capita income, shock type, and coping strategies undertaken by affected households (Olalekan et al. 2011).

The coping strategies adopted by the adversely affected households depend crucially on the types of negative shocks and availability of coping options. Households with higher education level can have greater access to stable and more income sources, hence are more likely to adopt effective coping methods. On the other hand, households with more assets tend to divest assets or vie for loans in the face of shock-induced negative effects (Rashid et al. 2006). Osmani et al. 2015 find that the lower level of education is usually associated with a higher level of poverty in rural areas of Bangladesh. In addition, the more educated household can weather a negative shock in a better way compared to the less educated counterpart, due to the higher productivity in their activities. Another interesting finding obtained in the Osmani et al. (2015) is that the poor households are not necessarily more prone to shocks than the non-poor in rural Bangladesh. As found in other studies, they conclude engaging in off-farm activities substantially reduces households' vulnerability to shocks. Whereas, microcredit borrowers and participants in social safety nets are more vulnerable than the non-borrowers and non-participants. However, the impacts of a large aggregate shock or a macro-economic shock differ from the household-specific negative shocks. The adjustment mechanisms such as household structure, fertility, household labor supply, inter and intra-household transfers used by the households to cope with the negative household-specific shocks are found to be not as effective for an aggregate shock (Mckenzie 2003).

FLFP as A Coping Mechanism against Income Reducing Shocks:

Several studies found evidence that poor households often consider female labor force participation and their labor supply as are covery mechanism against idiosyncratic shocks and earning risks. While some of the studies found FLFP as an effective mechanism, others found it rather ineffective. García-Gómez et al. (2013) identify the causal effects of individual health shocks on the household members' employment likelihood as well as the loss of income. According to their findings, an acute hospital admission reduces the employment probability by seven percentage points and results in an income loss of 5 percent during two years after the shock. Their results also suggest that, on average, females are more likely to start working or stay in the labor force in case their husbands fall ill, while husbands are more likely to withdraw from the labor force when their wives are sick. Coile (2004), Van Houtven and Coe, (2010) also find that husbands are more likely to stop working in case their wives become disabled, whereas females are more likely to compensate for earnings loss if their husbands fall ill. Halla Zweimuller (2013) looks into the households whose earning members experienced accidents and find adverse impacts on the employment of the affected person. However, their study does not find any added worker effect (increased labor

supply or labor force participation) for the spouses. Blau and Riphahn (1999) and Siegel (2006) find that the estimated spousal employment response crucially depends on the health measure used. Coile (2004) explores the unexpected health shocks' impact on family income as well as on the added worker effect. According to this paper, sudden health shocks can result in a significant loss for the family income and increases the labor supply of the spouse, generating an added worker effect. Such an added worker effect is significantly more if the husband experiences sudden health shock compared to the case when such a hazard is experienced by the wife. Attanasio et al. 2005 show that additional uncertainty regarding household earning increases female participation rates, and this increase is even larger for households with limited ability to borrow.

Western et al. (2012) explore the income flow smoothing and stabilization of the economic well being focusing on the households that are affected by unexpected events. Their findings suggest the capacity for the households to absorb adverse effects such as sickness and job loss depends on household composition. Single earning member households are more vulnerable to shocks than households where there are multiple earning members. The key sources of economic insecurities considered in this paper are job loss, falling ill of the earning member, and family dissolution. McKenzie (2003) examine the individual household-level impact of a large aggregate economic shock of the 1995 Peso crisis. Studying how the effect of the crisis differed across households, this paper explores the adjustment mechanisms used by families to cope with the shock. Some of the coping strategies found ineffective in the face of macro-level economic shocks that were otherwise effective against idiosyncratic shocks include changes in the household structure, fertility, household labor supply, child schooling, and inter house hold transfers. More specifically, this paper finds little change in the labor supply, as well as quite interestingly, reduced the labor force participation. This finding, however, is not surprising if the shrinking nature of the job market resulted from economy-wide shock is considered. Another paper that explores the impact of macro-economic changes such as house price volatility on the female labor force participation is Johnson (2014). However, this paper finds little evidence of any positive impact on married women's labor force participation from the house price increase. Lahoti and Swaminathan (2016) explore the relationship between economic development and female labor supply using state-level longitudinal data. This paper does not find any systematic relationship between the level of economic development and the female's labor force participation rate. Instead of economic growth, the composition of growth is more relevant for the labor force participation of women.

Several other recent studies have sought to understand the factors that deter and increase women's labor market activities from the micro perspective (Eswaran et al., 2013; Klasen and Pieters, 2013; Mahapatro, 2013). Evidence suggests that paid work has a higher impact on female labor force participation, and within paid work, formal and semi-formal employment is more beneficial for women compared to informal and casual work (Kabeer et al., 2013; Anderson and Eswaran, 2009). Calderon et al. (2016) show that female displaced and migrated women work longer hours relative to rural women who are not displaced or relocated. Sarwar and Abbasi (2013) explore several limiting factors of women's labor force participation in the context of Pakistan. They found the majority of women labor force participation can be found in the informal sector, mostly in

agriculture. Barriers that hinder the female labor force participation in Pakistan include political, legal, economic, and cultural factors.

According to the neo-classical theory, the supply of labor and participation in the labor force depends on the labor-leisure choice. Later the role of household works was emphasized by several economists (Mincer 1962, Becker 1965). In addition to these, a wide range of factors contributes to the female labor force participation decisions in Bangladesh. In the face of sudden negative shocks, opportunity costs of women for not being in the labor force, hence, not contributing to the household earning is very high. Therefore, economic, societal, or natural negative shocks reducing household income might act as supply-side factors affecting the female labor force participation. One of the early researches that theoretically explores the effect of household-specific negative shocks on the female labor force participation is Haurin (1989). This paper investigates the impact of a change in the husband's earning on women's labor force response. In the case of an unexpected loss in family income resulting from the death of the main earning member, unexpected unemployment of husband or sudden health shock induces an increase in the likelihood of female labor market participation. Similar results are also found in Cullen and Gruber (2000); however, these labor supply change does not occur in the same way when negative shocks induced a reduction in wage is permanent and transitory. Response in labor supply is larger when the shocks are permanent compared to transitory shocks (Zhang 2008).

From the discussion above, we can see a wide range of studies qualitatively and quantitatively discuss the linkages between economic shocks and impacts on women's labor supply as well as the vulnerability of households. However, almost no paper econometrically explores such linkage's implications for female labor force participation in rural Bangladesh. Hence, this paper makes important contributions to both the literature on female labor force participation as well as to the effective coping mechanisms in the face of a wide range of economic, social, and natural hazards that adversely affect rural households in Bangladesh.

3. Methodology

This paper has utilized several quantitative and econometric techniques to deal with the research questions and achieve research objectives. An economic model showing the linkage between female labor force participation and negative household-specific shock proposed in Haurin (1989) has been used to come up with a hypothesis and its implications for this research. Additionally, a detailed review, which has been discussed in the literature review section, has been completed of the available literature that includes relevant documents, academic papers, research reports, and cross-country analysis.

The empirical analysis part of the paper heavily uses the Bangladesh Integrated Household Survey (BIHS 2015), a rich dataset that is publicly available at the Harvard Data verse website.^{††} The BIHS-2015 survey was conducted on 6,500 households in 325 villages across seven divisions and the Feed the Future (FTF) Zone of Influence^{§§} in

Bangladesh. In the survey, data were collected on plot-level agricultural production and practices, dietary intake of individual household members, anthropometric measurements (height and weight) of all household members, and women's empowerment measurement in agriculture index (WEAI). A community survey supplements the BIHS data to provide information on area-specific contextual factors. BIHS (2015) dataset entails detailed information on shocks for all surveyed households covering 33 different types of negative shocks. Utilizing available information from this module, shocks have been classified under three broad categories, based on their economic, social, environmental impacts. While social and environmental impacts are discussed in detail through descriptive statistics, the focus of the research has been on the negative economic shocks. Another novelty of this dataset is, it also collects information on the frequency and the length of shocks, which has also been utilized to explore how impacts on households' changes with exposure to a different frequency of shocks.

The descriptive statistics provide detailed information on the nature and types of economic shocks experienced by rural households. We also discuss the socio-economic background and characteristics of the vulnerable and shock-affected population. Additionally, the impacts of economic shocks and their effects on the behavioral decisions of household members (both male and female) in terms of labor force participation of women in order to generate more income have been carefully estimated by statistical and econometric techniques such as Probit regression models. In order to ensure unbiasedness and consistency of our estimation, we control for a wide range of important factors that might affect the likelihood of female labor force participation, which include types of occupation, age, gender, education, religion, economic background provide by asset ownership, etc. Based on findings obtained from this paper, specific policy recommendations will be laid out to increase female labor force participation as well as improve shock-induced vulnerability-resilience of marginalized and vulnerable rural households of Bangladesh.

Economic Model:

The theoretical implication of negative shocks on female labor force participation has been derived in this paper based on an economic model developed by Haurin (1989). Household members in this model make ex-ante savings decisions and ex-post labor supply decisions. This model provides a framework to examine how household members make female labor supply decision in response to sudden negative shocks that reduce family income.

To analyze this question a two-period model has been presented in this paper, where the utility of the household is a function of the consumption of a composite good q and the leisure time of males m and females f . The measures of leisure time are normalized between 0 and 1. The wealth of the household is defined as W , the rate of interest is i , and ρ is the rate of time preference. Female wages and male wages are indicated by v and w respectively. There are two time periods in this model indicated by $t \in \{1, 2\}$ and are shown as subscripts. The household-specific negative shock in this

model is incorporated through the future or second time period employment prospects of the male household members are uncertain with density function $\varphi(m_2)$. In this setup, the optimization problem of the household is as follows,

$$(i) \max_{f_1, m_1, W_1} E(U^*) = U_1[f_1, m_1, q_1] + \frac{E(U_2^*)}{(1+\rho)} \quad \text{where, } E(U_2^*) = \int_0^1 U_2^* \varphi(m_2) dm_2 \quad \text{and} \quad U_2^* = \max_{f_2} U[f_2, m_2, q_2]$$

Subject to;

$$(ii) q_1 = W_0(1+i) + v_1(1-f_1) + w_1(1-m_1) - W_1$$

$$(iii) q_2 = W_1(1+i) + v_2(1-f_2) + w_2(1-m_2)$$

Equation (i) says that the household maximizes the lifetime (two-periods) discounted expected utility (second period expected utility is measured with respect to the probability of shock-induced leisure level in the second period) recognizing that the first period choices depend on the probability of occurrence of future negative shocks and the resultant level of utility. The inter temporal budget constraint has been used to derive consumption constraints for the first and second periods in equations (ii) and (iii). Solving this optimization problem, we have the following result,

$$(iv) \ln f_2 = \ln f_1 + (\ln B_2 - \ln B_1) - (\ln v_2 - \ln v_1) + \frac{\ln(1+i)}{(1+\rho)} - w_2 (\bar{m}_2 - E(m_2)) / \psi \quad \text{where, } \psi = v_2 + W_1(1+i)$$

Equation (iv) indicates, if due to a negative shock in the second period, male labor supply declines meaning actual leisure of males \bar{m}_2 is larger than the expected leisure time $E(m_2)$, then the female labor supply will increase (percentage change in female leisure in $t=2$ is negative). Additionally, if the negative shock on the household causes a reduction in the household wealth accumulated at the end of $t=1$ (that is, W_1 reduces), female labor supply in the household will also increase.

Utilizing results obtained from this economic model, we can hypothesize that a household experiencing any negative shock, which results in a decline in wealth or reduction of male earning, will optimally increase the female labor market participation in order to weather or recover the adverse impacts of hazards. In our paper, this also implies that a negative shock can increase the likelihood of female labor market participation for the affected households.

Data Description

This part of the paper provides an overall picture of different types of shocks that are experienced by rural households in Bangladesh. We also obtain the socio-economic background of the affected and non-affected groups of households utilizing the Bangladesh Integrated Household Survey (2015) dataset. According to the BIHS 2015, out of 6,569 households surveyed, 2653 experienced at least one shock since 2011. BIHS 2015 collected information on 33 different types of shocks that have negative impacts on households. We classify all these 33 shocks under three broad categories:

economics, societal, and natural shocks. The current scenario of shocks and characteristics and backgrounds of households experiencing them are presented in Table 1.

According to table 1, 2653 households (39.22% of the sample) were exposed to at least one type of shock during the years 2011-2014, whereas 3916 (60.78% of the sample) households did not face any shock during the same period. Most households that are exposed to shocks face economic hazards (60.2%). However, out of the three, on average, the societal shocks cause the largest amount of damages (81,394 takas), which is followed by economic and natural shocks (53,759 takas and 41,972 takas respectively). Many asset shocks may also involve loss of income. However, we do not state these as income shock as in the literature, income shocks are defined only as those shocks that do not necessarily flow from the loss of some assets. The average duration of shocks is also the highest for societal shocks (119 days), followed by economic and natural shocks (95 and 74 days, respectively).

From Table 1, we can also see that more than two-thirds (69.1%) of the households exposed to negative shocks suffered losses that made their condition worse than their pre-shock scenario. On average, households experiencing negative economic, social, or natural shocks are characterized by a significantly larger amount of both outstanding and total amount of loans, the bigger size of household, and more access to social security programs. On the other hand, such shock-induced families own less amount of assets, have lower per-capita income, and own less amount of land.

Another interesting finding gleaned from the dataset is that a significantly large portion, 2079 (81% of shock-experienced) of households allowed females to work because of financial reasons after the adverse effects induced by any type of distress. This portion is lower (76.7%) and statistically significant for the households that did not face any negative shock during their past five years. Additionally, our findings suggest that negative shock-induced households own a significantly lower amount of land (92.28 decimals against 108.60 decimals) compared to the families that did not experience any distress. This fact, along with the lower amount of asset (asset value was 62574.23 taka for shock-facing households, and that for families with no shock was 67216.45 taka), more outstanding loans (52920.24 takas in the face of 38580.74 takas), and many other factors indicate a severe vulnerability of the affected families. The total amount of loans for shock-incurring households and families facing no shock was 64860.67 taka and 46432 takas respectively, also provide similar results.

Table 1: Scenario of Households with and Without Shock

Particulars	Households without shocks	Households with shocks	p-value
Number of households	3916	2653 Economic shock: 60.2% Social shock: 20.2% Natural shock: 12.3% Others: 7.3%	
Average loss induced by shocks (in taka)		Economic shock: 53,759.83 Social shock: 81,394.47 Natural shock: 41,972 Others: 94,667.19	
Shocks duration (in days)		Economic shock: 95 Social shock: 119 Natural shock: 74 Others: 101	
Condition after shock		Worse than before: 2165 (69.1%) Same as before: 819 (26.2%) Better than before: 147 (4.7%)	
Households with working female (in percentage)	65.7%	77.3%	<0.001
Husbands/ households allowed female work because of financial reason	N=2079 (76.7%)	N=1887 (81.5%)	<0.001
Land ownership (in decimals)	108.60	92.28	<0.001
Households with disable member	1197 (30.6%)	1281 (41.0%)	<0.001
Average household size	4.96	5.09	0.005
Average yearly income per cap of household (in taka)	8278.88	6241.22	<0.001
Household asset (in taka)	67216.45	62574.23	0.036
Total amount of loan (in taka)	46432.43	64860.67	<0.001
Total outstanding loan (in taka)	38580.74	52920.24	<0.001
SSP access	40.6%	45.4%	<0.001

Source: Calculated by authors using BIHS 2015 dataset

Table 2: Number of Households with Negative Exposure

Number of negative-shock exposure	Number of Households
1	2,202
2	294
3	93
> 3	64
Total exposure	2653
Total non-exposure	3916

Source: Calculated by authors using BIHS 2015 dataset

Table 3: Number of Households with Working Females

	HH without working female	HH with working female
HH not exposed to shocks	N=1,098	N=2,814
HH exposed to shocks	N=583	N=1,941

Source: Calculated by authors using BIHS 2015 dataset

Furthermore, a larger percentage (41% against 30.6%) of households that went through negative shocks are comprised of disabled members compared to the unaffected population. Also, the families experiencing shocks are slightly larger (5.09 against 4.96 number of members). The average yearly income per capita of households experiencing no negative shocks was 8278.88 taka, whereas it was only 6241.22 taka for families facing shocks. However, we can see more percentage (45.4% against 40.6%) of the households have access to some social protection program (SPP) from the government when negative shocks are concerned. This is because, indeed, the households receive SSP assistance are more prone to shocks. The findings obtained here are both economically and statistically significant (based on p-value) and can help explain why women's labor force participation rate is higher for the negative shock-induced groups of households.

From Table 2, we can see, out of 2653 exposed-to-shocks households, 2202 (83%) experienced only one negative shock, 294 (11%) faced these shocks twice, and only about 6% of households were exposed to more than two shocks during 2011-2014. In table 3, an important finding is observed for the shock-induced households' female labor-force participation. Females were engaged in income generation activities in 77.3% (583 out of 1,941) of households that were exposed to different types of distresses, while this percentage was only 65.7% (1,098 out of 2,814) for families that did not experience any hazard. This result implies that households experiencing negative shocks, among other mechanisms, use female labor force participation as a coping mechanism. In other words, designing policies that improve female income-generating capacities can eventually make rural households more resilient in the face of negative shocks. In table 4 and 5, our descriptive statistics from the dataset show, in terms of damages caused, out of 2518 households, most households (1609 and 63%)

rank economic shocks as the worst type of shock, followed by societal (441 and 17%) and natural shocks (285 and 11%).

Table 4: Worst Type of Shocks by Household Ranking

Type of shocks	Ranked as worst by number of households (N)	Households(%)
Economic (1)	1,609	63
Social (2)	441	17
Natural (3)	285	11
Others (4)	183	7.2
Total	2518	100

Source: Calculated by authors using BIHS 2015 dataset

Table 5: Worst 10 Shocks by Household Ranking

Type of Shocks	Ranked as worst by number of HH
Medical expenses due to illness or injury	909
Loss of income due to illness or injury	236
Loss of livestock due to death	154
Other costs of wedding	135
Death of main earner	119
Major loss of crops due to flood	105
Dowry payment	95
Major loss of crops due to other reason	87
Failure or bankruptcy of business	78
Losses due to court case	78
Total	1996

Source: Calculated by authors using BIHS 2015 dataset

The top 5 shocks ranked by the affected households were medical expenses due to illness or injury, loss of income due to injury or illness, loss of livestock due to death, cost of a wedding, and death of the main earner of the family. Out of these five, four can be classified as an economic shock. From Table 6, we can see no matter whether the group is of the extreme poor, poor, or vulnerable households, in all the cases, most are affected by the economic shocks, followed by societal and natural shocks.

Table 6: Distribution of Affected Households According to Their Poverty Level

Extreme poor households (N=1384)			Poor households (N=2023)			Vulnerable households (N=3059)		
Economic shocks	(N=364)	26.30%	Economic shocks	(N=532)	26.30%	Economic shocks	(N=803)	26.25%
Societal shocks	(N=76)	5.49%	Societal shocks	(N=117)	5.78%	Societal shocks	(N=186)	6.08%
Natural shocks	(N=55)	3.97%	Natural shocks	(N=85)	4.20%	Natural shocks	(N=132)	4.32%
Others	(N=41)	2.96%	Others	(N=57)	2.82%	Others	(N=77)	2.52%

Source: Calculated by authors using BIHS 2015 dataset

Table 7: Socio-Economic Background of Households

	Households with shocks	Households without shock	Households facing economic shocks	Households facing societal shocks	Households facing natural shocks
Average years of schooling	3.49	3.57	3.48	3.34	3.11
Average age (in years)	46.08	45.54	45.53	48.18	46.60
Average per capita income (in taka)	6,403.66	8,286.37	6,562.83	7,028.50	4,677

Source: Calculated by authors using BIHS 2015 dataset

Table 8: Occupation of Household Heads (in %)

	Households with shocks	Households without shock	Households facing economic shocks	Households facing societal shocks	Households facing natural shocks
Household head's occupation is farming	40.06%	36.63%	36.70%	42.47%	58.54%
Household head's occupation is off-farm salaried worker	4.68%	4.98%	4.71%	5.94%	2.70%
Household head's occupation is off-farm self-employment	11.53%	13.04%	11.41%	12.79%	8.45%

Source: Calculated by authors using BIHS 2015 dataset

Table 7 and Table 8 portrays average education, age, per-capita income, and occupation of household-heads. Here it is shown that the average years of schooling of the household head facing shocks slower than that of household head's experiencing no hazard. This also supports the findings from the literature that, households are more resilient to shocks with a higher level of education. The same is true for the average per capita income of the household, which also supports the result of increasing resilience with more household income. In addition to these from table 8, we can observe, the households exposed to negative shocks are more engaged with farming activities, in line with the finding of off-farm activities that make households less vulnerable to hazards.

4. Econometric Analysis

A number of descriptive and econometric techniques have been used to analyze BIHS (2015) dataset in order to investigate the research questions. In the econometric analysis, our main interest is to estimate the household choice of female labor force participation affected by adverse socio-economic and natural shocks. Because the objective is to investigate the likelihood of the females' participation in income-generating activities, a probabilistic econometric model is the most pertinent specification. Several important works in the literature of shock-induced FLFP, namely García-Gómez et al. (2013), Johsohn (2014), Sheran (2007), and Coile (2004), have utilized probabilistic regression models to come up with important findings. Hence, following the practice in the literature as well as due to the suitability to address the research questions, in this paper, we have used a neoclassical random utility model for discrete choice decision-making, which is based on Probit Binary Response regression model. Several individual and household-specific characteristics have been considered in the Probit regression model of the following form,

$$\text{Prob}(y_i = 1 | X_i) = \text{Prob}(y_i^* | X_i > 0) = CDF_{normal}(\beta X_i)$$

$$y_i^* = [\beta X_i + \varepsilon_i] \begin{cases} \text{if } > 0, & y_i = 1 \\ \text{if } < 0, & y_i = 0 \end{cases}$$

Where y_i indicate if the i -th household chooses female labor force participation (1 for yes and 0 for no). y_i^* is the latent variable indicating the random utility of i -th household from a wide range of factors affecting the utility of labor force participation, that lead to decide on female labor force participation. $CDF_{normal}(\cdot)$ represents the normal cumulative distribution function; X_i is a vector of covariates (presented in the following Table9) affecting the likelihood of female participation in the labor force, and β contains a vector of parameters to be estimated. ε_i indicates the stochastic effects of unobserved factors affecting the household utility from the female labor force participation decision. If $y_i^* > 0$ meaning random utility of household is positive, females decide to engage in earning activities. Our variable of interest in this analysis is a dummy variable indicating if the

household experienced shock during 2011-2014. Other covariates are included in the models to control for omitted variable biases and endogeneity. Summary statistics of variables used in the analysis are presented in Table 9.

The Hypotheses:

We have estimated the Probit regression model using three different set-ups, each of which has its own importance and provides us a better understanding of the linkages between hazard and female engagement with earning activities. The first set-up uses the whole dataset to find out the impacts of shock-exposure on the FLFP. In the second set-up, we focus only on the vulnerable group of population in the sample and compare if the vulnerable groups FLFP response is different from that of the overall sample. Finally, we investigate which type out of economic, societal, and natural shocks have the largest impact on the FLFP. While, there has been a consensus in the literature that ill health is an important determinant of the disabled person's economic activity there is a dearth of consistent evidence regarding the labor supply response of the females resulted from the income shortfall. The household members' labor supply decisions might be affected from two important factors in this context (García-Gómez et al., 2013). In theory on one hand, through an income effect, the lost earnings of the household provide an incentive to the female to increase labor supply, implying, the spouse may substitute for the lost earning. The spouse might also reduce income generating activities in order to meet the care needs during the shock-affected period. These two roles namely earning replacement and caring, respectively, can have contradictory consequences for the spouse's participation in the labor market and market labor supply if they are already engaged in income generating activities.

In the context of rural Bangladesh where most of households live near the verge of poverty, the added worker effect might dominate the care induced reduction in economic activities. Utilizing the discussion mentioned above, we focus on testing two crucial hypotheses.

Hypothesis 1: Experiencing a household-income reducing shock increases the likelihood of FLFP. This hypothesis is formed from the existing literature that suggests, an income reducing adverse shock might encourage females to take part in the income-generating activities and compensate for the reduced amount of household income. However, if the household head is still employed despite the hazard, females are less likely to participate in the labor market, which forms our second hypothesis.

Hypothesis 2: Households with an employed household-head might have significant impact on the likelihood of FLFP. Exposed to different kind of hazards during the last-4 years, might incentivize females to take part in the labor force, on the other hand might motivate them to spend more time at home, therefore, not taking part in income generating activities, if household-head is employed and care is required more.

Result Discussion:

Table 9 shows the summary statistics of all the variables used in the econometric analysis in this paper. Whereas, Table 10 and Table 11 presents the marginal effects of a wide range of socio-economic, demographic, and regional factors on the likelihood of a household's female labor force participation. We can see in all of the three model setups, the hypothesis of no statistically significant effect of adverse shock is rejected, implying exposure to negative shocks induces household females to engage in income generation activities for families. On average, experiencing a negative shock (economic, societal, or natural) in the last four years between 2011 and 2014, a household is about 3 percent more likely to have female labor force participation. However, this effect is larger for the vulnerable groups of the population being about 4 percent. While all different types of negative shocks increase FLFP's likelihood, natural hazards cause the largest increase by about 6 percent more than the societal shocks. Hence, we can conclude that our hypothesis-1 is supported by the econometric analysis. These results are consistent with the findings obtained in most studies of the literature, namely García-Gómez et al. (2013), Coile (2004), Van Houtven and Coe (2010), and Cullen and Gruber (2000). However, having a statistically significant added worker effect from the adverse shock contradicts the findings of Halla Zweimuller (2013) and Siegel (2006), where the impact of the shock on the FLFP likelihood was conditional on several other aspects.

Table 9: Summary Statistics of Variables used for Analysis

Variable	Obs	Mean	Std.Dev.	Min	Max
Household with female labor force participation (1=yes, 0=no)	6708	.364	.481	0	1
Age of working age female	6708	35.787	12.988	17	64
Marital status (1=yes, 0=no)	6708	2.062	.582	1	5
Female's education (in school years)	6708	4.157	4.006	0	16
Passed primary schooling (1=yes, 0=no)	6708	.375	.484	0	1
Exposed to shocks during (2011-2014) (1=yes, 0=no)	5945	.386	.487	0	1
Total loss from shocks (in taka)	5945	30366.89	113000	0	2300000
Has children below 2 years age (1=yes, 0=no)	5945	.197	.398	0	1
Number of children below 6 years age	4435	.564	.706	0	4
Age of household head (HH) (in years)	6708	46.281	13.578	17	92
Education of household head (in school year)	6708	3.484	3.958	0	18
Interaction variable between female and HH's education	6708	21.369	34.782	0	288
Household head employed (1=yes, 0=no)	6708	.77	.421	0	1
Household has disable member (1=yes, 0=no)	5947	.377	.485	0	1
Household size	6708	5.386	2.272	1	21
Percapita yearly household income (in taka)	5947	9307.823	28684.84	0	527000
Total outstanding loan (in taka)	5947	53670.46	167000	0	3820000
Has access to social security program (1=yes, 0=no)	6708	.36	.48	0	1
Total amount of land (in decimals)	5947	101.343	165.191	0	3092
Value of household asset (in taka)	5947	81496.74	120000	80	2830000
Monthly expenditure of household (in taka)	5947	3819.809	2637.377	447.1	39172.1
Household is vulnerable (1=yes, 0=no)	5947	.398	.49	0	1
Total loss of vulnerable households (in taka)	5945	8123.43	49426.11	0	1520000

Source: Calculated by authors using BHIS 2015 dataset

Table 10: Results from the Probit Regression Model under Different Model Set-Up

	For all households (Model-1)	For vulnerable households (Model-2)	For shock experiencing households (Model-3)
Age (in years)	-0.003*	-0.004*	-0.001
Marital status (1= yes, 0=no)	0.044*	0.068*	0.04
Education (in school years)	-0.059***	-0.084***	-0.054***
Passed primary schooling (1= yes, 0=no)	0.028	0.018	-0.009
Experienced shock during (2011-2014)	0.031**	0.037*	
Household (HH) has children below 2 years old (1= yes, 0=no)	-0.027	-0.029	-0.047
Number of children below 6 years old	-0.025*	-0.017	-0.016
HH head's age (in years)	-0.001	-0.002	-0.003
HH head's education	-0.013***	-0.019**	-0.020***
Interaction variable of female and HH head's education	0.002***	0.004***	0.003**
HH head is employed (1=yes, 0=no)	0.011	0.088*	-0.101**
HH has disabled member (1=yes, 0=no)	0.069***	0.081**	0.074**
HH size	-0.021***	-0.014	-0.017*
Households per-capita income (in taka)	-0.000**	-0.000**	-0.000*
Total outstanding loans (in taka)	-0.000**	-0.000*	0
Access to SSP (1=yes, 0=no)	0.051***	0.036	0.042
HH is vulnerable (1=yes, 0=no)	-0.006		0.019
Interaction variable of age and education	0.001***	0.002***	0.001***
Faced economic shock (1=yes, 0=no)			-0.021
Faced natural shock (1=yes, 0=no)			0.059*
Household is extreme poor (1=yes, 0=no)			-0.004
Household is poor (1=yes, 0=no)			-0.027

Source: Estimated by authors using the BIHS 2015 dataset

Marginal effects in the rows

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

Table 11: Division Specific Effects on FLFP (Dhaka as the Base Division):

	Model-1	Model-2	Model-3
Chittagong	-0.087***	-0.123***	-0.105**
	-0.02	-0.03	-0.03
Khulna	0.031	0.098	0.095
	-0.06	-0.09	-0.1
Rajshahi	-0.079**	-0.095**	-0.034
	-0.02	-0.04	-0.04
Rangpur	-0.053*	-0.066	0.016
	-0.02	-0.04	-0.04
Sylhet	-0.163***	-0.085	-0.159***
	-0.02	-0.06	-0.04
	0.07	0.032	0.035
	-0.06	-0.08	-0.08

Source: Estimated by authors using the BIHS 2015 dataset

Marginal effects in first and Standard errors in second rows.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The null hypothesis that ‘household-head employment’ does not affect the FLFP likelihood’ is rejected in both model-2 and model-3, suggesting the ‘Household employment’ variable is significant when all the vulnerable populations, as well as the shock-affected group of the population, is considered. For the vulnerable group, having an employed household-head increases the FLFP likelihood by 9 percent, whereas the same likelihood declines by 10 percent when households experiencing adverse shocks are considered. These imply mixed results for the hypothesis-2, where we assumed having an employed household-head reduce the likelihood of FLFP. One possible explanation behind such mixed results can be explained by the two effects induced by adverse shocks, namely earning replacement and caring. When the household is vulnerable, to improve family income, females also engage in income-generating activities. However, once the household experiences adverse shocks, female household members are more likely to take care of the family, while household-head increases their labor supply. Such a result possibly indicate reduced opportunities for female members to take part in the labor force, which is resulted from the socio-economic shocks.

Other factors that are included in the model to control for omitted variable bias and endogeneity are also significant. Marital status, passing primary school education, experiencing shocks, having a disabled member in the household have positive impacts on the female labor force participation. Whereas, age, education, having children below two years old, the number of children below six years old, household head’s age, household head’s employment status when facing shocks, household size, and household head’s education negatively affect the likelihood of female labor force participation. One interesting result derived from the analysis is that in all three model setups, the variable “Interaction variable of female and HH head's education” is significant. Hence, we can say incremental education of females increases their likelihood of engaging in income generation activities when household heads are more education. We have also estimated regional impacts of FLFP, treating the Dhaka division as the baseline. Our results suggest Dhaka has the highest regional impact on FLFP, while the lowest regional impact is observed in Sylhet.

7. Concluding Remarks:

Results obtained from this paper have important implications, both in terms of findings and policy issues. Often increasing the labor force participation of women in rural households is considered to be an important policy tool to alleviate poverty. Findings from this research indicate that the households exposed to vulnerabilities can have an important impact on improving their poverty situation with support from the government of Bangladesh (GoB), coupled with the higher rate of women labor force participation. Another important implication of this paper is, the GoB should focus on the supply side policies to improve FLFP in the disaster and shock-prone areas. As our results suggest, females are more likely to engage in income-generating activities in the face of different

types of shocks, in addition to the government supports, improving the employment opportunities or income-generating activities for women can help households to graduate faster from the poverty traps. Findings from this paper also suggest that females from the vulnerable groups of the households that have income-earning household-heads in rural Bangladesh are engaging more with the income generation activities compared to the shock-affected groups of the population with employed household-head. This result implies, while providing better employment opportunities to the females from vulnerable rural households might be an effective way to improve FLFP, such employment opportunities might not be effective for the shock-affected households that already have an earning member. In such a scenario, the GoB can create more income-generating off-farm activities in the rural areas of Bangladesh, which might play a vital role in increasing the labor supply of household-members.

Based on the study, it can also be concluded that there is a significant absence of sufficient productive assets and financial resources faced by vulnerable rural households in Bangladesh. Additionally, they are characterized by a higher dependency ratio and more reliance on farming activities that are vulnerable to adverse shocks. In this context, labor is the primary recourse of impoverished households. Hence, increasing women's participation in the labor force and generating income can substantially improve the resilience of the rural poor and vulnerable households in Bangladesh. The increased female labor force participation not only acts as an effective coping mechanism against adverse shocks but also will contribute to alleviating poverty situation in rural Bangladesh. The resilience of the vulnerable households in rural Bangladesh can also be revamped by increasing the level of education, awareness regarding coping mechanisms, generating more employment through off-farm activities, and crop intensification as well as diversification of agricultural production of the households related to farming activities.

One limitation of this paper is due to the nature of the dataset. The results obtained here cannot be generalized for shock-induced households in the urban areas, because the BIHS 2015 is a representative dataset of rural Bangladesh. However, because of the rapid rate of urbanization in Bangladesh, the vulnerability, resilience, and impacts of shock on the urban population warrant significant importance. In our future work, we will try to incorporate information on shocks and their effects on urban households, using the Household Income and Expenditure (HIES 2016) dataset. While findings obtained from this paper are of crucial importance, in order to better understand the dynamics of various types of shocks and how those are mitigated through women's labor force participation, we plan to use several other econometric techniques in our future work, utilizing the longitudinal feature of the dataset. Such analysis will allow us to explore how different types of shocks have affected the rural population in Bangladesh over time.

* Source: The World Bank dataset (accessed on December 12, 2019)

† Source: Household Income and Expenditure Survey (HIES) 2016.

‡ According to the national Social Security Strategy (NSSS) of Bangladesh, 2015 vulnerability is defined by the 1.25*upper poverty line.

§ Source: International Foundation of Red Cross and Red Crescent Societies (IFRC)

** Bangladesh Integrated Household Survey (2015) is conducted by International Food Policy Research Institute covering 6,500 rural households.

†† Vulnerability is defined as 1.25 times the upper poverty limit according to the National Social Security Strategy 2015.

‡‡ BIHS 2015 dataset is collected from the following link:

<https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/BXSYEL>

§§ Feed the Future (FTF) initiative is led by U.S. Agency for International Development (USAID) seeking to reduce poverty and under-nutrition in Bangladesh. Geographic areas targeted by FTF interventions are known as the Future Zones of Influence (ZOI) and include rural areas of 20 districts in the Southern Delta region of Bangladesh with a population of 28 million (IFPRI, 2017).

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