FINANCING OBSTACLES OF BANGLADESHI FIRMS: EVIDENCE FROM PRE-CRISIS AND POST-CRISIS PERIODS

Elvin Afandi

Islamic Corporation for the Development of the Private Sector (ICD), Islamic Development Bank Group, Bangladesh

Majid Kermani

Islamic Corporation for the Development of the Private Sector (ICD), Islamic Development Bank Group, Bangladesh

ABSTRACT

Access to finance appears to be among the most severe obstacles of the private firms' growth particularly in developing and less developed countries. Using the micro data over 1,500 enterprises, our study aims to understand the determinants of firm-level access to external finance before and after the global financial crisis 2008-09, and how in general the crisis affected the financing obstacles across the firms in Bangladesh. We find that the small, domestically owned enterprises and firms with small capacity utilization are facing higher financing obstacles than other firms. There is statistically significant increase in financing obstacles of Bangladeshi firms, which can perhaps be explained by the "implicit" or indirect effect of the global financial crisis. We found that the root cause of increase in financing obstacles of Bangladeshi firms in post-crisis period is at least partly related to banks' credit procedures, which became tighter and more sophisticated.

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Keywords: Bangladesh, Financing obstacles, Financial crisis, Wake-up call, Blinder-oaxaca decomposition, Directed acyclic graphs.

JEL Classification: E22, G21, G30, O16.

Originality/Contribution

First, this is the first study that focuses on firm-level determinants of financing obstacles in Bangladesh. Second, we find strong evidence on the effect of global financial crisis 2008-09 on firms' financing. Third, we find that the main channels of this effect was "a wake-up call" by banks.

1. INTRODUCTION

Access to finance appears to be among the most severe obstacles of the private firms' growth particularly in developing and less developed countries. Ample of empirical studies show that better access to finance tends to be a key determinant of firms' ability to expand. Empirical literature suggests the positive effect that financial inclusion has on firms' growth, especially firms that need the finance most (Rajan and Zingales, 1998; Aisen and Franken, 2010). Access to finance is associated with the ability of enterprises to finance their investment projects and to allocate resources to the most profitable ones (Levine, 2005).

Ayyagari *et al.* (2008) find that not all obstacles are equally detrimental to firms' growth and among many, three appear to be most binding constraints. Those that directly influence the promotion of firms' growth are: better access to finance, controlled crime and maintained political stability. Further sensitivity tests used by the authors reveal that among these three only the access to finance is consistently and robustly affecting the performance of firms in developing countries. Empirical study conducted by Kinda *et al.* (2011) in a sample of developing countries confirms the findings of Ayyagari *et al.* (2008) in a sense that satisfactory access to external financing is an important factor for the enterprises' productive performance.

At the onset of the financial crisis in late 2007, banks sharply reduced their credit supply in many countries due to increased uncertainty over borrowers quality (Aisen and Franken, 2010). Although a higher percentage of the private sector firms reported access to finance as a severe obstacle at the onset of the global financial crisis in 2008-09, Bangladeshi economy did not observe any significant detrimental effect of the crisis through traditional transformation channels. Nevertheless, there are numerous indirect channels of impact for the global financial crisis that might affect any economy. Among many, banks' credit contractions due to 'behavioral adjustments' is one of the indirect channels that one may consider (Haas and Horen, 2010). In fact, behavioral adjustments through the screening and monitoring of borrowers on behalf of financiers are among the key functions of banks and may vary across customer types and over time (Diamond, 1996; Holmstrom and Tirole, 1997).

In the case of developed countries, particularly in United States of America, various empirical studies have showed evidence that before the 2008-09 global financial crisis banks had gradually relaxed their screening processes and monitoring standards and later have tightened the screening and monitoring due to the crisis effect (Dell' Ariccia *et al.*, 2008; Mian and Sufi, 2009; Keys *et al.*, 2010). However, empirical evidence on the link between banks' monitoring standards and the credit curtail during or after the crisis is still lacking (Ivashina and Scharfstein, 2010). Moreover, to the best of our knowledge, similar empirical evidence in the case of developing countries in general, and in the case of Bangladesh in particular, is even non-existent. An important reason is that banks' screening and monitoring efforts are largely unobservable (Haas and Horen, 2010).

In the light of above mentioned ideas, in this paper, we use a unique micro-level survey database on Bangladeshi firms to address the following questions. First, what are the determinants of financing obstacles of Bangladeshi firms? Second, has financing obstacle of firms in Bangladesh

changed after the global financial crisis 2008-2009? Third, If yes, through which channels the financial crisis affected Bangladeshi firms?

Since the seminal study by Fazzari *et al.* (1988), a number of methodologies have been suggested and a large body of empirical literature has been emerged to analyze the access to finance at firm level. Those works largely appear to focus on two types of factors of access to finance: country-specific and firm-level predictors. Our paper investigates the firm-level determinants of financing and shows the consequences of the 2008-09 global financial crisis on the access to finance status of Bangladeshi firms. We are motivated by our own casual empiricism, and succeed in contributing to three mains stands of the literature. First, to the best of our knowledge this is the first study which specifically focuses on the firm-level determinants of financing obstacles in Bangladesh. This is very important, since access to finance appears to be among the top three obstacles of business growth for Bangladeshi firms. We use high-quality nationally-representative micro data set to identify the characteristics of firms which may be associated with their reporting on financing obstacles.

Second, we study whether the occurrence of global financial crisis in 2008-2009 affected firms' financing obstacles in Bangladesh, where it is believed that the crisis did not influence the economy as far as the traditional channels of the crisis are concerned. We use both regression analysis as well as Oaxaca-type decomposition to understand any possible (direct or indirect) effect of the crisis on financing obstacles of Bangladeshi firms. Third, and perhaps most importantly, our paper sheds light on the main channels of the 2008-2009 global financial crisis that altered the financing obstacles of Bangladeshi firms. We have also benefited from a unique methodology called 'Directed Acyclic Graphs', to assess the root causes of financing obstacles of Bangladeshi firms.Our results show that the young, small, domestically owned enterprises and firms with small capacity utilization are facing with higher financing obstacles than other firms. Furthermore, according to the regression outcomes, time-specific variable turns to be negative and significant in explaining the drop in financial access, even after controlling for a number of firm-level predictors.

In addition, Oaxaca-type decomposition technique reveals that maximum 18 percent of the raise in financing obstacles of Bangladeshi firms over the period can be explained by the change in firms' endowments. Remained or unexplained portion of the differential found to be statistically significant and pretty identical in all three decomposition techniques (Blinder-Oaxaca, Reimers and Neumark). Using 'Directed Acyclic Graphs' method we are able at least partly prove that tight screening processes and monitoring standards of banks were among core causes of the worsening of the financial access among Bangladeshi firms. We found that a root cause of increase in financing obstacles of Bangladeshi firms in post-crisis period is related to banks' behavioral adjustments that were reflected in their credit procedures and standards. Most probably, the crisis acted as "a wake-up call" during which banks tightened their screening and monitoring standards.

The rest of the paper is structured as follows. Section 2 discusses the data base and main methodology. Section 3 discusses the outcomes of our empirical analysis, while Section 4 concludes.

2. DATA & METHODOLOGY

2.1. Data

In our paper we use the firm-level data set of the Enterprise Survey (ES), which is a joint initiative of the European Bank for Reconstruction and Development (EBRD) and the World Bank (WB). For Bangladesh, the main wave of survey conducted in 2007 and collects data from over 1,500 enterprises operating in manufacturing and service sectors in the country. In addition, we utilize the panel data set of 250 identical firms in Bangladesh which were interviewed in both 2007 and 2011. The ES aims at (i) providing statistically significant business environment indicators, (ii) assessing the constraints of private sector growth, and (iii) stimulating policy dialogue on the business environment. There are three levels of stratification: industry, size and region. The survey universe was defined as private business establishments with at least five full-time employees. Government departments including military, police, education, health and similar activities were excluded, as were those in primary industries including agriculture, mining, etc.

The structure of the ES questionnaire consists of the topics such as firm characteristics (i.e. firm's age, size, owner, legal status), access to infrastructure (i.e. electricity, transportation, water), government relations (i.e. regulations, tax administration, corruption, construction permits), labor (i.e. number of temporary employees, permanent jobs), firm performance (i.e. capacity utilization, sales, export), access to finance (i.e. saving accounts, sources of investment financing), and main business obstacles (i.e. ranking most important 15 obstacles to business[1]).

2.1.1. Outcome Variable

Our variable of main interest is the degree to which access to finance is an obstacle to daily operations of Bangladeshi firms. We use the following question on the ES: "How problematic is financing for the operation and growth of your business?" to construct our measure of financing constraint. Responses vary between 0 (no obstacle), 1 (minor obstacle), 2 (moderate obstacle), 3 (major obstacle), and 4 (very severe obstacle).

2.1.2. Independent Variables

We use a wide set of firm-level control variable as previous literature has done (Beck *et al.*, 2004; Beck *et al.*, 2005). We expect firm's access to finance to be related to its size, age, capacity utilization, ownership and legal status. Table A.1 in the appendix reports the descriptive statistics of the outcome as well as independent variables.

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[1] These elements are: 1) Access to finance, 2) Access to land, 3) Business licensing and permits, 4) Corruption, 5) Courts, 6) Crime, theft and disorder, 7) Customs and trade regulations, 8) Electricity, 9) Inadequately educated workforce, 10) Labor regulations, 11) Political instability, 12) Practices of competitors in the informal sector, 13) Tax administration, 14) Tax rates, and 15) Transport.

2.2. Methodology

The methodology consists of three consecutive steps. First we estimate the firm-level determinants of perceived financing obstacles. Second, we analyze the increase in financing obstacles of Bangladeshi firms over time and aim to answer whether this increase can at least be partly explained by the global financial crisis. Finally, we attempt to understand among many, what are the main channels through which the crisis has affected the financing obstacle of Bangladeshi firms.

2.2.1. Determinants of Financing Obstacle

Given the normal distribution of our dependent variable, we analyze the determinants of financing obstacle by estimating two OLS regressions, in parallel with ordered Probit and panel regressions for the sake of robustness check[2]. We run the regression for pooled cross-sectional data of 2007-2011. Econometrically, we regress our dependent variable (perceived financing obstacle) assuming that firm's underlying response can be described by the following equation:

$$Y_{i,t} = \alpha + F_t(X'\beta) + \varepsilon \qquad (1)$$

where $Y_{i,t}$ denotes financing constraint of firms i in year t, $H_t(X'\beta)$ is the vector of firms independent variables in year t, and ε is a disturbance parameter which is assumed to be normally distributed. Our panel regressions with random effects are described by the following equation:

$$Y_{i,t} = \beta_k X_{it} + z_i\delta + u_i + \epsilon_{it} \qquad (2)$$

where X_{it} is a *1 x k* vector of variables that vary over firms and time, β_k is the *k x 1* vector of coefficients on X, z_i is a *1 x p* vector of time-invariant variables that vary only over firms, δ is the *p x 1* vector of coefficients on *z*, u_i is the firms-level effect, and ϵ_{it} is the disturbance term. Panel regression with random effects assumes that u_i are uncorrelated with the regressors, and therefore the firm-level effects are simply parameterized as additional random disturbances. We use Hausman test to test the null hypothesis that the extra orthogonality conditions imposed by the random effects estimator are valid. If we don't reject the null hypothesis it means that fixed effects estimator is consistent, albeit inefficient, whereas the random effect estimator is consistent and efficient.

2.2.2. Crisis's Effect on Financing Obstacle

Before assessing the potential role of global financial crisis in rise of financing obstacle, we use descriptive analysis to portrait our outcome variable across the Bangladeshi firms. Here, t-test is used to compare the level of financing obstacle in 2007 and 2011. Then we start to analyze to what extent this increase can be explained by the global financial crisis. We first use time dummy

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[2] Although our dependent variable is ordered categorical by nature, in both years it appears to be normally distributed. Furthermore, the formal test of normality conducted for 2007 demonstrates that the financing obstacle is normally distributed from the strict statistical point of view (Chi-squared = 97.77; p = 0.000). Similarly, financing obstacle is distributed normally in 2011 (Chi-squared = 10.68; p = 0.005).

and show whether financing constraint has changed after controlling for firm-level determinants. In addition, we use Oaxaca-type decomposition to decompose the change in financing constrain after the crisis.

Econometrically, in the second step we employ the following equation:

$$Y_{i,t} = \alpha + F_t(X'\beta) + TimeDummy + \varepsilon \qquad (3)$$

Where, *TimeDummy* shows the period of the sample: pre and post-crisis period.

Using the Blinder-Oaxaca decomposition algorithm, we assess the effects of endowments and coefficients on the drop of access to finance (Jann, 2008). The Blinder-Oaxaca decomposition equation is as follows:

$$\overline{Y}_{bc} - \overline{Y}_{ac} = [\overline{E}_{bc} - \overline{E}_{ac}]'\gamma_{bc} + \overline{E}'_{ac}(\gamma_{bc} - \gamma_{ac}) + [\overline{E}_{bc} - \overline{E}_{ac}]'(\gamma_{bc} - \gamma_{ac}) \qquad (4)$$

where $\overline{Y}_{bc}$ and $\overline{Y}_{ac}$ are expected value of financing constraint before and after crises respectively, $\overline{E}_{bc}$ and $\overline{E}_{ac}$ are vector of average endowments (firm-level characteristics) before and after crises respectively, and γ_{bc} and γ_{ac} are vector of parameters before and after crises respectively. In the equation (4), $[\overline{E}_{bc} - \overline{E}_{ac}]'\gamma_{bc}$ is the part that is explained by changes in the endowments or socio-economic characteristics, while the second two terms represent the unexplained part which come both from the changes in the coefficients and an interaction effect.

In equation (4), nondiscriminatory coefficients vectors (γ^*) is defined as weighted average of the coefficient vectors, γ_{bc} and γ_{ac}:

$$\gamma^* = \Omega\gamma_{bc} + (I - \Omega)\gamma_{ac}$$

Where $\boldsymbol{\Omega}$ is a weighting matrix and I is diagonal unit matrix. Original Blinder-Oaxaca decomposition in (4) represents special case of the generalized equation in which $\boldsymbol{\Omega}$ is a null matrix or is equal to I (Jann, 2008). However, there are two more assumptions about the form of weighting matrix ($\boldsymbol{\Omega}$) that we will consider in our decomposition analysis for the sake of robustness check. First, Reimers (1983) scalar matrix that proposes weighting matrix $\boldsymbol{\Omega} = (0.5)I$. Second, there is Neumark (1988) pooled model to derive the counterfactual coefficients vectors.

2.2.3. Core Channels of the Global Financial Crisis

The final step of our methodology attempts to understand through which channels the crisis has worsened the financing obstacle of Bangladeshi firms. For this, the Directed Acyclic Graphs (DAG) methodology is employed. A number of empirical studies were utilized the DAG technique both in economics and finance literature. Among a few examples include: Bessler and Akleman (1998), Bessler and Fuller (2000), Ayyagari *et al.* (2006) and Ayyagari *et al.* (2008). Nevertheless, a general literature on the DAG is more extensive (Spirtes *et al.*, 1999; Pearl, 2000). We utilize the software called TETRAD IV where algorithm and more refined extensions of the DAG are available.

The DAG methodology provides a compact representation of joint probability distributions with the nodes of the graphs representing the random variables and the edges connecting the nodes representing conditional independence assumptions. Briefly, a directed graph is a path diagram representing causal flow between or among a set of variables. For example, given set of four

vertices: {A1, A2, A3, A4}, and a set of two edges among these vertices: {*A1→ A2, A2→ A3, A3→ A4*}, the corresponding DAG would be: *A1→A2→A3→A4*. In our analysis, we are concerned with paths containing no cycles (acyclic path); where a cyclic path begins with a variable, say *A1* and eventually returns to *A1* {e.g., *A1→ A2→ A1*}. Our directed graphs provide the visual representation of causal flow which depicts the set of independence or conditional independence conditions.

The DAG methodology is derived from the application of Bayes rule and relies on the concept of the Causal Markov Condition to identify which variable is a true cause or predictor of the outcome variable. The Causal Markov Condition amounts to assuming that every variable *A* is independent of all other variables that are not its direct effects, conditional on its immediate causes. In graph theory, the equivalent of the Causal Markov Condition is referred to as d-separation.

The strength of DAG methodology over regression analysis lies in its ability (i) to distinguish genuine from spurious correlations in a set of data, (ii) to identify which variables need to be included in a model to accurately measure one variable's effect on another, and (iii) to differentiate between direct and indirect effects of different variables[3].

3. EMPIRICAL RESULTS

3.1. Determinants of Financing Obstacles

The regressions in Table 1 indicate that the size, foreign ownership and capacity utilization are the most robust predictors of financing obstacles of Bangladeshi firms. Overall, our regression results are largely consistent with the main finding in the literature. Nevertheless, none of the regressions found listed companies affecting significantly their reporting on financing obstacles.

The OLS columns 1-2 of Table 1 show significant effect of age on the financing obstacle. Reported financing obstacles decrease in the age of the enterprise. This result also holds true for the ordered probit estimation. However, the results of panel regression found the age variable non-significant in explaining the difference between financing obstacles of Bangladeshi firms.

As was mentioned in the "Data and Methodology" section of the paper, for the size of firms we use two variables: the amount of sales and dummy variables for small and medium firms. In regressions (both in OLS and ordered probit), both the volume of sales and the dummy variables for small and medium enterprises enter statistically significant even when we control for other firm characteristics that are conjectured to determine financing obstacles. Small and medium firms report significantly higher financing obstacle than large firms. Furthermore, the more volume of sales a firm has the less financing obstacle it reports. Although the dummy variables for small and medium firms tend to be only economically significant, the volume of sales found to be statistically significant as well in the panel regressions with random effects.

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[3] For further illustration of the DAG methodology and how it works in TETRAD software program please see Ayyagar *et al*, (2008).

Table-1. Determinants of Financing Obstacle

Variables	OLS		Ordered Probit		Panel Regression (RE)	
	(1)	(2)	(1)	(2)	(1)	(2)
Constant	2.7595***	3.224			2.6859***	1.993***
	(0.2098)	(0.2918)			(0.3341)	(0.6026)
Age	-0.0049*	-0.0045*	-0.0045**	-0.0041*	-0.0001	0.0001
	(0.0026)	(0.0026)	(0.0023)	(0.0023)	(0.0041)	(0.0041)
Small	0.1681**		0.1417**		0.1820	
	(0.0773)		(0.0683)		(0.1723)	
Medium	0.2316**		0.2155**		0.1904	
	(0.1155)		(0.1018)		(0.1692)	
Foreign	-0.0092***	-0.0096***	-0.0093***	-0.0096***	-0.0090**	-0.0094**
	(0.0027)	(0.0027)	(0.0025)	(0.0025)	(0.0040)	(0.0040)
Capacity	-0.0098***	-0.0108***	-0.0085***	-0.0093***	-0.0076**	-0.0112***
	(0.0023)	(0.0023)	(0.0021)	(0.0021)	(0.0037)	(0.0038)
Listed	-0.0621	-0.0909	-0.0818	-0.1076	-0.1794	-0.2711
	(0.1916)	(0.1924)	(0.1709)	(0.1711)	(0.2694)	(0.2705)
Sales		-0.0174		-0.0151		-0.0553*
		(0.0153)		(0.0136)		(0.0323)
Obs	1161	1142	1161	1142	453	434
Pseudo R2	0.0415	0.0388	0.0143	0.0133	0.0305	0.0352

Notes: The dependent variable is firms' reporting on financing obstacles. Responses vary between 0 (no obstacle), 1 (minor obstacle), 2 (moderate obstacle), 3 (major obstacle), and 4 (very severe obstacle). In all three set of estimations (OLS, Ordered probit and Panel regression) first column always use a small and medium size dummies, while the second columns include the logarithm of annual sales as a proxy of firm's size. Robust standard errors are in parentheses. The results of Haussmann test for the extra-orthogonality conditions imposed by the random effects estimator of the panel regression can be provided upon the request. (***), (**) and (*) denote significance at 1%, 5% and 10%, respectively.

Source: Authors' computations using data from Enterprise Surveys Bangladesh - 2007 and 2011

Another result of the regressions is that foreign-owned firms report significantly lower financing obstacles, even when controlling for other firm characteristics. This result is true in the case of panel regression estimations. Finally, we found that firms that close to their production frontier report lower financing constraint, and this results is significant at least 5% level.

3.2. Global Financial Crisis's Effect on Financing Obstacles

Table 2 displays the percentage of Bangladeshi firms that report a particular business environment element to be their top obstacle. For the sake of comparison, we also add average percentage of relevant obstacles for the firms in world as well as in South Asia region. Each firm in the sample identifies only one business environment element out of a list of fifteen that represents the biggest obstacle faced by this establishment.

According to Table 2, the business environment in Bangladesh appears to have similar weaknesses that average firm reported in the region. Electricity, access to finance and political instability tend to be the top three obstacles for the firms both in Bangladesh as well as South Asia

region. However, there are some differences when it comes to comparison with global averages. For example, 85 percent of Bangladeshi firms consider these elements as the top three obstacles for their businesses, while this cumulative figure stands only at 40 percent globally.

Table-2. Percentage of firms reporting a business environment element to be the top obstacle

		Bangladesh	**Region**	**World**
1.	Access to finance	15	13	15
2.	Access to land	2	4	3
3.	Business licensing and permits	0	2	3
4.	Corruption	2	6	7
5.	Courts	0	0	1
6.	Crime, theft and disorder	2	6	6
7.	Customs and trade regulations	4	2	3
8.	Electricity	64	29	16
9.	Inadequately educated workforce	1	2	6
10.	Labor regulations	0	2	2
11.	Political instability	6	14	9
12.	Practices of competitors in the informal sector	1	6	11
13.	Tax administration	1	3	3
14.	Tax rates	1	4	11
15.	Transport	1	3	3

Source: Authors' computations using data from Enterprise Surveys Bangladesh - 2007 and 2011

From top obstacle reporting, 64 percent of firms in Bangladesh are reporting electricity to be top obstacle to their daily businesses compared to 29 percent and 16 percent of firms in South Asia region and global average respectively. About 15 percent of Bangladeshi firms report access to finance as the top obstacle which is very similar to the South Asia region and world averages.

Being the third biggest business obstacle, political instability appears to be lower in Bangladesh (6 percent) compared to the region and world averages that stand at 14 percent and 9 percent, respectively. Noteworthy, business environment elements related to tax rates, crime and practices of the informal sector seem not to be the biggest obstacle for majority of Bangladeshi firms.

In order to understand whether the top three constraints have really improved or worsened over time, we investigate the degree of severity of each individual element in Figure 1. There are a number of observations that stand out. First, in 2011, political instability became less binding constraint to the business compared to 2007. The percentage of firms reporting this business element to be very severe obstacle to their operations decreased from 32 percent in 2007 to 11 percent in 2011.

Second, both electricity and access to finance appear to be more severe constraint in 2010. For example, the percentage of firms reporting electricity and access to finance as a very severe obstacle increased from 30 percent and 7 percent in 2007 to respectively 50 percent and 26 percent in 2011. Furthermore, these increases are found to be statistically significant. The formal t-test

demonstrates that distributions of electricity constraint and financing obstacle in 2011 are significantly different from that in 2006 (t=-4.9707; p=0.000 and t=-9.7614; p=0.000 respectively).

Figure-1. Percentage of Bangladeshi firms reporting a business environment element as a constraint to daily operations
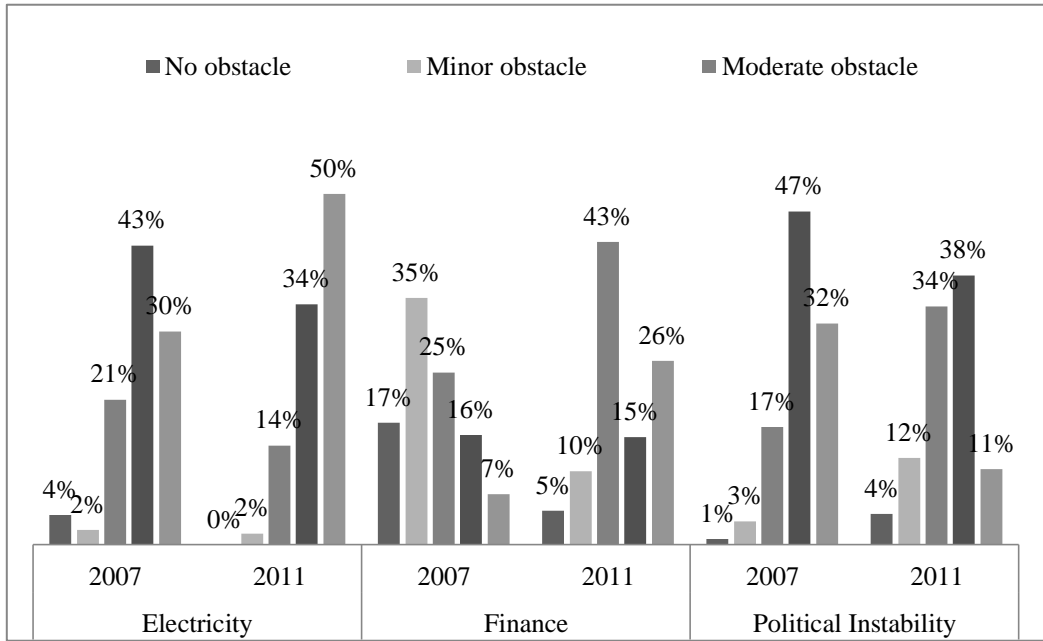
Source: Authors' computations using data from Enterprise Surveys Bangladesh - 2007 and 2011

Since access to finance is the second largest obstacles for Bangladeshi firms and it has worsened in 2011, main question raises. Did the global financial crisis play a role in this increase? To answer the question, we employ a number of empirical techniques to understand the possible effect of the global financial crisis on the rise of the financial obstacle.

We start to look closer at the time-specific "crisis" dummy that we add to our regression models described in Table 1. Our crisis-dummy measures the unexplained change in financing obstacle of Bangladeshi firms after the crisis period. According to the results of Table 3, the "crisis" dummy is positive and statistically significant which means that even after controlling for the firm-level characteristics there is still statistically significant increase in financing obstacle after the crisis. This increase is about 1 unit, which means exactly one scale increase (for example increase from 0 (no obstacle) to 1(minor obstacle) or from 3 (major obstacle) to 4 (very severe obstacle) etc.).

Next, we conduct a Blinder-Oaxaca decomposition to check the robustness of our conclusion on the role of the global financial crisis in the increase of financing obstacle. As per Table 4, changes in the firm characteristics can explain a negligible part (18%) of the changes in the level of financing constraint, while remained or unexplained component explain a very large part (119%) of the changes which also tends to be statistically significant.

Table-3. Effect of Crisis on Financing Obstacle

	OLS		Ordered Probit	
	(1)	(2)	(1)	(2)
Constant	2.7306***	4.4023***		
	(0.2007)	(0.2987)		
Age	-.0052**	-0.0042*	-0.0049**	-0.0040*
	(0.0024)	(0.0025)	(0.0022)	(0.0023)
Small	0.3748***		0.3378***	
	(0.0765)		(0.0712)	
Medium	0.2680**		0.2656***	
	(0.1105)		(0.1026)	
Foreign	-0.0079***	-0.0076***	-0.0084***	-0.0082***
	(0.0025)	(0.0025)	(0.0025)	(0.0025)
Capacity	-0.0127***	-0.0126***	-0.0119***	-0.0117***
	(0.0022)	(0.0022)	(0.0021)	(0.0021)
Listed	0.1250	0.1721	0.0915	0.1393
	(0.1842)	(0.1850)	(0.1725)	(0.1737)
Sale		-0.0890***		-0.0842***
		(0.0160)		(0.0152)
Time Dummy	0.9211***	1.0460***	0.8642***	0.9930***
	(0.0886)	(0.0970)	(0.0846)	(0.0934)
Obs	1161	1142	1161	1142
Pseudo R2	0.1236	0.1280	0.0437	0.0458

Notes: The dependent variable is firms' reporting on financing obstacles. Responses vary between 0 (no obstacle), 1 (minor obstacle), 2 (moderate obstacle), 3 (major obstacle), and 4 (very severe obstacle). In both set of estimations (OLS and Ordered probit) first columns always use a small and medium size dummies, while the second columns include the logarithm of annual sales as a proxy of firm's size. Robust standard errors are in parentheses. (***), (**) and (*) denote significance at 1%, 5% and 10%, respectively.

Source: Authors' computations using data from Enterprise Surveys Bangladesh - 2007 and 2011

In Table 4, we also show the results of two other decomposition techniques, namely Reimers and Neumark decomposition techniques. The comparison of various techniques yields the two main findings. First, there is no significant difference between the results of decomposition techniques used. Generally, firm-level endowments explain very small part of the differential in financial obstacle before and after the crisis, while unexplained part of the decomposition remains fairly large. Second, standard Blinder-Oaxaca decomposition appears to overestimate the role of explained and unexplained portion of the difference in financing obstacle, while Neumark decomposition technique seems to underestimate the contribution of the both portions.

One may argue that raise in financing obstacles that associated with some unexplained change during 2007-2011 is very likely stemming from the global financial crisis that happened during that period. However, given the peculiarities of Bangladeshi economy, the global financial crisis most probability played implicit role rather than explicit in financing obstacles of firms. According to various studies, none of the three traditional channels (a) banking failures and reductions in domestic lending, b) reductions in export earnings, and c) reductions in financial flows as well as

remittances) has shown a sign in Bangladesh (For further analysis on the role of global financial crisis in Bangladeshi economy see for example, (Murshid *et al.*, 2009; Rahman *et al.*, 2009).

Table-4. Decomposition of the Difference in Financing Obstacle between 2007 and 2011

	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
Model with Small and Medium Dummies						
Differential						
Prediction (2006)	1.6123	0.0787	20.49	0.0000	1.4581	1.7666
Prediction (2011)	2.5354	0.0762	33.26	0.0000	2.3860	2.6848
Difference	-0.9231	0.1096	-8.42	0.0000	-1.1378	-0.7083
Decomposition						
Blinder-Oaxaca						
Explained	0.1766	0.0613	2.88	0.0040	0.0564	0.2969
Unexplained	-1.0997	0.1201	-9.15	0.0000	-1.3352	-0.8643
Reimers						
Explained	0.1019	0.0406	2.51	0.0120	0.0223	0.1814
Unexplained	-1.0249	0.1115	-9.19	0.0000	-1.2434	-0.8064
Neumark						
Explained	0.0769	0.0406	1.89	0.0580	-0.0027	0.1565
Unexplained	-0.9999	0.1056	-9.47	0.0000	-1.2069	-0.7929
Model with Log of Sales						
Differential						
Prediction (2006)	1.6123	0.0785	20.53	0.0000	1.4584	1.7663
Prediction (2011)	2.5411	0.0810	31.38	0.0000	2.3823	2.6998
Difference	-0.9287	0.1128	-8.23	0.0000	-1.1498	-0.7076
Decomposition						
Blinder-Oaxaca						
Explained	0.1687	0.0786	2.15	0.0320	0.0146	0.3227
Unexplained	-1.0974	0.1315	-8.34	0.0000	-1.3551	-0.8396
Reimers						
Explained	0.1473	0.0540	2.73	0.0060	0.0415	0.2531
Unexplained	-1.0760	0.1193	-9.02	0.0000	-1.3098	-0.8422
Neumark						
Explained	0.1127	0.0544	2.07	0.0380	0.0060	0.2193
Unexplained	-1.0414	0.1168	-8.92	0.0000	-1.2702	-0.8126

Notes: The dependent variable is firms' reporting on financing obstacles. Responses vary between 0 (no obstacle), 1 (minor obstacle), 2 (moderate obstacle), 3 (major obstacle), and 4 (very severe obstacle).

Source: Authors' computations using data from Enterprise Surveys Bangladesh - 2007 and 2011

In fact, the effect of global financial crisis does not necessarily need to be direct and through traditional channels that we have seen in the literature so far. A credit contraction during and after the global financial crisis can be also explained by changes in banks' behavior that were reflected in intense screening and monitoring of credit decisions (Haas and Horen, 2010). In the next section we assess to what extend stricter screening and monitoring processes by banks may have contributed to the financing obstacles of Bangladeshi firms after the crisis.

3.3. Core Channels of the Global Financial Crisis: DAG Approach

In this section we attempt to understand root causes behind the financing obstacle of Bangladeshi firms. Since there is no clear evidence on the reason of credit contraction in Bangladesh, we expect this drop to be associated with the tightened screening processes and monitoring standards by banks regardless of any official or unofficial directives from the Bangladeshi government, namely from the monetary policy authority (Central Bank). In fact, banks' screening and monitoring efforts are largely unobservable (Haas and Horen, 2010).

Therefore, empirical researchers proxy it through using observable variables such as denial rates, share of bank credits in investments or making inferences about the strictness of screening monitoring by examining the responses from actual or potential borrowers. In our study, we also utilize the same line of thinking and examine the root causes of credit contraction by using the Directed Acyclic Graphs (DAG) methodology. From the survey the enterprises report a number of causes of not applying for a loan or line of credit. These include: (a) complex application procedures, (b) high interest rates, (c) high collateral requirement, (d) insufficient size and maturity of credit, and (e) do not believe that the credit will be approved.

By adding all reported causes into the DAG analysis, we aim to understand among those reasons which ones are true causes of firms' financing obstacles. By analyzing the Enterprise Survey's results in the software program TETRAD IV, we estimated our DAG model for 2007 and 2011 separately. Figure 2 illustrates the application of the DAG algorithm to our 2011 sample, while the results of the DAG analysis for 2007 are shown in the appendix (see Figure A.1). For 2007, the estimated DAG algorithm portraits very straightforward inference and concludes that all five reasons (i.e., complex application procedure, high interest rates, high collateral requirements, insufficient size and maturity of credit, and do not believe that the credit will get approved) appear to be statistically significant at least 10% level in explaining the financing obstacles of Bangladeshi firms.

However, for 2011 sample, the estimated DAG algorithm concludes that among these five reasons only the complexity of application procedure has direct and statistically significant effect on access to finance problem of Bangladeshi firms. Complexity of application procedures in turn is directly affected by two factors: the perceptions of high interest rates and no hope for getting a credit. It means that those two reasons have only an indirect influence on the financing constraint of Bangladeshi firms in 2011.

Nevertheless, reasons such as high collateral requirements and insufficient size and maturity of credit do not show neither direct nor indirect effect on the access to finance challenges of Bangladeshi firms in 2011. These results justify our previous assumption that the raise in financing obstacles of Bangladeshi firms after the crisis was caused by stricter bank screening and monitoring standards. Before the crisis banks had probably relaxed their screening and monitoring standards, while during the crisis banks had gradually tightened their procedures. This is perhaps a sudden and broad increase in risk awareness and asymmetric information of banks and can be called a "wake-up call".

Figure-2. Causes of Financial Obstacles in 2011: Directed Acyclic Graphs (3-tier order)
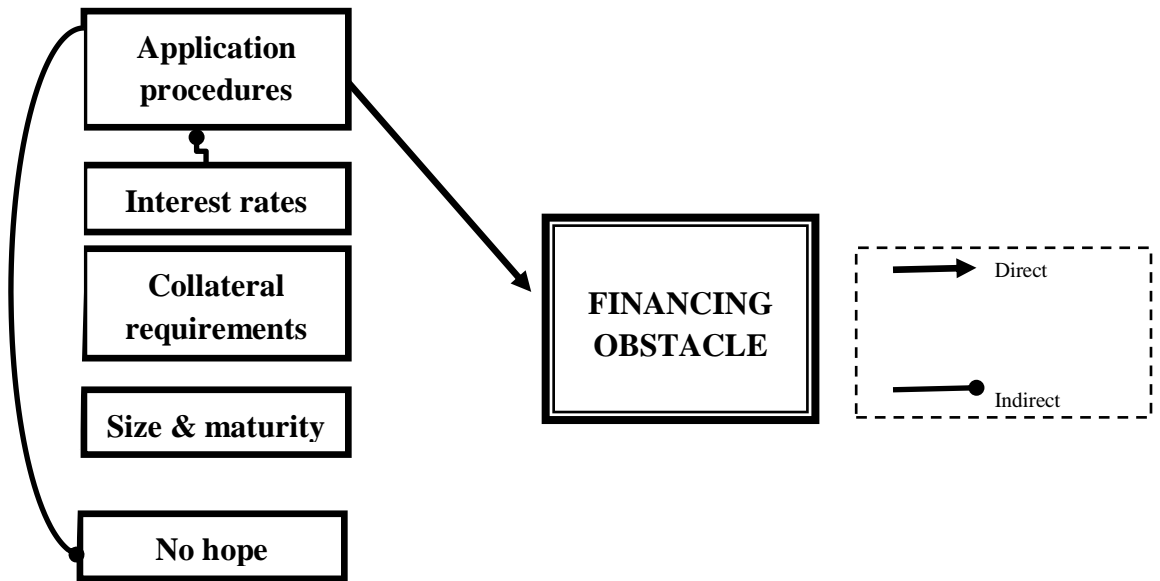
Source: Authors' computations using Enterprise Surveys Bangladesh data - 2011

4. CONCLUSION

In this paper, we use a unique micro-level survey database on Bangladeshi firms and attempt to address the following questions. First, more generally, what are the determinants of financing obstacles of Bangladeshi firms? Second, has financing obstacle of firms in Bangladesh changed throughout the global financial crisis 2008-2009? Third, if yes, what are the core channels of the crisis affecting the firms' financial constraints?

Our results show that the small, domestically owned enterprises and firms with small capacity utilization are facing higher financing obstacles than other firms. Furthermore, it is found that there is statistically significant increase in financing obstacles of Bangladeshi firms even after controlling for characteristics of Bangladeshi firms. This finding points to a sudden increase in banks' screening and monitoring standards: a wake-up call.

With the help of further empirical tests, we find that a root cause of increase in financing obstacles of Bangladeshi firms in post-crisis period is at least partly related to banks' behavioral adjustments that were reflected in their credit procedures and standards. Most probably, the crisis acted as a wake-up call during which banks tightened their screening and monitoring standards.

These results show an important influence of banks' behaviors on the credit contraction among private sector enterprises. Therefore, policies aimed at stimulating bank lending should place emphasis not only on traditional channels of financial crisis, but also on banks' behavioral adjustments which are very hard to observe. In addition, policy making authorities need to assess the underlying reasons why the crisis has induced Bangladeshi banks to intensify their screening and monitoring efforts for the same level of borrower risk.

Finally, at least one main limitation of our study should be mentioned. Because of data limitations, in our study, the level of financing obstacle was gauged by a single subjective question. As argued by Beck *et al.* (2005), it is possible that while firms report financing obstacles, they are actually not constrained by them and perceived financing exclusion is largely related to their growth rates, in the sense that firms that report financing obstacles tend to be growth-constrained. Therefore, one must be cautious while interpreting the results and therefore it is suggested not associate the perceived financing constraint with absolute constraint of firms.

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Appendix

Table-A1. Summary statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
POOLED SAMPLE					
Obstacle	1473	1.819	1.1978	0	4
Age	1477	17.7123	13.3183	1	177
Small	1754	0.4064	0.4913	0	1
Medium	1754	0.0974	0.2967	0	1
Large	1754	0.3397	0.4737	0	1
Foreign	1479	1.8231	12.4103	0	100
Capacity	1169	81.1673	15.2440	4	100
Listed	1754	0.0267	0.1615	0	1
Log sales	1455	16.8314	2.4244	1.6486	23.2081
SAMPLE – 2011					
Obstacle	248	2.4758	1.13082	0	4
Age	248	18.2419	13.8127	1	177
Small	250	0.1400	0.3476	0	1
Medium	250	0.1760	0.3815	0	1
					Continue

Large	250	0.6840	0.4658	0	1
Foreign	249	2.0883	12.2332	0	100
Capacity	231	86.4329	15.0224	5	100
Listed	250	0.0160	0.1257	0	1
Log sales	225	19.27143	1.9565	14.5086	23.2081

Source: Authors' computations using data from Enterprise Surveys Bangladesh - 2007 and 2011

Figure-A.1. Direct Causes of Financial Obstacles in 2007: Directed Acyclic Graphs

Source: Authors' computations using Enterprise Surveys Bangladesh data - 2007