

CREDIT RISK AND ITS DETERMINANTS IN BANGLADESHI COMMERCIAL BANKS

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Abstract *Due to the surge in non-performing loans during the financial crisis, management and regulatory agencies are now more concerned about credit defaults. Using a two-step system GMM approach to the bank-level data from 2009 to 2018 in Bangladesh, this paper explores the bank-specific determinants and macroeconomic determinants of the credit risk of commercial banks in Bangladesh. This paper employs two credit risk metrics (i.e., non-performing loans and Z-score) to draw better conclusions. Banks with lower liquidity, high capital, and profit efficiency are more successful in managing credit risk. Increased access to loans, a strong capital base, and efficiency in profitability actually raise the number of prospective borrowers, build public confidence and bank resilience, and enhance the scrutiny and monitoring that reduce the probability of problem loans and variability in earnings. Again, the negative impact of GDP and inflation on credit risk have policy implications for the regulatory authorities in the country (i.e., Bangladesh Bank, Ministry of Finance, and so on).*

Keywords: *Credit Risk, GMM, Bangladesh*

JEL Code: *G21, G32*

INTRODUCTION

With the constant progression of globalisation, financial frameworks often encounter new challenges, complications, and rapid changes; thus, risk management instruments are intriguing to different groups, like investors, regulatory agencies, and management within the financial system (Moudud-Ul-Huq et al., 2020). From the start of the bank financial system, credit risk models existed, and their determinants were recognised. Even though there are sufficient models to evaluate credit risk, models to detect critical factors to deliver strategies often fail or partially recognise the asymmetric information between borrowers and lenders, leading to credit default situations (Zovic, 2017).

The uncontrolled credit risk exposure would deteriorate the profitability of the bank (Ali & Dhiman, 2019) and hamper long-term business potentiality (Ahmed & Bashir, 2013). The objective of credit risk management (CRM) is to preserve credit risk inside satisfactory boundaries, to exploit the risk-adjusted returns of a bank (Basel I, 2000, p.18).

Credit risk arises from the probable loan loss resulting from numerous reasons; for instance, counterparty default, devaluation of collateral, and decline in credit quality of the borrower. Due to the rise in non-performing loans over the years after the financial crisis across the world,

credit defaults have become a matter of great concern to management bodies and regulatory authorities. This fragility in the performance of loans and advances for banks hinder the growth of an economy (Ramanadh & Rajesham, 2013). As a result, investigation of credit risk in the banking sector in Bangladesh would answer the question of the status of credit risk and how it may be affected in an emerging economy where the money market dominates the financial market. In addition, the banking sector in Bangladesh has to deal with incremental non-performing loans and systematic turbulences regularly. This unique behaviour justifies the relevancy of this study to domestic and international academicians and researchers.

This paper answers the question of what bank-specific and macroeconomic variables affect credit risk in Bangladesh. Using two different measures of credit risk, i.e., ratio of non-performing loans to total loan and Z-score, and most recent data, the findings would be more informative and robust. Thus, this paper provides bank management boards and regulatory bodies with the necessary information and inferences that define credit risk in Bangladesh.

The rest of the paper is planned as follows: section 2 shows a review of literature, section 3 displays the data and research framework, section 4 portrays the observational empirical results, and finally, section 5 concludes the study.

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LITERATURE REVIEW

Realising financial soundness through credit risk management is progressively gaining attention, particularly during a crisis like financial collapse and the recent COVID-19 pandemic. Considering the significance of credit risk management, the study of CRM has attracted many researchers and academicians from different fields, in both developing and emerging economies. Most of the literature concerning credit risk determinants consider advanced nations, disregarding the emerging world. For instance, Bonfim (2009), Incekara and Çetinkaya (2019), Pestova and Mamonov (2013), Louzis et al. (2012), Castro (2012), and Boss et al. (2009) are among those who worked bank risk determinants in the developed world. They investigated various issues of credit risk, its determinants, impact, and consequences related to different variables before or after a financial crisis.

Bank-Specific Determinants of Credit Risk

Of the various bank-specific variables, the study considers only the most widely accepted variables that are significant in explaining credit risk. Louhichi and Boujelbene (2016) argue that bank capital influences bank credit risk management. They claim that banks usually hold high capital to decrease the chances of bankruptcy. Berger and DeYoung (1997) examine the relationship among cost-efficiency, loan quality, and capital and credit risk. They observe poor management hypothesis as cost inefficiency that intensifies problem loans, particularly for banks with thin capital. Later, Louzis et al. (2012) suggest too-big-to-fail and managerial competency hypothesis of credit risk determinants, which are found to be true in explaining non-performing loans in the banking sector of Greece. Cebenoyan and Strahan (2004) confirm the significant impact of capital and liquid asset on credit risk. Abedifar et al. (2013) report an inverse relationship between credit risk and capital asset ratio. Hyun and Zhang (2012) and Chawla and Rani (2021) show return on equity as a significant determinant of credit risk.

Macroeconomic Determinants of Credit Risk

This study uses the most commonly used macroeconomic determinants of credit risk, i.e., GDP growth rate and inflation rate. With the rise in GDP, there is a fall in credit risk (Khemraj & Pasha, 2009; Louzis et al., 2012). Klein (2013) confirms the significant impact of inflation rate on credit risk.

METHODOLOGY

Data

This investigation is quantitative in nature and utilises secondary data for the examination. The study uses 18 listed conventional commercial banks over the period 2009 to 2018 in Bangladesh. All the data have been collected from the annual report of individual banks.

The study measures credit risk in two ways.

NPL: The ratio of non-performing loans is calculated by dividing the total amount of non-performing loans by the total amount of loans (Beck et al., 2013; Louzis, 2012; Ramesh, 2019). Obviously, a greater non-performing ratio means greater risk and insolvency.

Z-score: Z-score is a widely used measure of bank stability and risk. The formula is:

$$Z \text{ Score} = \frac{(ROA + ETA)}{\sigma(ROA)}$$

Where, ROA is return on assets, ETA is total equity to total assets, and $\sigma(ROA)$ is the standard deviation of ROA. An increase in Z-score indicates a rise in bank solvency and vice-versa.

Bank Size: As suggested by the economies of scale hypothesis, the greater the production volume, the lesser the per-unit cost. As a result, larger banks tend to have sophisticated risk management policies and procedures and opportunities for risk diversification that reduce the bank problem loan and stabilise profitability (Salas & Saurina, 2002; Ranjan & Dahl, 2003). However, the too-big-to-fail proposition of Louzis et al. (2012) indicates that bigger banks' aggressive risk-taking behaviour may lead to greater credit risk.

Liquidity: Risky ventures offer greater profit than less risky ones; the profit motive of the bank management therefore instigates lending more against deposits, which eventually reduces bank liquidity. Thus, bank risk is positively related to liquidity. This relation is explained by the moral hazard hypothesis of bank credit risk. On the other hand, keeping the liquidity level low offers availability of loanable funds, which attracts more prospective borrowers and builds confidence on timely fund disbursement. Banks have more options in selecting a project to finance. As a result, there would be a fall in bank risk.

Cost Efficiency: One way of measuring management efficiency is cost efficiency. This paper measures cost

efficiency by cost to income ratio; a higher cost to income ratio indicates lower efficiency and vice-versa. Lower cost efficiency means rising costs in monitoring bank credits, which eventually raises probability of credit default (Berger & DeYoung, 1997).

Capital Adequacy Ratio: However, regulatory theory suggests that greater regulatory compliances lead to lower credit risk (Maji & De, 2015).

Equity to Asset: Based on the moral hazard literature, banks with thin capital have higher problem loans due to acceptance of risky projects (Altunbas et al., 2007).

Return on Equity: Another efficiency measurement technique is profit efficiency. Profit efficiency can be measured by return on equity. Profitable banks are less likely to accept risky projects, and eventually have lower credit risk (Gosh, 2015).

GDP Growth: Bank credit risk is negatively related to GDP growth (Louzis et al., 2012). When people engage in more economic activities and contribute positively to the economy,

they are less likely to be bankrupt or become a defaulter.

Inflation Rate: Fall in real income due to rising inflation rate causes an increased probability of problem loans (Klein, 2013). On the other hand, a rise in inflation rate increases the money flow in the economy, which may be used to repay the accrued loans that eventually lower credit default.

Estimating Techniques

The study follows the GMM model of Arellano and Bover (1995) and Blundell and Bond (1998). It is a two-step system GMM method, with robust standard error to overcome endogeneity, heteroscedasticity, and autocorrelation in panel data. The study further tests autoregressive AR(2) to detect autocorrelation for a diagnostic check. The study also conducts both Sargen and Hansen tests to validate the instruments.

The study includes the following models in determining credit risk determinants in Bangladesh.

$$NPL_{it} = \delta_0 + \delta_1 BS_{it} + \delta_2 LIQ_{it} + \delta_3 INEFF_{it} + \delta_4 CAR_{it} + \delta_5 LEV_{it} + \delta_6 ROE_{it} + \delta_7 GDP_{it} + \delta_8 INF_{it} + v_{it} \tag{2}$$

$$Z-Score_{it} = \delta_0 + \delta_1 BS_{it} + \delta_2 LIQ_{it} + \delta_3 INEFF_{it} + \delta_4 CAR_{it} + \delta_5 LEV_{it} + \delta_6 ROE_{it} + \delta_7 GDP_{it} + \delta_8 INF_{it} + v_{it} \tag{3}$$

Where, *i* represents banks (*i* = 1 to 18) and *t* represents years (*t* = 2009 to 2018).

The definitions of all variables are summarised in Table 1.

Table 1: Definition of Variables

	Variable	Notation	Definition	Expected Sign
Dependent Variable: Bank Risk Proxies	Non-performing Loan	NPL	Percentage of non-performing loan to total loan	
	Z-score	Z-score	$Z\ Score = \frac{(ROA + ETA)}{\sigma(ROA)}$	
Independent Variables:				
Bank Specific Variables	Bank Size	BS	Logarithm of Total Assets	+
	Liquidity	LIQ	Total Loan to Total Deposit	+/-
	Cost Inefficiency	INEFF	Operating Cost to Operating Income	+
	Capital Adequacy	CAR	Core Capital + Supplementary Capital + Any other Provision maintained as capital cushion divided by Risk-Weighted Asset	+
	Equity to Asset	ETA	Total Equity to Total Assets	-
	Return on Equity	ROE	Net Profit after tax to Total Equity	-
Macro-economic Variable	GDP Growth	GDP	GDP Growth Rate	-
	Inflation Rate	INF	Annual Inflation Rate	+/-

EMPIRICAL RESULTS

Descriptive Statistics

Table 2 presents the summary statistics of all the variables used in the study. The summary statistics contain the mean, standard deviation, and maximum and minimum values of the variables. The dependent variable, NPL ratio, has a mean value of 4.6%, with a standard deviation of 1.9% and minimum and maximum values of 1.1% and 10.6%, respectively. Another measure of credit risk, Z-score, has values from 0 to 8.68. The mean value is 4.54% and standard deviation is 1.23%. As suggested, most of the banks in Bangladesh have an NPL ratio and Z-score within 5% and 5, respectively, implying a moderate degree of credit risk in commercial banks in Bangladesh. The independent variables, bank size (BS), liquidity (LIQ), management inefficiency (EFF), leverage ratio (ETA), capital adequacy (CAR), and return on equity (ROE), have mean values of 11.98%, 83%, 47%, 9.9%, 11.9%, and 15.5%, respectively. The macroeconomic variables, GDP growth rate (GDP) and inflation rate (INF), have an average value of 6.4% and 6.9%, respectively. Except for bank size, the standard deviation for all independent variables lies within -1.2% to 81.1%.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
NPL	180	0.046	0.019	0.011	0.106
Z-Score	180	4.540	1.231	0.000	8.687
BS	180	11.987	0.506	10.718	12.923
LIQ	180	0.832	0.082	0.194	1.100
ETA	180	0.471	0.128	0.204	0.811
LEV	180	0.099	0.075	0.052	0.618
CAR	180	0.119	0.015	0.063	0.170
ROE	180	0.155	0.074	-0.012	0.538
GDP	180	0.064	0.008	0.050	0.079
INF	180	0.069	0.017	0.054	0.114

Source: Author's calculations based on data from the banks' annual reports.

Correlation Analysis and Multicollinearity

Table 3 presents the results of the correlation matrix for all variables in this study. None of the variables have a correlation greater than 50%, except the correlation between return on equity and bank size, and GDP growth rate and bank size. Thus, the study further checks multicollinearity through variance inflated factor and eigenvalue. Table 4 shows variance inflated factor less than three and eigenvalue far from 0; thus, there is no problem of multicollinearity in the independent variables.

Table 3: Correlation Results

	NPL	Z-Score	BS	LIQ	EFF	LEV	CAR	ROE	GDP	INF
NPL	1									
Z-Score	0.007	1.000								
BS	0.455	0.175	1.000							
LIQ	-0.174	0.005	-0.040	1.000						
EFF	0.153	0.040	0.082	-0.230	1.000					
ETA	-0.119	0.253	-0.108	0.039	-0.145	1.000				
CAR	0.196	0.117	0.389	0.157	0.078	-0.120	1.000			
ROE	-0.515	-0.121	-0.538	0.140	-0.271	0.030	-0.230	1.000		
GDP	0.379	0.066	0.747	0.116	0.248	-0.134	0.387	-0.527	1.000	
INF	-0.353	-0.030	-0.327	0.102	-0.158	0.160	-0.278	0.280	-0.233	1.000

Source: Author's calculations based on data from the banks' annual reports.

Table 4: Multicollinearity Results

Variable	VIF	1/VIF
GDP	2.87	0.348
BS	2.83	0.353
ROE	1.62	0.616
CAR	1.29	0.773

Variable	VIF	1/VIF
EFF	1.28	0.783
LIQ	1.23	0.814
INF	1.22	0.819
ETA	1.06	0.942
Mean VIF	1.68	

Stationary Test

As a part of the preliminary investigation, both dependent variables should be stationary. The study uses Levin-Lin-Chu (2002) and Im-Pesaran-Shin (2003) test, with the null of all panels having unit root. The test statistics are significant at 1% level, indicating null rejection. Thus, both NPL and Z-score follow a stationary process.

Table 5: Stationary Test

Stationary Test	NPL	Z-Score
Levin-Lin-Chu	-3.6174*	-3.5937*
Im-Pesaran-Shin	-2.0904*	-2.8215*

Note: Ho: All panels contain unit roots. *indicates 1% level of significance.

System GMM Estimation

Table 6 reports the results of the two-step system GMM analysis for the dependent variables, NPL and Z-score. Though bank size remains statistically insignificant, it has a negative effect on non-performing loans and a positive effect on the Z-score, which is theoretically supported by Louizis et al. (2012). Bank liquidity has a statistically significant negative impact on non-performing loans and a positive effect on the Z-score. These results contradict the expected outcome of the estimation, as the theory suggests that a raise

in loan to deposit ratio raises problem loan and reduces Z-score. However, this contrasting feature can be explained by the fact that prudential loan disbursement reduces problem loan, and increased loan availability generates greater access to loan, attracts more clients, and provides management a wide window to select quality borrowers and projects. The cost efficiency was found to be insignificant, but the direction of relation to credit risk is theoretically true. Equity to asset ratio is significant at 1% level, where it has a positive effect on the Z-score. This supports the moral hazard hypothesis and the findings confirm earlier studies (i.e., Salas & Saurina, 2002; Altunbas et al., 2007). On the other hand, capital adequacy ratio suggests an insignificant effect on credit risk in Bangladesh. Return on equity, a proxy for profit efficiency, has a significant negative effect on non-performing loans and a significant positive effect on the Z-score. This result is compatible with the theoretical arguments of increased capability and resource mobility generated from regular screening and monitoring. Thus, profitability reduces the credit risk of a bank. These findings are consistent with earlier studies (i.e., Saeed & Izzledin, 2016; Gosh, 2015).

The macroeconomic variable, GDP growth, has a significant positive effect on the Z-score, meaning GDP negatively contributes to credit risk. The inflation rate has a significant negative impact on problem loan. This means that the expansionary monetary policy lowers non-performing loans in Bangladesh.

Table 6: System GMM Results

	NPL			Z-Score		
	Coefficient	T-Value	P-Value	Coefficient	T-Value	P-Value
LDV	0.436	4.530	0.000	-0.104***	-2.05	0.056
BS	-0.003	-0.600	0.558	0.333	0.59	0.561
LIQ	-0.062**	-3.090	0.007	4.989**	2.65	0.017
EFF	-0.015	-1.630	0.121	0.518	0.57	0.573
ETA	-0.005	-0.640	0.532	4.642*	5.93	0.00
CAR	0.022	0.280	0.784	8.252	0.96	0.35
ROE	-0.089*	-5.390	0.000	6.594**	2.12	0.049
GDP	-0.076	-0.410	0.686	-83.672**	-5.33	0.00
INF	-0.194*	-3.680	0.002	-21.353	-1.53	0.144
CONS	0.148	2.490	0.023	1.438	0.19	0.849
F-value		115.07	0.00		23.68	0.00
AR(1)		-3.04	0.002		-2.48	0.01
AR(2)		1.04	0.3		-1.34	0.17
Sargen		13.05	0.11		9.51	0.30
Hansen		7.84	0.449		6.84	0.55
Instrument		18			18	
Observation		180			180	

Note: *, **, and *** represent statistical significance at 1%, 5%, and 10% level, respectively.

Source: Author's calculations based on data from the banks' annual reports.

The robustness of the system GMM is checked by the F-value, test of autocorrelation, and test of validity of the instruments. All these test results confirm the robust estimation in this study.

CONCLUSION

This paper examines bank-specific and macroeconomic factors affecting bank risk for 18 private commercial banks over the period 2009 to 2018 in Bangladesh. This paper simultaneously uses two credit risk measures (i.e., non-performing loan and Z-score), which give better results for drawing inferences. Again, using the two-step system GMM approach, the paper offers robust results and important findings.

Among bank-specific variables, bank liquidity and profit efficiency significantly impact both non-performing loans and the Z-score, and equity to asset ratio significantly contributes to the Z-score. The negative effect of bank liquidity to credit risk actually confirms that the ability to generate the availability of loanable funds and prudential loan disbursement contributes positively to bank confidence, for the borrower and client, which eventually reduces bank credit risk. The rise in profit level actually contributes to the efficiency level by generating resource mobility in screening and monitoring of credit management, and eventually minimising credit risk for the bank. Bank capital measured by equity to asset ratio works as a cushion against any bank risk. Banks with high capital can emphasise the quality of loan rather than quantity, and have greater public confidence, contributing to lower credit risk. On the other hand, macroeconomic variables suggest that a rise in GDP growth and expansionary monetary policy significantly contributes to the fall in credit risk in Bangladesh. As a result, this paper has broad significance to the bank management and regulatory authorities in Bangladesh.

APPENDIX

A1. List of Sample Banks

Sr. No.	Bank Name
1	Dhaka Bank Limited
2	Bank Asia Limited
3	BRAC Bank Limited
4	City Bank Limited
5	Dutch Bangla Bank Limited
6	Eastern Bank Limited
7	IFIC Bank Limited

Sr. No.	Bank Name
8	Meghna Bank Limited
9	Merchantile Bank Limited
10	Midland Bank Limited
11	Mutual Trust Bank Limited
12	National Bank Limited
13	NCC Bank Limited
14	Prime Bank Limited
15	One Bank Limited
16	Standard Bank Limited
17	Premier Bank Limited
18	United Commercial Bank Limited

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