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DETERMINANTS OF DOMESTIC BANK CREDIT TO PRIVATE SECTORS IN BANGLADESH: AN EMPIRICAL INVESTIGATION

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ABSTRACT

This article examines the key determinants of domestic bank credit the private sectors receive in Bangladesh by using annual time series data over the period from 1974 to 2018. The ARDL (autoregressive distributed lag) model has been applied to identify the variables that contribute to the changes in domestic credit to private sectors from banks over time in Bangladesh. Empirical results reveal that broad money (M2), gross domestic product (GDP), real interest rate (RI), trade openness (TO), gross capital formation (GCF), and exchange rate (ER) have a significant impact on the amount of credit flowing to the private sectors from banks in Bangladesh, particularly in the long run. The findings also confirm that the long run relationship among the relevant variables is robust and stable. Any disequilibrium found in the short run seems to be eliminated with a speed of 40.96% per year. The findings of the research suggest that a stable growth of money supply, an increase in real interest rate, sustainable growth in GDP, and high degree trade openness are crucial for the growth of bank credit to private sectors. Gross capital formation and local currency depreciation, on the other hand, negatively influence bank loans to the private sector in Bangladesh. The significance of the study lies in the fact that it paves the way for a better understanding of the functionality of domestic bank credit flow in Bangladesh. The policy implications of the findings suggest that authorities pay special attention to stable money supply growth, expansionary monetary policy, and trade liberalization to strengthen the financial market in Bangladesh.

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INTRODUCTION

Financing is said to be the heart of any business activity. Business firms, companies, and corporations are dependent on numerous external sources in addition to their internal funds for raising capital. Domestic bank credit is one of the major external sources with which businesses are found to fulfil the need for financial resources like loans, purchases of nonequity securities, and so on. Small firms are more dependent on credit institutions as they do not have an adequate number of sources to raise capital (Cestone and White, 2003). The financial resources provided to the private sectors by credit institutions are crucial to relieve the budgetary constraints of businesses and meet the financial requirements of investors and thus helping the private sectors of the economy to flourish. An efficiently managed credit system can, by transferring surplus funds of individuals and institutions to the deficit spenders, encourage savings and investment, promote more efficient allocation of financial resources, and strengthen economic and commercial growth in a country. Financial markets, according to Stiglitz (1993), can be viewed as the brain of the entire economy. Substantial evidence is found in the existing literature about the cruciality of domestic bank credits in boosting economic growth (Acharya et al., 2009).

Schumpeter (1911), in one of the earliest works ever done about the impact of financial development on economic progress, attempted to articulate that financial institutions, including banks, can significantly stimulate economic growth through technological innovation and productive investments. Following this, economists like Robinson (1952), McKinnon (1973), Gurley and Shaw (1955), Shaw (1973), and Goldsmith (1969), have shown that development in financial sectors has a positive effect on economic growth across countries. Later, the roles of financial institutions in promoting GDP growth have been examined substantially in the literature (Spellman, 1982; King and Levine, 1993). Considering the economy of Bangladesh, Rahman (2004) attempted to illustrate that financial development can improve per capita income in Bangladesh in the long run. Shahbaz et al. (2015) later confirmed the causality between per capita GDP growth and financial development in Bangladesh, where the former Granger causes the latter. Banks, often called the 'lifeblood of economy' (Banga, 2013), are the most dominant financial institutions. A strong correlation has also been established between a sound banking system and fast economic growth (Levine, 1997). Financial development is impossible without

the availability and growth of bank credit. Therefore, it is crucial to know the determinants of domestic credit to private sectors flowing from banks. Considering the scenario of Bangladesh, private sector bank lending has been increasing steadily since 1974.

Figure 1 demonstrates the increasing trend of bank loans as a percentage of gross domestic product over time. As figure 2 indicates, the amount of private sector bank credit has sharply increased to 128.163 billion USD in 2018 from only around 0.32 billion USD in 1974. Figure 1 demonstrates the increasing trend of domestic credit from banks as a percentage of GDP over time, while it is evident from figure 2 that the private sector bank lending rose to 128.163 billion USD in 2018 from only around 0.32 billion USD in 1974. Bangladesh adopted several financial liberalization measures during the 1990s as a part of the extensive financial sector reforms. According to Chowdhury (2001), some of the reform measures include eliminating barriers for commercial banks to enter the market and flourish, introducing market-based credit sanctions and interest rates, exchange rate unification, and adoption of more flexible exchange rates.

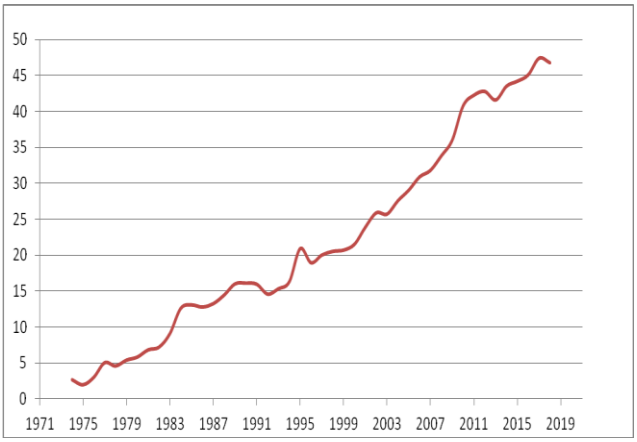

Figure 1. Domestic credit to the private sector by Bank (% of GDP) in Bangladesh (19974-2018) (Source: World Bank, 2019).

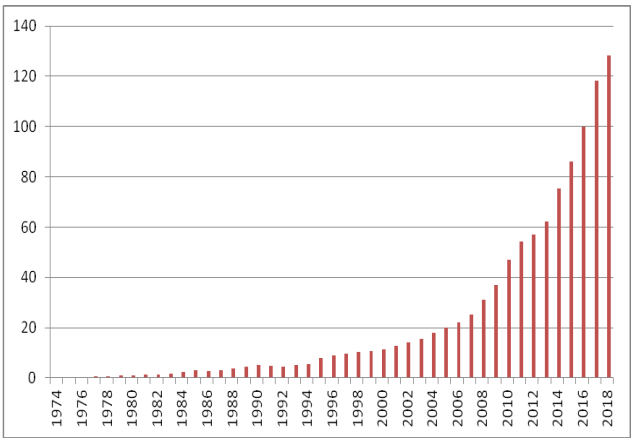

Figure 2. Domestic credit to the private sector by Bank (Billion USD) in Bangladesh (1974-2018) (Source: World Bank, 2019).

The percentage of private sector bank credit reached double-digit after Bangladesh embraced financial reforms during the 1990s. Investigating the variables that determine the domestic credit to the private sectors is vital for a critical assessment of the growing trend that bank loans to private sectors exhibit and their empirical role in GDP growth and the country's overall economic performance. To the best of my knowledge, no study is available that investigates the determinants of bank lending to the private sectors in Bangladesh.

The fundamental objective of our study is to examine the key determinants that influence bank lending to the private sector in Bangladesh. The study focuses on the construction of a time series regression model in an attempt to investigate the effect of relevant factors on private sector credit flow from the banks. An empirical framework would be modeled in order to measure the strength of influence of the variables on banks' loan disbursement. The variables are likely to have separate dynamics with respect to the time horizon. The article, therefore, surveys the distinguishing features of the variables influencing the bank loan to the private sector in the short run and also in the long run.

Extant literature has attempted to find out the basic determinants of credit flow from banks. For example, Timsina (2017) attempts to identify the factors of commercial bank credit in Nepal by employing ordinary least square regression for the period from 1975 to 2014. The explanatory variables explored for the dependent variable- Nepalese commercial banks' loans- are the number of deposits, interest rate, cash reserve requirements, liquidity ratio, exchange rate, inflation, and GDP. Of all the relevant variables, only GDP and liquidity ratio of banks seemed to influence bank lending behavior in Nepal with statistical significance, whereas the coefficients of all other variables were statistically insignificant. Granger causality test was also performed in the study that showed a 'unidirectional causal relationship from GDP to private sector credit'. Baoko et al. (2017), on the other hand, studied the variables affecting Ghanaian domestic bank lending using the ARDL approach with the aid of time series data from 1970 to 2011. Among the explanatory variables used to examine the factors of bank lending in Ghana, real lending rate, bank deposit, bank assets, broad money supply, and different political regimes turned out to have a statistically significant and long-run effect on domestic bank lending in Ghana where real GDP, real exchange rate and inflation are found to have no relationship in the long run with Ghanaian bank credit flow. Inflation, however, seemed to be inversely associated with bank credit in Ghana only in the short run.

Akinlo and Oni (2015) analyzed the factors that affect the credit to private sectors by Nigerian banks for the period of 1980 to 2020 using the 'Engle and Granger error correction model' framework. Results establish a long run along with a significant (statistically) positive association between Nigerian bank credit and cyclical risk premium, liquidity ratio, and inflation. But reserve ratio and lending rate in the long run and real gross domestic product per capita in the short run seemed to impact credit growth inversely in Nigeria, which is not consistent with the finding of Sharma and Gounder (2012), who established a positive association between bank lending and per capita GDP. Gozgor (2014) investigated the possible causes of bank credit levels across 24 developing economies using the dynamic panel data estimation technique both from the internal demand and external supply side. The results indicate that differences between domestic and global credit rates, expansionary monetary policy, and real trade openness

have a positive relationship with domestic lending, while external balances are negatively associated with domestic bank credit in the economies studied. However, Amidu (2014) studied the macro and micro determinants of domestic credit using data from 24 countries in Sub Saharan Africa (SSA). Bank size and growth are found to be positively associated with bank lending as opposed to high non-performing loans, the level of bank stability, and risk-adjusted profit, which do not have any impact on bank credit in SSA. Policy induced interest rate is, however, negatively associated with bank credit in SSA. Shijaku and Kalluci (2013) examined variables that determine the private sector bank lending by Albanian Banks using the Johansen VECM approach. The results show that a cointegrating relationship exists between bank credit in Albania and its determinants explored in the study from both the demand and supply side. Explanatory variables used in the research include the gross domestic product in real terms, banking developments, financial liberalization indices, rate of exchange, default loans, and rate of interest. Imran and Nishat (2013) investigated the determinants of private sector bank lending from the supply side in Pakistan with the help of time series data from 1971 to 2010. A stable long-run association has been found between domestic credit by banks in Pakistan and its supply-side determinants such as the growth rate in foreign liabilities, deposits in domestic sectors, GDP growth, supply of money, and exchange rate. Money market rate and inflation in long run and domestic deposit in the short run came out to have no impact on bank credit. Sharma and Gounder (2012) examined the determinants of private sector credit from banks for six economies in South Pacific countries for the period starting from 1982 to 2009. The average interest rate, inflation rate, bank deposit to GDP, bank asset to GDP, stock market, and GDP were found to be the basic determinants of bank credit. Empirical findings indicate that the average rate of interest and inflation rate are inversely associated with the credit growth rate, whereas a higher amount of bank deposits and bank assets resulted in a rise in bank credit. The higher credit growth was also found to be a consequence of stronger economic growth. Stepanyan and Guo (2011) examined the impact of the variables like domestic bank deposits, foreign liabilities, rate of inflation, real GDP, deposit rate, US federal funds rate, and non-performing loan ratio of bank lending on the dependent variable bank credit across 38 emerging market economies. The result was in line with the other studies in showing that higher credit growth is a result of stronger growth of the economy. Also, the results indicate that the domestic and funding from abroad, along with expansionary monetary policy, is conducive to the expansion of bank credit while the increase in nominal credit impedes real credit growth. Olokoyo (2011) examined the credit behavior of Nigerian banks by applying 26 years of time series data from 1980 to 2005. The determinants impacting bank loans and advances are deposits, rate of exchange, investment portfolio, and gross domestic product, whereas 'interest rate', 'liquidity ratio' and 'cash reserve requirement' were found to be statistically insignificant. Berrospide and Edge (2010) explored the relationship between bank capital and bank lending behaviour using the method of shared regression analysis, while Bakker and Gulde (2010) attempted to examine the external factors for credit growth across Europe. Aisen and Franken (2010) studied the change in the behaviour of credit growth of banks in 80 countries in the wake of the financial crisis that was found to hinder the growth of bank lending in these countries. Liquidity situation in the banks and "cyclical fluctuations in the monetary policy" are found to be the most prominent factors that caused a fall in bank credit after the financial crisis. In response, different countries adopted different strategies reflecting the variations in the structural characteristics coming from the integration and financial gravity of the countries examined.

Chodechai (2004) examined the sensitivity of the lending interest rates in forming lending decisions by Thai banks between 1992 and 1996. The study attempts to show that the "interest rates, the volume of lending, and the identification of collateral" are some of the factors that affect the credit behavior of banks. Hofmann (2001) examined the variables that determine private sector bank lending for 16 countries using a cointegrating VAR approach. His findings emphasized on the addition of real property prices to the system with the aim of allowing the identification of the relationship that exists between real GDP and real credit.

More recently, Aryestya and Marta (2022) established that credit flow is crucial for economic growth up to a certain point. Applying GMM method, they found an inverted U shape relationship between bank lending and growth in ASEAN countries. Ongena et al. (2021) examined the impact of domestic and foreign monetary policy on bank lending behavior in both currencies. Their findings indicated that bank loans in foreign currencies are more responsive to the change in monetary situations abroad than in their home countries.

Most of these studies have been carried out with regard to the countries other than Bangladesh. Economic growth of an underdeveloped economy like Bangladesh largely depends on the contribution of private sector. Examining the factors affecting private sector credit flow in Bangladesh therefore requires additional focus. This research is an attempt to analyze bank lending behavior in Bangladesh that can potentially facilitate the policy implications to benefit the overall performance of financial sector in the country

DATA AND METHODOLOGY

Time series data (annual) starting over the period of 1974 to 2018 have been collected from WDI (World Development Indicators) database.

Empirical examination of the determinants of domestic bank-credit is done by using the following regression model, where 'domestic credit to private sectors' (DCP) is viewed as the dependent variable.

$$lnDCP_t = \beta_0 + \beta_1 lnM2_t + \beta_2 ER_t + \beta_3 RI_t + \beta_4 lnGDP_t + \beta_5 lnGCF_t + \beta_6 lnTO_t + \varepsilon_t \quad (1)$$

Explanatory variables are broad money (M2), exchange rate (ER), real interest rate (RI), real GDP, gross capital formation (GCF) and trade openness (TO).

Where ln represents the natural logarithm, ε_t is the stochastic error term accounting for all the omitted variables that influence domestic bank credits but are not included in this model.

Domestic credit to the private sectors (DCP), which is measured in US dollars, is the amount of financial resources that are transferred from depository corporations to private sectors. Broad money includes all the currency outside the banks, time deposits, and demand deposits. A significant number of studies in the literature have considered broad money as one of the major determinants of bank credit growth (Baoko et al., 2017). The exchange rate is the price of local currency relative to the US dollar. The long run and short run association of rate of exchange with bank-credit has been investigated by Timsina (2017), Shijaku and Kalluci (2013), Imran and Nishat (2013), Stepanyan and Guo (2011) and Olokoyo (2011). Real interest rate is the price level adjusted official lending rate in the country. Different authors including Rabab'ah (2015), Shijaku and Kalluci (2013), Sharma and Gounder, (2012), Olokoyo (2011) examined the long run along with short run partial effects of interest rate on credit growth. Surveys carried out by Timsina (2017), Rabab'ah (2015), Shijaku and Kalluci (2013), Imran and Nishat (2013), Sharma and Gounder (2012), Stepanyan and Guo (2011) and Olokoyo (2011) found different measures of GDP including GDP growth, per capita and real GDP or real GDP per capita as the determinants of bank lending. Capital formation is the amount of fixed assets in an economy in addition to the net changes in the number of inventories. Commercial banks' credit has been found to positively impact gross capital formation (Omankhanlen, 2012). This study also attempts to determine whether a change in gross capital formation can lead to a change in private sector bank credit. Trade openness has been calculated as the addition of exports as well as imports normalized by GDP. As Gozgor (2014) attempted to show the partial impact of real trade openness on bank lending, trade openness has been considered as one of the regressors.

This study, like Imran and Nishat (2013), applied autoregressive distributed lag (ARDL) technique proposed and popularized by Pesaran et al. (1996), Pesaran (1997), Pesaran and Shin (1995) for the investigation of the long-run cointegrating among variables. Using ARDL is more advantageous than other techniques like Johansen and Juselius (1990), Johansen (1988) in several respects. For instance, it allows for proper estimation even if there happens to occur an endogeneity problem (Pesaran and Shin, 1998) and is applicable when the variables are fractionally cointegrated, integrated of order one, or at level (Pesaran et al., 2001). Our current study uses ARDL framework in both its long run model and short run error correction model (ECM). First, equation 2 has been estimated following Pesaran et al. (2001):

$$\Delta lnDCP_t = \alpha_0 + \sum_{i=1}^{p} \varphi_i \Delta lnDCP_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta lnM2_{t-i} + \sum_{i=1}^{p} \eta_i \Delta ER_{t-i} + \sum_{i=1}^{p} \rho_i \Delta RI_{t-i} + \sum_{i=1}^{p} \lambda_i \Delta lnGDP_{t-i} + \sum_{i=1}^{p} \pi_i \Delta lnGCF_{t-i} + \sum_{i=1}^{p} \tau_i \Delta lnTO_{t-i} + \delta_1 lnDCP_{t-1} + \delta_2 lnM2_{t-1} + \delta_3 ER_{t-1} + \delta_4 RI_{t-1} + \delta_5 lnGDP_{t-1} + \delta_6 lnGCF_{t-1} + \delta_7 lnTO_{t-1} + \mu_t \quad (2)$$

where Δ and p stand for the difference operator and optimal lag length respectively. The hypothesis for no cointegration in the variables, according to Pesaran et al. (2001), is as follows:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0 \quad (3)$$

F-test has been used to make the decision of rejecting the null hypothesis H_0. If the computed *F*-statistic lies above UCB (upper critical bound), that is F > UCB, we reject the null hypothesis and come to the conclusion that a 'long-run relationship' exists. When the *F*-statistic < lower critical bound (LCB), we do not reject the null hypothesis of 'no cointegration', and when the calculated *F*-statistics lie within the lower bound and upper bound, the decision is said to be inconclusive. If the null hypothesis is rejected and therefore the long-run relationship among found in the variables, the long-run model will be estimated as below:

$$lnDCP_t = \alpha_1 + \sum_{i=1}^{p} \varphi_{1i} lnDCP_{t-i} + \sum_{i=1}^{p} \gamma_{1i} lnM2_{t-i} + \sum_{i=1}^{p} \eta_{1i} ER_{t-i} + \sum_{i=1}^{p} \rho_{1i} RI_{t-i} + \sum_{i=1}^{p} \lambda_{1i} lnGDP_{t-i} + \sum_{i=1}^{p} \pi_{1i} lnGCF_{t-i} + \sum_{i=1}^{p} \tau_{1i} lnTO_{t-i} + \omega_t \quad (4)$$

The lag orders have been chosen based on AIC (Akaike Information Criterion). For obtaining short-run dynamics, an error-correction model (ECM) will be estimated. It is a short run ARDL model that associates the long-run estimate, which is given as follows (Pesaran et al., 2001).

$$\Delta lnDCP_t = \alpha_2 + \sum_{i=1}^{p} \varphi_{2i} \Delta lnDCP_{t-i} + \sum_{i=1}^{p} \gamma_{2i} \Delta lnM2_{t-i} + \sum_{i=1}^{p} \eta_{2i} \Delta ER_{t-i} + \sum_{i=1}^{p} \rho_{2i} \Delta RI_{t-i} + \sum_{i=1}^{p} \lambda_{2i} \Delta lnGDP_{t-i} + \sum_{i=1}^{p} \pi_{2i} \Delta lnGCF_{t-i} + \sum_{i=1}^{p} \tau_{2i} \Delta lnTO_{t-i} + \theta ECM_{t-1} + \nu_t \quad (5)$$

Where ECM_{t-1} represents 'the error correction term' θ, also called 'the speed of adjustment', denotes the coefficient of error correction in disequilibrium.

ANALYSIS OF EMPIRICAL RESULTS

Correlation and Descriptive Analysis

Tables 1 and 2 highlight correlation analysis and the summary of the descriptive statistics, respectively. The pair-wise correlation analysis in Table 1 demonstrates that there exists a strong positive correlation DCP and all the variables except real interest rate (RI). DCP and RI signify a negative but weak correlation.

It can be inferred from Table 2 that all the variables exhibit leptokurtic distribution with the exception of ER, which follows a platykurtic distribution as ER is the only variable with a kurotosis value of less than 3. Similarly, the skewness value of ER is close to zero implying that its distribution is approximately symmetrical where the other variables show positive skewness in their distributions. Finally, as indicated by Jarque-Bera statistic, again ER happens to be the only variable that is found to be normally distributed.

Table 1. Pair-wise correlation of the variables.

Variables	M2	DCP	GCF	GDP	TO	ER	RI
M2	1.000000	0.998933	0.997313	0.996414	0.986558	0.821280	-0.092421
DCP	0.998933	1.000000	0.997494	0.995712	0.983439	0.807505	-0.093899
GCF	0.997313	0.997494	1.000000	0.998743	0.983530	0.831892	-0.092319
GDP	0.996414	0.995712	0.998743	1.000000	0.986845	0.850733	-0.090475
TO	0.986558	0.983439	0.983530	0.986845	1.000000	0.861996	-0.087486
ER	0.821280	0.807505	0.831892	0.850733	0.861996	1.000000	-0.000272
RI	-0.092421	-0.093899	-0.092319	-0.090475	-0.087486	-0.000272	1.000000

Table 2. Descriptive statistics of the variables.

Stat.	M2(in billion USD)	DCP(in billion USD)	GCF(in billion USD)	GDP (in billion USD)	TO(in billion USD)	ER	RI
Mean	33.86182	23.03063	16.25046	63.72212	22.43521	43.76887	6.013289
Median	11.90399	8.782445	6.734150	35.85420	9.212054	40.24503	5.764269
Maximum	176.2113	128.1633	85.59590	274.0250	104.8006	83.46620	34.75849
Minimum	1.155178	0.300013	0.295403	6.288246	1.220378	7.700184	-11.63749
Std. Dev.	46.35841	32.86324	20.62124	65.86532	28.08370	24.23366	6.818781
Skewness	1.737188	1.828396	1.837963	1.689475	1.497013	0.110890	1.192390
Kurtosis	5.023865	5.425300	5.706732	5.108706	3.989468	1.707545	9.526753
Jarque-Bera	30.31371	36.10164	41.67767	31.72788	19.88647	3.439252	86.51184
Probability	0.000000	0.000000	0.000000	0.000000	0.000048	0.179133	0.000000
Sum	1523.782	1036.378	780.0223	3058.662	1076.890	2100.906	258.5714
Sum Sq. Dev.	94560.49	47519.67	19986.06	203897.3	37068.62	27601.71	1952.822
Obs.	45	45	48	48	48	48	43

Table 3. Unit roots results with constant.

Variables	ADF test statistic (with intercept)		P.P test statistic (with intercept)		Result
	Level	First difference	Level	First difference	
lnDCP	-2.8781	-6.3602 ***	-1.0695	-6.3670***	I(1)
lnBM	0.38495	-5.3418***	3.4539	-6.8049***	I(1)
ER	0.20296	-6.222***	0.9091	-9.0956***	I(1)
RI	-6.379***	-7.2864***	-6.132***	-11.131***	I(0)
lnGDP	0.07081	-7.2535***	1.1995	-12.894***	I(1)
lnGCF	-0.0369	-5.5859***	0.4493	-11.344***	I(1)
lnTO	0.40056	-7.8623***	0.7371	-7.8537***	I(1)

Note: *** represents significant at 1% level; ** represents significant at 5% level; * represents significant at 10% level.

Unit Root Analysis

Examination of order of the variables is done for expository purposes. Although ARDL approach allows valid estimation of the variables that are not integrated of same order, the procedure only remains valid as long as the series used in the model are integrated of less than order 2. The presence of any I(2) series in the study will invalidate the *F*-test used to make the decision of cointegration among variables. Therefore, this study used two tests for unit roots namely ADF test (Dickey and Fuller, 1979) test and PP test (Phillips and Perron, 1988). One-sided *p*-values (MacKinnon, 1996) have been used to reject or accept the null hypothesis of individual series having unit roots. The lag length has been selected on the basis of Schwarz Information Criterion (SIC) to use in the ADF test and Newey-West Bandwidth has been performed for PP test. Unit root tests have been performed first with the inclusion of a constant term (Table 3) and later with the inclusion of both a constant term and a trend term (Table 4).

The unit root test results have been presented in Table 3 and 4, which reveal that the series real interest rate (RI) is stationary at level for all kinds of tests performed. All other variables except RI are found as integrated of order 1, hence are stationary at the first difference in the test, which includes only intercept term (Table 3). The series ER, lnGDP and lnGCF are, however, found to be I(0) at least in one of the two tests while considering a trend term and an intercept term in the test equation (Table 4). As there happens to have a combination of I(0) variables and I(1) variables without any I(2) variables, the ARDL model is expected to produce plausible estimates. The next step will be to look if there is an existence of a long-run relationship.

Bound Test Approach

Bounds-test method has been used in order to identify the relationship between DCP and its relevant determinants in the long run. Following Imran and Nishat (2013), the lag length has been chosen following AIC (Akaike Information Criterion) for ARDL framework (Pesaran et al., 2001). The results are given in Table 5, where evidently, my *F*-statistic 8.807 is higher than the upper critical bound 3.23 at both 1% and 5% level of significance leading us to reject the null hypothesis of no cointegration establishing a long-run association between domestic bank credit and its determinants in Bangladesh. The t-statistic value is, in absolute terms, also greater than upper critical bound 5% significance level making us more confident about the existence of the possible long-run association.

Table 4. Unit roots results with trend and intercept.

Variable	ADF test statistic (with trend and intercept)		P.P test statistic (with trend and intercept)		Result
	Level	First difference	Level	First difference	
lnDCP	-2.3427	--6.3623***	-2.0982	-6.3806***	I(1)
lnM2	-1.2130	-9.5093***	-3.5220	-10.4862***	I(1)
ER	-3.755**	-6.15273***	-2.9753	-9.5568***	I(0) /I(1)
RI	-6.449***	-7.175***	-6.21***	-9.1461***	I(0)
lnGDP	-3.410*	-7.9886***	-3.567**	-12.537***	I(0)
lnGCF	-2.1074	-5.3853***	-3.548**	-11.2498***	I(1) /I(0)
lnTO	-2.4537	-7.7725***	-2.4537	-7.7999***	I(1)

Note: *** underlines significant at 1% level; ** underlines significant at 5% level; and * underlines significant at 10% level.

Table 5. Result of bound test.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance level	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.8067006	10%	2.12	3.23
		5%	2.45	3.61
K	6	2.5%	2.75	3.99
		1%	3.15	4.43
t-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
		10%	-2.57	-4.04
t-statistic	-4.583580	5%	-2.86	-4.38
		2.5%	-3.13	-4.66
		1%	-3.43	-4.99

Table 6. Long-run ARDL model result.

Selected Model: ARDL(1, 1, 1, 3, 1, 3, 3)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
lnDCP(-1)	0.590363***	0.089371	6.605780	0.0000
lnM2	0.606420***	0.180629	3.357274	0.0031
lnBM(-1)	0.321959	0.237062	1.358122	0.1895
ER	-0.018725**	0.007830	-2.391421	0.0267
ER(-1)	-0.020569***	0.006617	-3.108435	0.0055
RI	0.008889**	0.003885	2.288261	0.0331
RI(-1)	-0.005301**	0.002468	-2.147540	0.0442
RI(-2)	-0.004294	0.002913	-1.474228	0.1560
RI(-3)	-0.001850	0.001430	-1.293472	0.2106
lnGDP	1.130474**	0.420969	2.685412	0.0142
lnGDP(-1)	-2.069372***	0.476058	-4.346890	0.0003
lnGCF	-0.841529***	0.247845	-3.395381	0.0029
lnGCF(-1)	0.846746***	0.291758	2.902221	0.0088
lnGCF(-2)	0.146266	0.229633	0.636956	0.5314
lnGCF(-3)	0.457652**	0.199447	2.294604	0.0327
lnTO	0.410776***	0.124980	3.286744	0.0037
lnTO(-1)	0.214959*	0.123822	1.736035	0.0979
lnTO(-2)	-0.129117	0.133501	-0.967161	0.3450
lnTO(-3)	-0.259250**	0.109873	-2.359542	0.0286
C	-6.794154***	1.988860	-3.416104	0.0027
R-squared	0.999514	Mean dependent var		23.11978
Adjusted R-squared	0.999053	S.D. dependent var		1.403427
S.E. of regression	0.043186	Akaike info criterion		-3.139730
Sum squared resid	0.037301	Schwarz criterion		-2.295290
Log likelihood	82.79459	Hannan-Quinn criter.		-2.834407
F-statistic	2166.636 (Prob: 0.000)	Durbin-Watson stat		2.364283

Note: Dependent Variable: *lnDCP* ; *** underlines 1% level of significance; ** underlines 5% level of significance; * underlines 10% level of significance.

ARDL Long-run Model Estimation: This section is dedicated to estimate long-run ARDL (1, 1, 1, 3, 1, 3, 3) model. Following Imran and Nishat (2013), the optimal lag selection has been made based on AIC (Akaike Information Criterion). The findings have been summarized in Table 6.

Before interpreting the findings of this long run model, the short run one has been summarized below and the two models are evaluated together later.

Short-run Error Correction Model Estimation: The findings of short run model are summarized in Table 7.

Granger Causality Test: From the *t*-statistics of the regressors in both long and short run ARDL models, it is evident that all the estimators are statistically significant. So, the causality between the regressors and the dependent variable can be inferred. In order to find which direction causality worked, pairwise Granger causality tests have been performed with lag specification at 3, based on Akaike Information Criterion (AIC). The results summarized in Table 8 establish a unidirectional causality from broad money to domestic bank credit and exchange rate to domestic bank credit. That is, both broad money and exchange rate Granger cause private sector bank credit in Bangladesh but the opposite is not true. However, rest of the variables exhibit a bidirectional causality.

Table 7. Short-run error correction estimation model result (ARDL Error Correction Regression).

Selected Model: ARDL(1, 1, 1, 3, 1, 3, 3)				
Case 3: Unrestricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.794154***	0.758055	-8.962614	0.0000
D(lnM2)	0.606420***	0.124180	4.883385	0.0001
D(ER)	-0.018725***	0.005011	-3.736687	0.0013
D(RI)	0.008889***	0.002403	3.698391	0.0014
D(lnGDP)	1.130474***	0.272966	4.141443	0.0005
D(lnGCF)	-0.841529***	0.193797	-4.342315	0.0003
D(lnTO)	0.410776***	0.085646	4.796224	0.0001
ECT(-1)	-0.409637***	0.045759	-8.952149	0.0000
R-squared	0.905572	Mean dependent var		0.134012
Adjusted R-squared	0.858357	S.D. dependent var		0.100642
S.E. of regression	0.037877	Akaike info criterion		-3.439730
Sum squared resid	0.037301	Schwarz criterion		-2.848622
Log likelihood	82.79459	Hannan-Quinn criter.		-3.226004
F-statistic	19.18007	Durbin-Watson stat		2.364283
Prob(F-statistic)	0.000000			

Note: Dependent Variable: *D(lnDCP);* *** underlines 1% level of significance; ** underlines 5% level of significance; * underlines 10% level of significance.

Table 8. Granger causality test result.

Pairwise Granger Causality Tests (Lags: 3)			
Null Hypothesis:	F-Statistic	Prob.	Result at 5% level of significance
lnM2 does not Granger Cause lnDCP	8.25351	0.0003	Reject
lnDCP does not Granger Cause lnM2	2.23746	0.1011	Fail to reject
ER does not Granger Cause lnDCP	8.06543	0.0003	Reject
lnDCP does not Granger Cause ER	1.68618	0.1878	Fail to reject
RI does not Granger Cause lnDCP	3.24081	0.0344	Reject
lnDCP does not Granger Cause RI	8.69406	0.0002	Reject
lnGDP does not Granger Cause lnDCP	3.13198	0.0378	Reject
lnDCP does not Granger Cause lnGDP	3.45008	0.0268	Reject
lnGCF does not Granger Cause lnDCP	3.53376	0.0245	Reject
lnDCP does not Granger Cause lnGCF	2.48009	0.0772	Fail to reject
lnTO does not Granger Cause lnDCP	4.37690	0.0102	Reject
lnDCP does not Granger Cause lnTO	4.47233	0.0092	Reject

Analysis of Results in Long-run and Short-run ARDL Model

The estimates obtained from both models to examine the determinants of private sector bank lending are similar. All these variables are significant at 1% level in short run, but in the long run, though all variables are significant at level 5%, some are not significant at the lowest 1% level. The impacts of individual determinants are as follows:

Broad Money: The estimated coefficient signals that broad money is significant highly in both models. Broad money is found to leave a direct positive long-run impact on bank lending provided to the private sector. More compactly, a 1% rise in broad money will likely to result in a 0.606% rise in domestic credit in Bangladesh. An expansionary monetary policy is found to be helpful in the growth in private sector

bank lending in Bangladesh. The finding is in line with all the previous studies like Stepanyan and Guo (2011), Imran and Nishat (2013), Gozgor (2014), and Boko et al. (2017).

Exchange Rate: A long-run and statistically significant inverse association between exchange rate and private sector domestic credit has been found in Bangladesh. According to the findings, 1.00 Bangladesh Taka increase in the exchange rate will cause around 1.87% reduction in bank lending. This might be of special interest in light of the study conducted by Ahmed and Islam (2004), where they tried to link between exchange rate and bank lending in the context of Bangladesh economy. Contrary to GDP and broad money, the impact of exchange rate on bank credit was not found to be similar for all the countries studied in the literature. Exchange rate turned out to have no statistically significant influence on bank credit in Nepal (Timsina, 2017) and Ghana (Baoko et al., 2017). But in Pakistan (Imran and Nishat, 2013), Albania (Shijaku and Kalluci, 2013) and Nigeria (Olokoyo, 2011), exchange rate was found to positively impact bank credit.

Real Interest Rate: In both models, real lending rate appears to be positively associated with bank credit in Bangladesh. Domestic bank lending seems to increase around 0.89% following a 1 percentage point rise in real rate of interest. This is similar as the case of Nigeria where a positive relationship between commercial bank loans and the interest rate was found by Olokoyo (2011). Sharma and Gounder (2012), however, found that interest rate negatively influences bank lending where Rabab'ah (2015) showed that in Jordan, the impact of interest rate on credit growth was insignificant. Čeh et al. (2011) argued that an rise in interest rate is equivalent to a rise in the cost of borrowing and can reduce credit demand and worsen the macroeconomic situation. But in Bangladesh, the increase in lending rate may not translate into less bank lending behaviour. Two possible reasons can be offered in this respect. First, the private sector may not be able to explore other means of financing and hence rely on bank credit for financing and secondly the private sector, in general, yield investment returns that can exceed the prevailing lending rate.

Gross Domestic Product: GDP was found to be one of the most influential short run and long run determinants of bank lending in Bangladesh. GDP elasticity of bank credit is 1.13 signifying that a 1% increase in gross domestic product will result in a 1.13% rise in bank loans. Domestic private sector credit growth is always seen as one of the results of gross domestic product growth. This is substantiated by almost all the studies in the literature like Timsina (2017), Rabab'ah (2015), Shijaku and Kalluci (2013), Sharma and Gounder (2012), Imran and Nishat (2013), Stepanyan and Guo (2011) and Olokoyo (2011).

Gross Capital Formation: Formation of more gross capital and domestic investment has been found to hinder the private sector credit growth in Bangladesh. The corresponding negative estimate is significant both in short and long-run. A 1% rise of GCF appears to lower DCP by around 0.842% in Bangladesh.

Trade Openness: Trade Openness was found to be particularly beneficial for domestic bank credit in Bangladesh. There exists a statistically significant association between domestic credit and trade openness articulating that high degree trade openness can contribute to the growth of bank lending both in short and long run. More precisely, domestic credit will increase by around 0.41% due to a 1% rise in trade openness. The finding resembles with the study of Gozgor (2014), who discovered a positive partial association with real trade openness and domestic credit in 24 different economies.

The short run error correction model seems to be reliable because the error correction estimate got the right sign and magnitude, which is highly significant even at 1% level. As a result, any discrepancies in short run will be corrected with a speed of 40.96% per year.

Diagnostic Tests

Since the ARDL model is essentially based on OLS estimation, the efficiency of the estimators found in the model and the validity of their statistical tests strongly depend on classical normal linear regression model (CNLRM) assumptions. To this end, a number of diagnostic tests have been performed.

Table 9. Summary of the diagnostic tests performed in the study.

Test	Null Hypothesis, H0	Test statistic/Observer R2	P-value	Conclusions
Jarque–Bera (JB) Test of Normality	Residuals are normally distributed	4.336939	0.114352	Do not reject H0 as P-Value is greater than 5%, i.e., the residuals of the model are normally distributed.
Breusch-Godfrey Serial Correlation LM Test	No serial correlation	2.523647	0.2831	Do not reject H0 as P-Value is greater than 5%, i.e., the residuals of the model are not serially correlated.
Breusch-Pagan-Godfrey Heteroskedasticity Test	No heteroskedastricity	13.28430	0.8237	Do not reject H0 as P-Value is greater than 5%, i.e., the conditional residual variances of the model are homoskedastic.
White's General Heteroskedasticity Test	No heteroscedastricity	18.50345	0.4891	Do not reject H0 as P-Value is greater than 5%, i.e., there doesn't exist any Heteroscedastricity in the model
Ramsey's RESET Test	No misspecification	2.026514	0.1608	Do not reject H0 as P-Value is greater than 5%, i.e., the model is correctly specified.

The summary of the tests given in Table 9 reveals that the model is free from heteroskedasticity, serial auto correlation, and misspecification error with residuals being normally distributed. Furthermore, in the CUSUM test (Brown, et al., 1975), parameter instability will be evident when the cumulative sum does not lie in the space between two 5% critical lines. As seen in figure 4, the movement of recursive residual lies between 5% significance lines reflecting coefficient stability of our model. Like the CUSUM test, the CUSUM of squares test shown in the figure below also indicates that the cumulative sum of squares lies within the lines. Thus, it is concluded that the residual variance is, therefore, stable.

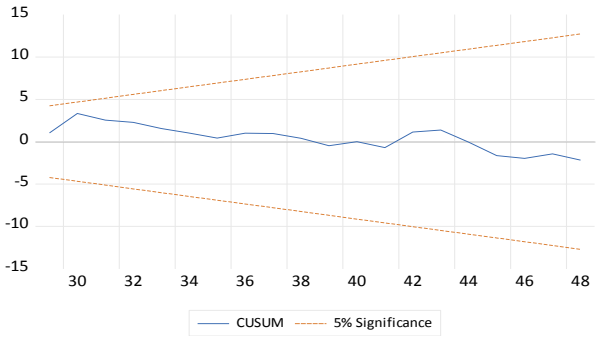

Figure 3. Plot of cumulative sum of recursive residuals.

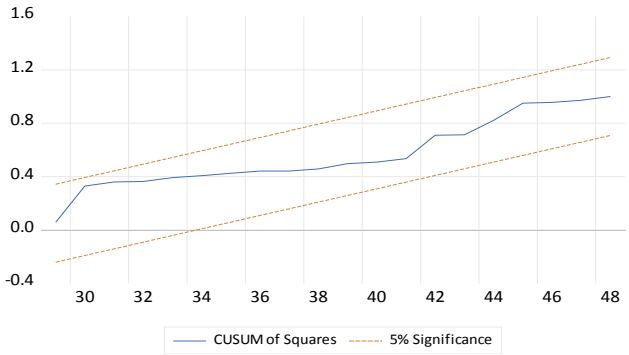

Figure 4. Plot of cumulative sum of squares of recursive residuals.

CONCLUSIONS AND RECOMMENDATIONS

The study is an attempt to investigate the long-run effect of certain macroeconomic variables as the determinants of domestic bank lending to private sectors in Bangladesh. With the help of World Bank annual data over the period from 1974 to 2018, and applying ARDL (autoregressive distributed lag) model, broad money, exchange rate, GDP, the real rate of interest, trade openness, and gross capital formation are found to maintain an empirically stable and robust long-run relationship with bank credit. Contrary to conventional wisdom, in Bangladesh, real interest rate and bank loans change in the same direction, where further increase in exchange rate and gross capital formation may cause a reduction in bank credit. Gross capital formation and trade openness are two of the variables that, though less frequently explored in the literature, seem to contribute to the private sector credit growth in Bangladesh. A series of diagnostic tests are performed to ensure the validity of the assumptions of CLRM, which help prove the robustness and stability of the model.

Based on the findings of this study, several recommendations can be made. Stable growth of money supply and expansionary monetary policy is crucial for healthy credit management of the banks. Evidently, after GDP, broad money has a greater direct effect on bank lending than the rest of the explored determinants. If there happens to be an urgent need for a boost in bank loans or financing of the private sector, the monetary authority of the country is required to play a vital role. Another recommendation, with regard to the degree of openness of the country, maybe in order. More involvement in international trade is significant for bank credit behavior in Bangladesh. The country must continue encouraging trade liberalization and providing incentives to exporters and importers. The net export, apart from contributing to the economic growth, will increase the volume of bank credit and presumably help in the advancement of the financial market in the Bangladesh economy. The appreciation of Bangladesh Taka against US Dollar, although may not be a good choice for the stimulation of the export in the country, may catalyze the development of the financial market through domestic credit growth flowing from banks. Thus, the stability of the exchange rate must be ensured, and the appreciation of the local currency can be proven useful during any financial crisis. Stable and sustainable GDP growth always works in favour of financial development in Bangladesh. The higher amount of bank credit is the outcome of higher levels of output. In order to have a steady credit flow to the private sector, appropriate policy measures conducive to a sustainable increase in GDP remain as a requirement. Gross capital formation may capture different alternative means of business financing in Bangladesh, which might limit the necessity for credits. The financial structure of different entities existing in the private sector must be analyzed to channel credit through this sector smoothly and help this flourish.

Future research may be conducted to examine the determinants of bank-credit growth in Bangladesh distinguishing supply-side and demand-side. The inverse relationship between exchange rate and bank credit, which seems to contradict extant literature, may be examined further to come up with a credible explanation. Examining the specific role of gross capital formation in determining the credit behavior of Banks can also be an area of focus.

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