Jahangirnagar University Journal of Business Research (JUJBR), Vol. 24, No. 01, June 2024
ISSN 1681-9748

The Association between Credit Risk Management and Banks' Performance in Bangladesh: A Panel Autoregressive Distributed Lag Approach

JUJBR

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Abstract: *This paper aims to empirically investigate both the long-run and short-run association between credit risk management and commercial banks' performance of Bangladesh by employing a panel data collected from 23 Dhaka Stock Exchange (DSE) listed conventional commercial banks over a period of 13 years spanning from 2008 to 2020. The study incorporates capital adequacy ratio (CAR), non-performing loan ratio (NPLR), and geographical loan concentration ratio (GLCR) as the indicators of credit risk management, while considering return on asset (ROA) as the performance measure. The results indicate that there is a significant positive long run as well as short-run relationship between CAR and ROA. In addition, the study reveals a short-run negative relationship between NPLR and ROA. The study suggests that commercial banks may maintain sufficient capital to absorb any substantial loan loss without collecting any emergency funds.*

JEL Classification: *C33, C52, G21*

Keywords*: Credit risk management; Capital adequacy ratio; Geographical loan concentration ratio; Non-performing loan ratio; Return on Asset; Bangladesh*

1. Introduction

Commercial banks should demonstrate a good performance not only for ensuring their sustainable operations but also for maintaining a stable banking industry in the economy (Sain and Kashiramka, 2023). Hence, a well performing banking sector can strengthen financial stability, thereby facilitating the economic growth of the country by absorbing the external shocks. Due to the nature of business, commercial banks' performances could be substantially affected by the credit risks, the risks associated with the failure of the borrowers to fulfil their obligations in repaying interest and principal (Islam et al., 2019). Excessive level of credit risk arising from the American real estate sector jeopardized the banking sector's performance of the country, leading to the world financial crisis in 2008 (Saif-Alyousfi, 2022).

Inefficient credit risk management creates regulatory pressure to banks owing to their failure to maintain the minimum risk-based capital requirement specified by BASEL III (Radovanov et al., 2023). More importantly, banks are required to

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maintain loan loss provision from their operating income to absorb the bad loans, reducing the overall performance of commercial banks. The excessive accumulation of classified loans may downgrade the performance of low-capitalized banks as they cannot absorb the loss from bad loans.

During the last decade, there has been an overriding concern among the regulators, and banking practitioners of the financial system of Bangladesh about reduction of the large amount of classified loans from the system (Bangladesh Bank, 2022, p.24). However, Bangladeshi banking sector has been experiencing higher proportion of non-performing loans than that of several South Asian countries over the past few years. The average non-performing loan ratio of Bangladesh banking sector was 7.55% over the period 2011-2020, whereas it was, during the same period, 6.61%, and 1.75% in case of India and Malaysia respectively (World Development Indicator). This excessively high proportion of non-performing loans are detrimental to the steady profit generation of the commercial banks of Bangladesh.

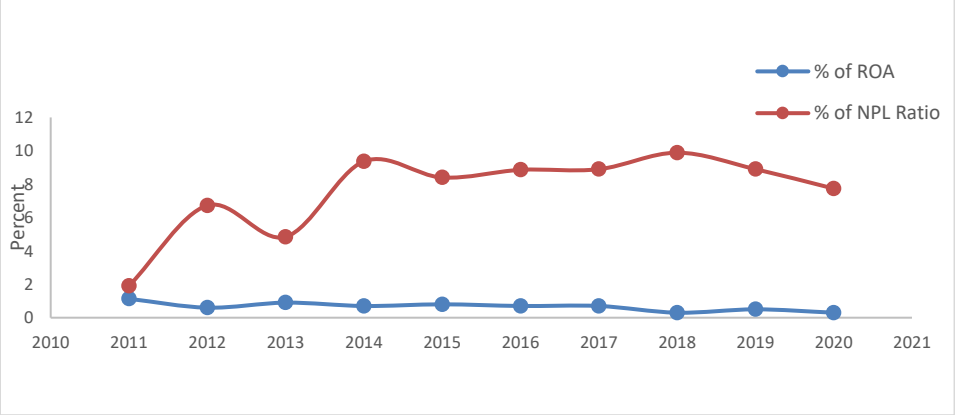

Fig. 1: % of Non-performing Loan Ratio and % of ROA (Source: World Development Indicators and Bangladesh Bank)

From Fig. 1, non-performing loan ratio demonstrates an increasing trend over the period of ten years (2011-2020) with a little fluctuation in the year 2013. However, we get a declining trend in case of ROA over the same years with a little fluctuation in the years 2013 and 2015. Therefore, the accelerating non-performing loans and decreasing profitability of banking industry of Bangladesh can be arguably attributable to the inefficient management of credit risk. So far, a good number of research has been conducted on the financial system of Bangladesh, focusing on the factors relevant to profitability determinants of commercial banks (Sufian and Kamaruddin, 2012; Samad, 2015; Mahmud et al., 2016; Chowdhury et al., 2022; Akther et al., 2023; Lalon et al., 2023; Biswas, 2023). However, to the best knowledge of the researcher, there has been very few previous studies conducted on the impact of credit risk management on the banking system of Bangladesh. A few of the studies considered asset quality (the

proportion of the classified loans to total loans) as the measure of credit risk without including any other indicators arising from loan concentration (see Islam and Rana, 2019; Chowdhury et al., 2022). This inspires the researcher to devise a credit risk model by including a credit risk measure indicating loan concentration into a certain geographic area.

The present study will have threefold contributions on the existing literature of credit risk management. Firstly, it enriches the current literature of credit risk management by adding the context of a developing country, Bangladesh. Secondly, it includes a loan concentration measure, geographical loan concentration ratio, in the model of credit risk management which is unaddressed in the similar types of research around the world. Thirdly, it estimates the parameters by using three different estimators of panel ARDL framework to avoid estimation bias and endogeneity problem.

The rest of the paper is organized as follows: Section 2 demonstrates a literature review of relevant studies while section 3 discusses methodology. Results and discussions of the study have been presented in section 4. Finally, section 5 describes the conclusion and policy implications of the study.

2. Literature Review

2.1 Studies Conducted in Other Regions except South Asia

Researchers throughout the world have contemplated the importance of credit risk management and conducted their studies on this issue. Salas and Saurina (2002) investigated the determinants of problem loans of Spanish commercial and saving banks over the periods 1985-1997 by considering some macroeconomic and bank level variables, and the study revealed that capital ratio has a significant negative association with problem loans in case of commercial banks, meaning that solvent banks are less likely to suffer from the accumulation of problem loans. With an aim to examine the determinants of banks' performance in Greece, Kosmidou (2008) conducted research on an unbalanced panel data collected from 23 commercial banks over the period 1990 to 2002, incorporating some bank specific and macro level variables. The major findings of the study suggested that higher equity to total assets exerted a significant positive impact on bank performance measured by Return on Average Assets (ROAA).

Boahene et al. (2012) investigated the connection between credit risk and profitability of selected banks in Ghana and the findings claimed that non-performing loan rate had a positive relationship with bank profitability measured by ROA. Kolapo et al. (2012) carried out research to estimate the detrimental effect of credit risk on Nigerian commercial banks, analyzing a panel data collected from 5 commercial banks over a period of 11 years starting from 2000 to 2010. The study employed some credit risk measures as the regressors and ROA as the performance indicator. The results of the study indicated that both the ratios non-performing loan to total loan and advances (NPL/LA), and Loan loss provision to classified loans (LLP/CL) impacted ROA negatively. Gizaw et

al. (2015) worked on eight commercial banks in Ethiopia to quantify the effect of credit risk on two different indicators of profitability: ROA and ROE. The study claimed that the ratio of non-performing loans to total loans and advances exerted a negative effect on profitability irrespective of any measure. In similar research done on thirty-seven commercial banks in Kenya, Kurba and Garba (2014) posited that capital adequacy ratio (CAR) had a positive association with ROA.

In a contemporary study, Qehaja-Keka et al. (2023) contented that some bank specific factors namely loan interest rate, non-performing loans and total loan disbursements had a significant impact on the profitability of commercial banks of Kosovo and Albania. The results of the econometric models suggested that non-performing loans deteriorated the banking system's profitability. In a very recent study, Belcaid and Al-Faryan (2024) investigated the importance of BASEL III requirements on the banking sector's profitability in the context of Morocco. The study incorporated appropriate measures for ownership structure, solvency, and liquidity as the profitability determinants. The findings suggested that foreign ownership is negatively associated with the profitability measured by ROA. However, higher level of equity capital and adequate liquid assets affected the profitability positively.

In case of BRICS countries, Sain and Kashiramka (2023) argued that bank profitability could have a significant impact on bank stability. The outcomes of the study highlighted the negative impact of non-performing assets on the bank profitability while suggesting a positive effect of the institutional quality on profitability.

2.2 Studies Conducted in South Asian Countries including Bangladesh

In the context of Indian economy, Almaqtari et al. (2018) carried out a study to explore the profitability determinants of the commercial banks. Among the internal factors, bank size and liquidity ratio were found to be positively associated with profitability, whereas high leverage was identified to be negatively associated with profitability. To provide evidence from Pakistani economy, Ali and Puah (2019) examined the panel data collected from twenty-four commercial banks over a nine-year period. The researchers argued that bank size had a significant positive impact on profitability, meaning that larger banks were found to exercise economies of scales in terms of their operations. In addition, the study revealed that well managed credit risk was also favorable with profitability.

Among the studies conducted on the commercial banks in Bangladesh, Mahmud et al. (2016) claimed that CAR had a positive association with the profitability of commercial banks in Bangladesh. Conversely, the study demonstrated a negative relationship between non-performing loan ratio and ROA. Samad (2015) investigated the factors affecting profitability of commercial banks in Bangladesh. According to the findings of the study, loan to deposit ratio and equity capital to total assets (EQTA) had positive association with the performance of commercial banks in Bangladesh. In case of 23 listed commercial

banks of Bangladesh, Islam et al. (2019) suggested that CAR had a positive association with all the three profitability measures namely ROA, ROE, and market-to-book value ratio, whereas NPLR affected the profitability measures negatively. In another study, Noor and Das (2020) confirmed a significant negative association between NPLR and ROA, while a positive but insignificant association between CAR and ROA. Chowdhury et al. (2022) conducted a study on many commercial banks to reveal the impact of bank size, capital ratio, and loan risks measured by non-performing loan ratio. The findings of the GMM estimation suggest that bank size is negatively associated with ROA, while capital ratio is found to be positive with ROA. On the other hand, the study revealed a negative association between loan risks and ROA. In a recent study, Akther et al. (2023) highlighted the importance of capital adequacy, asset quality, and inflation in determining the profitability of commercial banks in Bangladesh. The findings suggested an insignificant impact of capital adequacy on bank performance, while indicating a positive association between inflation and ROA. The existing literature of both developing and developed countries has indicated a significant association between credit risk management and banks' performance. However, the measure of credit risk is not uniform throughout the existing literature. At this backdrop, it will be interesting to see how a novel measure of credit risk namely geographical loan concentration ratio (GLCR) behaves towards profitability of commercial banks in the context of Bangladesh.

3. Methodology

3.1 Data collection

At present, the banking industry of Bangladesh comprises of 61 commercial banks. However, only 36 commercial banks have been listed in DSE (Dhaka Stock Exchange). Based on the differences in their core business policies, the DSE listed commercial banks fall under two broad categories: Conventional commercial banks and Islami shariah banks. Therefore, the present study merely considers 23 conventional commercial banks due to their similar nature of business, excluding seven Islamic banks and six fourth generation conventional banks. Secondary data has been collected from the audited annual reports of the selected banks over a period of 13 years starting from 2008 to 2020 for the study.

3.2 Variables' definition

The underlying variables which represent credit risk measures are CAR, NPLR, and GLCR. The performance of the commercial banks has been measured through ROA. This ratio is commonly used as an indicator of competence and operational efficiency of banks since it addresses the profit earned from the assets employed by the bank (Jahan, 2012). ROA is an important performance measure as it is directly related to the profitability of banks and it is not affected by high equity multipliers (Rivard and Thomas, 1997; Kosmidou, 2008; Chowdhury et al., 2022). Capital adequacy ratio refers to the amount of equity and other reserves which a bank holds against its risky assets. The purpose of this reserve is to protect the depositors from any adverse and unpredicted loss (Basel

Committee on Banking Supervision, 1988). Considering the importance of regulatory capital in managing credit risk, many researchers use CAR as an indicator of credit risk management (Kurwa and Garba, 2014; Gizaw et al., 2015; Alshatti, 2015; Ahmad and Ariff, 2008; Mahmud et al., 2016, Akther et al., 2023). Previous literature demonstrates a mixed relationship between regulatory capital requirements measured by CAR and bank performance measured through ROA. Therefore, the relationship between CAR and bank performance cannot be predicted precisely.

NPLR measures the proportion of classified loans against the total loans and advances for a period. The ratio is considered as the best measure of credit risk for a bank according to many studies (Salas and Saurina, 2002; Samad, 2015; Mahmud et al., 2016; Chowdhury et al., 2022; Lalon et al., 2023). Previous studies suggest differing opinions regarding the nature of the association between NPLR and ROA. Therefore, the researcher cannot expect a specific sign of the coefficient of NPLR. GLCR refers to the ratio between the loans extended to the counterparties in a particular region and total loans and advances of a bank for a given year. The Basel Committee on Banking Supervision (1999) reinforced the source of credit risk which might arise from geographical concentration. Therefore, it is reasonable to include a variable representing the geographical concentration of loan portfolios of commercial banks in Bangladesh. It is expected that the relationship between geographical loan concentration ratio and bank performance may be inverse. Measures of all the variables included in the study along with their individual expected effect on bank performance are presented in Table 1.

Table 1: Notation, Measurement and Expected Impact of Different Variables

Variable	Notation	Measurement	Expected Impact
Return on Asset	ROA	Net income/ Average Total Assets	
Capital Adequacy Ratio	CAR	Tier I Capital + Tier II Capital/ Risk Weighted Assets	+
Non-performing Loan Ratio	NPLR	Non-performing Loans/ Total Loans and Advances	+/-
Geographical Loan Concentration Ratio	GLCR	Loans Concentrated in Dhaka Division/Total Loans and Advances	-

3.3 The empirical model selection

Two recent versions of panel ARDL such as Pooled Mean Group (PMG) and Mean Group (MG) estimators can provide efficient estimates of regression parameters when number of cross-sections (N) and number of time periods (T) are sufficiently large and thereby avoiding the restrictive assumptions of uniform

slope coefficients across the cross-sections of interest (Pesaran et al., 1999). MG estimator allows all the parameters such as intercepts, short run and long run coefficients, and error variances to vary across the groups (Pesaran and Smith, 1995). Conversely, DFE estimator assumes all the parameters to be equal both in the long run and in the short run across the individual units (Blackburne and Frank, 2007). Considering the homogeneity of the estimated coefficients, PMG estimator takes an intermediate position between MG and DFE estimators. In PMG method, short run coefficients are allowed to take different estimated values, while long run coefficients are restricted to be equal across all the groups (Pesaran et al., 1999). To estimate the regression parameters according to PMG, MG, and DFE methods, the common form of panel ARDL ($p, q, q, ..., q$) model is as follows:

$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} x_{i,t-j} + \gamma_i d_t + \varepsilon_{it}$, where $t = 1,2,3,..,T$ (time periods); $i = 1,2,3,...,N$ (number of groups); x_{it} $(k \times 1)$ is the vector of independent variables, d_t $(s \times 1)$ is the vector of dummy variables representing observable time effects, $y_{i,t-j}$ is the lagged dependent variable, λ_{ij} is scalar, δ_{ij} and d_t are $(k \times 1)$ and $(s \times 1)$ vectors of unknown parameters to be estimated, and ε_{it} is the error term which varies across groups and time spans. This model requires time periods (*t*) must be sufficiently large enough to estimate the parameters for each group separately. To produce consistent estimates, panel ARDL model assumes that error terms (ε_{it}) are independently distributed across individual groups (i) and time periods (t). Moreover, disturbances (ε_{it}) will not be correlated with regressors: x_{it} and d_t. The inclusion of time dummy variables (d_t) (in ARDL model eliminates any time shock affecting all the groups in a specific year and thereby assuming of independent distribution of error terms across individual entities quite reasonable. If the time specific effect (d_t) is not observable, then year mean is subtracted, to eliminate cross-sectional dependence, from each observation for all variables as suggested by Pesaran et al. (1999). Another assumption of the model stipulates that error terms (ε_{it}) of different time periods will be independent of each other. This assumption is also not too restrictive as panel ARDL model keeps a provision for the regressors to be included in the model with proper lags (Pesaran et al., 1999). The selection of appropriate lag structures of the regressors essentially reduces the possibility of the interdependence between disturbances (ε_{it}) and time periods (t). Therefore, panel ARDL model can arguably be said to be the consistent estimator

controlling for the problems arising from the specific nature of panel data. The overall procedure for estimating the regression parameters by employing panel ARDL involves four steps. The first step requires the series to get free from cross-sectional dependence. In the present study, the researchers did not get any observable time effect during the period of interest (2008-2020) in the banking sector of Bangladesh. Therefore, the researchers find the cross-sectionally demeaned data by subtracting yearly mean value from each observation of all variables. To further verify that the data set no longer suffers from cross-sectional dependence, Pesaran CD test has been conducted. The second step involves running different unit root tests relevant to panel data to know the maximum order of integration of the non-stationary series. Unlike the traditional panel error correction model, ARDL based error correction model does not necessarily require all the non-stationary series to be first difference stationary or purely $I(1)$ (Pesaran and Shin, 1997). The ARDL model appears to be equally consistent estimator irrespective of the order of integration of the series: $I(0)$, $I(1)$, or mixed form of $I(0)$ and $I(1)$ (Pesaran and Shin, 1997). Through conducting unit root tests, the researchers must be assured that no non-stationary series exhibits order of integration greater than one, $I(1)$. The third step deals with selecting proper lags of the regressors by applying different lag structure criteria such as Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn (HQ) Information Criterion. The lag structure which estimates the regression parameters by keeping the value of Schwarz Bayesian Information Criterion the most parsimonious will be considered as the optimal lags. The fourth step helps the researchers to estimate three different versions of panel ARDL from the error correction model. Moreover, the Hausman test is conducted to select the most efficient model out of MG, PMG, and DFE estimators.

4. Results and Discussions

The descriptive statistics of the variables included in the present study has been demonstrated in Table 2. The overall average ROA of the 23 DSE listed conventional commercial banks over the period 2008-2020 is 1.36% with a minimum of -13.97% and up to a maximum of 7.40%. Like ROA, similar types of information have been presented for other variables such as CAR, NPLR, and GLCR in the following table. Both ROA and CAR have a negative value in their minimum range, indicating that some banks were not capable of generating positive return to their shareholders in some years and did not maintain the minimum capital requirements imposed by the central bank.

Table 2: Descriptive Statistics

Variables	Mean	Std. Deviation	Minimum	Maximum
ROA	0.0136	0.0124	-0.1397	0.0740
CAR	0.1113	0.0372	-0.2967	0.1878
NPLR	0.0573	0.0875	0.0003	0.9817
GLCR	0.6916	0.0848	0.0681	0.9824

Out of the four variables, ROA exhibits the least volatility of 1.24% followed by 3.72% volatility of CAR. However, the other two variables such as NPLR and GLCR illustrate greater volatility. The lower standard deviations of ROA and CAR suggest their relatively small variability across the banks and time periods, while the higher standard deviations of NPLR and GLCR indicate greater deviations across groups and time spans.

Panel data of banking sector is highly likely to suffer from cross-sectional dependence arising from common shocks like political instability, and declining credit growth due to lower demand of loanable funds sweeping over a specific banking industry in a certain time. To avoid this problem, the current study uses cross-sectional demeaned data by taking individual deviations from yearly mean values of all variables. In this regard, the researchers conducted Pesaran CD test proposed by Pesaran (2004) to be sure that the residuals do not have any cross-sectional dependence. The results of the corresponding Pesaran CD test[1] suggest that the residuals do not suffer from cross-sectional dependence. The current study examines the presence of non-stationarity of the variables by applying four widely used panel unit root tests: Levin, Lin and Chu test, Im, Pesaran and Shin test, ADF-Fisher test, and PP-Fisher test. Upon conducting these unit root tests, the researchers can detect any non-stationary variable and its maximum order of integration, which is very critical to the validity of panel ARDL model. In Table 3, the results of the four-unit root tests individually confirm that all the variables used in the study are stationary at their levels, being integrated of order zero, $I(0)$.

Table 3: Results of the unit root tests.

	Levin, Lin and Chu Test		Im, Pesaran and Shin Test		ADF-Fisher Test		PP-Fisher Test	
Variables	Individual Intercept		Individual Intercept		Individual Intercept		Individual Intercept	
	Level	1st difference	Level	1st difference	Level	1st difference	Level	1st difference
ROA	-8.827***	-16.54***	-5.84***	-11.99***	111.45***	202.27***	121.5***	288.77***
CAR	-8.79***	-14.46***	-6.63***	-12.01***	123.38***	205.79***	141.20***	315.72***
NPLR	-8.04***	-14.12***	-4.60***	-8.56***	94.08***	150.77***	99.07***	159.34***
GLCR	-6.89***	-17.08***	-3.26***	-11.50***	83.17***	191.82***	85.42***	227.31***

Note: *** denotes the rejection of null hypothesis at 1% level of significance

[1] Pesaran CD test provides Pesaran's CD statistics result – 0.103 with a probability of 0.9183, supporting the null hypothesis of no cross-sectional dependence.

Therefore, there is not any non-stationarity present in the variables of interest, meaning that all the regressors are stationary. The researchers select the optimal lag lengths of the regressors for the ARDL model, thereby controlling the serial correlations of the residuals across the time periods. In this regard, several ARDL models with different lag structures of the independent variables have been evaluated based on Schwarz-Bayesian Information Criterion (SBC). However, the values of other two information criteria such as Akaike Information Criterion (AIC), and Hannan-Quinn Information (HQ) Criterion have also been presented with that of Schwarz-Bayesian Information Criterion (SBC). Table 4 demonstrates different ARDL models with the corresponding values of three information criteria. In Table 4, we see that ARDL (1, 1, 1, 1) model estimates regression parameters keeping the most parsimonious value of SBC and the same model has the most parsimonious value under HQ as well.

Table 4: ARDL model selection based on Schwarz Bayesian Information Criterion

Model	LogL	AIC	SBC*	HQ	Specification
1	1073.21	-7.55	-5.90	-6.89	ARDL(1,1,1,1)
2	1100.75	-7.59	-5.62	-6.79	ARDL(2,1,1,1)

After determining the appropriate lag structures of the regressors, the following ARDL (1,1,1,1) model was estimated through PMG, MG, and DFE estimators.

$$ROA_{it} = \alpha_i + \delta_{10i} CAR_{it} + \delta_{11i} CAR_{i,t-1} + \delta_{20i} NPLR_{it} + \delta_{21i} NPLR_{i,t-1} + \delta_{30i} GLCR_{it} + \delta_{31i} GLCR_{i,t-1} + \lambda_i ROA_{i,t-1} + \varepsilon_{it} \quad (1)$$

The error correction equation corresponding to the above ARDL (1,1,1,1) model is as follows:

$$\Delta ROA_{it} = \phi_i (ROA_{i,t-1} - \theta_{0i} - \theta_{1i} CAR_{it} - \theta_{2i} NPLR_{it} - \theta_{3i} GLCR_{it}) - \delta_{10i} \Delta CAR_{it} - \delta_{20i} \Delta NPLR_{it} - \delta_{30i} \Delta GLCR_{it} + \varepsilon_{it} \quad (2)$$

Here,

$$\theta_{0i} = \frac{\alpha_i}{1-\lambda_i}, \theta_{1i} = \frac{\delta_{10i} + \delta_{11i}}{1-\lambda_i}, \theta_{2i} = \frac{\delta_{20i} + \delta_{21i}}{1-\lambda_i}, \theta_{3i} = \frac{\delta_{30i} + \delta_{31i}}{1-\lambda_i}, \phi_i = \lambda_i - 1.$$

4.1 The model estimate

The results of the three estimators, MG, PMG, and DFE have been presented in table 5.

Table 5: ARDL (1,1,1,1) estimation through MG, PMG, and DFE (Dependent Variable: ROA)

	MG	PMG	DFE
Adjustment coefficient (ϕ)	-1.0003***	-0.8254***	-1.005***
	(0.1041)	(0.073)	(0.1282)
Long-run coefficients (θ_i)			
CAR	0.2529	0.0723***	0.1110***
	(0.2299)	(0.0141)	(0.0209)
NPLR	0.1529	0.0050**	0.0010
	(0.2059)	(0.0021)	(0.0053)
GLCR	-0.0433	-0.0251***	-0.0157
	(0.0461)	(0.0063)	(0.0169)
Short-run coefficients (δ_{ij})			
Δ CAR	0.0110	0.0760	0.1221***
	(0.0503)	(0.0472)	(0.0268)
Δ NPLR	-0.0040	0.0033	-0.011***
	(0.0348)	(0.0385)	(0.0039)
Δ GLCR	-0.0502	-0.0400	0.0103
	(0.0708)	(0.0360)	(0.0090)
Intercept (α_i)	0.0026	-0.00004	0.00007
	(0.0018)	(0.0010)	(0.00004)
Hausman Test		0.09	0.00
		(0.9932)	(1.00)

Note: **, and *** denote significance at 5% and 1% respectively

Table 5 demonstrates the significant negative values of error-correction speed of adjustment term under the three estimators, although the magnitudes of the coefficient are not same across the three methods. These negative significant values of the convergence coefficient (ϕ) essentially indicates the existence of long-run relationship between credit risk management and bank performance in each of the estimated model MG, PMG, and DFE. In the MG estimator, no other parameters except the error-correction coefficient are statistically significant, and the standard errors corresponding to the estimates are larger compared to that of the other two estimators. Furthermore, the result of the Hausman test fails to reject the null hypothesis (PMG is more efficient than MG), confirming the

superiority of PMG over MG. In another Hausman test conducted between DFE and PMG, the test result also fails to reject the null hypothesis (DFE is more efficient than PMG) and thereby suggesting that DFE is the most efficient estimator among the three. In Table 5, long-run coefficients of the three regressors (CAR, NPLR, and GLCR) exhibit uniform signs across the three estimators, whereas short-run coefficients demonstrate different signs across the estimators. Out of the three regressors, CAR exerts long-run positive impact on ROA across all the three estimators, and this association between ROA and CAR is statistically significant in case of DFE and PMG estimators. Moreover, according to DFE estimator, there is a short-run positive association between CAR and ROA, while the association is negative between NPLR and ROA. Previous studies also documented a positive association between CAR and ROA (Kurba and Garba 2014; Mahmud et al., 2016; Samad 2015; Akther et al., 2023; Biswas 2023). One of the plausible reasons behind the positive relationship between CAR and ROA might be the lower cost of funds incurred by the well capitalized banks. The banks maintaining the minimum CAR do not need to raise funds on an emergency basis to avoid regulatory pressure, and thus reducing the cost of funds. Similar findings have been documented by a study conducted by Kosmidou et al. (2008) where they claimed that well capitalized banks can manage external financing at a lower cost than capital deficit banks, and this results in generating higher ROA.

The present study has revealed an interesting finding regarding the impact of NPLR on ROA. All the three estimators uniformly claim a positive long-run association between NPLR and ROA, although the association is statistically significant only for PMG estimators. The finding is opposite to that of the studies conducted by Chowdhury et al. (2022) and Lalon et al. (2023), which revealed a negative association between non-performing loan ratio and profitability. This positive association might be an outcome of the insufficient loan-loss provisioning of the commercial banks. Commercial banks are directed by the regulatory authority to deduct a certain percentage of their outstanding problem loans from yearly operating profits. The improper loan-loss provisioning helps the commercial banks to report higher ROA than they would be, and thereby preventing the detrimental effect of non-performing loan on ROA. Boahane et al. (2012) also reported a positive relationship between NPLR and ROA, having a conformity with the finding of our study.

The results of the three estimators uniformly claim a long-term negative association of GLCR with ROA. However, out of the three estimators, PMG estimator alone exhibits a significant long-term negative association between GLCR and ROA. Bangladeshi commercial banks have already concentrated their loan books by extending a significant portion of their total outstanding loans to different business entities and individual borrowers of Dhaka division. That is why performance of the banking industry of Bangladesh is highly sensitive to the shocks affecting the business organizations operating in Dhaka city. Moreover, the loanable fund market of Dhaka division is highly saturated due to the

aggressive lending of all the commercial banks in that specific geographic region. Commercial banks are in fierce competition to attract the same group of customers and business organizations for extending loans, and thus reducing the prospects of getting new customers locating in different geographical areas. This mismanagement of loan portfolios arising from geographical loan concentration may significantly reduce the profitability of commercial banks. The finding of our study is in line with that of other studies such as Grippa and Gornica (2016) which indicated the negative consequences of concentration risk.

5. Conclusion and Policy Implications

This paper analyzes the long-run association between ROA and three credit risk measures namely CAR, NPLR, and GLCR by employing three estimators such as MG, PMG, and DFE estimators under panel ARDL framework. Out of the three estimators, DFE appears to be the best estimator supported by Hausman test. The key outcomes of the three estimators suggest that CAR and NPLR exert a positive long-run impact on bank performance measured through ROA, while GLCR has a negative long-run influence on ROA. Out of the short-run coefficients, CAR has a significant positive association with ROA, whereas NPLR has a significant negative association with ROA. The findings of the study provide some valuable insights into banking professionals and the banking regulator as well. Top management of commercial banks should reduce the accumulation of risky assets by originating good quality loans. These may shrink the portion of risky assets in the loan portfolios of commercial banks, contributing to the higher CAR. In addition, Bangladesh Bank which is the regulatory authority of commercial banks in Bangladesh might increase its monitoring to prohibit commercial banks in extending loans to lower creditworthy borrowers. The management of commercial banks should also be conscious of sufficient loan-loss provisioning each year to prevent the overestimation of ROA and the real scenario of classified loans. Otherwise, the detrimental effect of non-performing loans on ROA would not be well perceived among the different stakeholders of commercial banks. Commercial banks of Bangladesh are excessively extending credits in Dhaka division, impacting ROA negatively. In this regard, banks should focus on other potential geographical locations by introducing new loan policies compatible with the requirements of the borrowers of those regions. The central bank might impose a maximum limit for extending credit in Dhaka division to reduce the concentration risk arising from loan concentration in that area.

It is possible to undertake future studies on the same issue by overcoming the limitations of the present study. One of the major limitations of the study includes that it did not consider all the DSE listed commercial banks due to some differences in their lending policies. Future research can focus on some interesting research work by applying different econometric models on a long and wide panel data and by including more variables associated with credit risk measures, such as loan-loss provision ratio, and the ratio of off-balance sheet assets to total assets etc.

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