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Factors Influencing the Capital Adequacy Ratio of Commercial Banks of Bangladesh: A Panel Data Analysis

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Abstract

This paper examines the explanatory factors influencing the capital adequacy ratio (CAR) of commercial banks in Bangladesh. The study covers all commercial banks during the period 2010-2020. There were 47 banks in 2010, which increased to 60 by 2020. Thus, the panel was unbalanced. We examined the relationship between CAR, the dependent variable, and the following independent variables: earnings-to-assets ratio, profitability, liquidity, net interest margin, growth, size, loans-to-assets ratio, and deposits-to-assets ratio. We have used Ordinary Least Squares, GLS-random effect, and GLS-fixed effect models using STATA-14 to estimate the parameters in multiple regression analysis. The results show that bank size, equity-to-asset ratio, and earnings on assets had a significant positive effect on the capital adequacy ratio, whereas nonperforming loans, interest rate spread, credit growth, net interest margin, and inflation rate had negative and statistically significant effects.

Keywords: *Capital Adequacy Ratio (CAR) · Commercial Banks · Bangladesh*

JEL Classification: *C4 · F15 · G21 · G28 · L19*

1. Introduction

The capital adequacy ratio ensures that banks have the capacity to meet their liabilities and other risks, such as credit, market, and operational risks. Capital adequacy focuses on a bank's overall capital position and on protecting depositors and other creditors from potential losses the bank might incur. It helps banks absorb potential losses from credit, market, and operational risks they may be exposed to in the normal course of business. Under Basel-III, banks in Bangladesh are required to maintain the minimum capital requirement (MCR) at 10.0 percent of risk-weighted assets (RWA) or BDT 5.0 billion in capital, whichever is higher. The aggregate regulatory capital of the banking sector was

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BDT 1571.8 billion as on 31 December 2022, rising to BDT 1578.1 billion at the end of June 2023. The CRAR of the banking industry as a whole was 11.2 percent at the end of June 2023 (BB Annual Report 2022-23).

The average Capital to Risk-Weighted Asset Ratio (CRAR) across our panel of banks was 11.64% during 2010-2020. Capital adequacy ratios are a measure of a bank's capital expressed as a percentage of its risk-weighted credit exposures. According to international standards, banks must maintain a minimum capital adequacy ratio to absorb a reasonable level of losses before becoming insolvent. Applying minimum capital adequacy ratios protects depositors and promotes the stability and efficiency of the financial system. Chart 1 shows the movement of the Capital Adequacy Ratio for Bangladesh's commercial banks from 1996 to 2020.

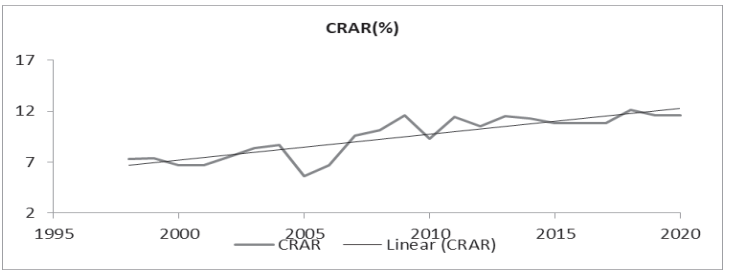

Chart 1: Capital to Risk-weighted Asset Ratio
(%):1998-2020 Yhat = 6.407 + .256TIME , R2= .727, F(1,21)=56.008 P= .000 DW= 1.479
Source & Note: Bangladesh Bank. Analysis by the Author.

The chart depicts the CRAR (%) of commercial banks from around 1998 to 2020, along with a linear trend line for reference. The CRAR shows a gradual upward trend over the period, as indicated by the linear fit. Early years (late 1990s–early 2000s) show CRAR values of 7–8%, close to the regulatory minimum at the time. By 2020, CRAR rises to around 12%, reflecting a strengthening of bank capital over two decades. There are noticeable short-term fluctuations, particularly around 2005–2010, where CRAR dips slightly below the trend line before recovering. These fluctuations could reflect macroeconomic shocks, bank-specific risk events, or regulatory changes affecting capital requirements. The upward trajectory suggests that commercial banks have been gradually improving their capital adequacy, likely in line with Basel II and III requirements. According to the Basel III guidelines implemented by Bangladesh Bank, commercial banks in Bangladesh are required to maintain a minimum Capital to Risk-weighted Asset Ratio (CRAR) of 10%, plus a Capital Conservation Buffer (CCB) of 2.50%. Despite improvement, the CRAR in 2020 (12%) is still moderate compared to regional peers, as noted in the following table 1, indicating scope

for further capital strengthening. The increasing CRAR supports the banking system's enhanced resilience to absorb unexpected losses, reduce systemic risk, and promote financial stability.

The chart confirms a long-term improvement in commercial banks' capital adequacy, with CRAR rising from 7% in the late 1990s to 12% by 2020, albeit with some volatility. While this trend is positive, Bangladesh's commercial banks remain moderately capitalized relative to regional standards, highlighting ongoing regulatory and policy challenges to financial stability.

Table 1: CRAR for some Selected Countries

Country	CRAR (%)				
	2016	2017	2018	2019	2020
Bangladesh	10.8	10.8	10.5	11.6	11.6
India/a	13.3	13.9	13.7	15.1	15.8
Pakistan	16.2	15.8	16.2	17.0	18.6
Sri Lanka	15.6	15.2	15.1	16.5	16.5

Source & Note: Adapted from BB, FSR 2020; Data as of the end of September.

Table 2 presents the Capital to Risk-Weighted Assets Ratio (CRAR) for selected South Asian countries during 2016–2020. CRAR measures a bank's capital adequacy relative to its risk-weighted assets and is a key indicator of the banking sector's resilience under the Basel III international regulatory framework. A higher CRAR generally implies a stronger capacity of banks to absorb potential losses and maintain stability.

Bangladesh shows relatively lower capital adequacy compared with its regional peers throughout the period. The CRAR of Bangladesh Bank-regulated banks remained almost unchanged at 10.8% in 2016 and 2017, declined slightly to 10.5% in 2018, and then increased to 11.6% in both 2019 and 2020. Although this level meets the regulatory minimum requirement, it remains considerably below that of other South Asian banking systems, suggesting relatively weaker capital buffers.

In contrast, banks in India exhibit a consistent improvement in capital adequacy, with CRAR rising from 13.3% in 2016 to 15.8% in 2020. The upward trend reflects capital-strengthening efforts following banking sector reforms and the Reserve Bank of India's regulatory tightening.

The banking sector of Pakistan demonstrates the highest capital adequacy among the countries considered, with CRAR increasing steadily from 16.2% in 2016 to

18.6% in 2020. This indicates strong capitalization and improved resilience of banks under the supervision of the State Bank of Pakistan.

Similarly, banks in Sri Lanka maintain relatively high and stable CRAR levels, ranging from 15.1% to 16.5% during the period, supported by the Central Bank of Sri Lanka's regulatory oversight.

Overall, the comparative evidence suggests that Bangladesh's banking sector maintains the lowest capital adequacy among the selected countries, indicating relatively limited capital buffers against risk. Strengthening bank capitalization, therefore, remains an important policy concern for ensuring financial stability in Bangladesh.

Banking Sector Performance

The capital adequacy performance scenario for Bangladesh's banking sector in 2022 is presented in Table 2. At the end of December 2022, out of the total 61 banks, 45 banks could maintain a CRAR of 12.50% and more, with the minimum regulatory requirement of 10% with a Capital Conservation Buffer (CCB) of 2.5%, in line with Basel III. 11 scheduled banks could not maintain the minimum required CRAR of 10%. Moreover, an additional 5 banks were not able to maintain the CCB of 2.50% with an existing CRAR of 10%. It is encouraging to see that 45 banks (73.8%) have a CRAR of 12.50% or above.

Table 2. Distribution of Banks by CRAR

CRAR Class	Number of Banks(%)
<0.10%	11 (18.0)
≥10.00- but<12.50%	5 (8.2)
≥12.50-but<15.00	16 (26.2)
≥15.00-but <20.00	14 (23.0)
≥20.00	15 (24.6)
All Class	61 (100.0)

Source & Note: BB. FSR 2022; Author's analysis

Table 2 provides information on CRAR for some selected countries. We see that the value of CRAR is much higher by several percentage point shown in the table.

2. Objectives

This paper examines the explanatory factors influencing the capital adequacy ratio (CAR) of commercial banks in Bangladesh. during the period 2010-2020.

3. Data and Methodology

Data on all bank-specific variables were obtained from the respective banks' websites. Annual data from all commercial banks for the 11-year sample period from 2010 to 2020 have been used to estimate a panel-data model. The panel variable, banks, was unbalanced. The data were compiled from Annual Reports and Financial Statements of individual banks, Annual Reports of the Financial Institution Division (FID), and publications of Bangladesh Bank and the Bangladesh Bureau of Statistics. Statistics from the Bangladesh Bureau of Statistics, Bangladesh Bank, and the Ministry of Finance have also been used, particularly for macroeconomic variables. Data from the ADB, OECD, World Bank, and IMF have also been used. All ratios are estimated by the author. The Pooled Ordinary Least Squares (OLS), GLS Random Effects (Group variable-Banks), and GLS-Fixed effect-Group variable-Banks models for panel data have been applied to estimate the effects of the explanatory variables. The regression equations have been estimated using STATA 14.

Variable Measurements and their Operationalizations

Dependent Variable: Capital Adequacy Ratio

Bank capital adequacy ratio has been measured as the ratio of capital fund to Risk-Weighted Assets.

To examine the relationship between the banks' capital adequacy ratios and explanatory variables, a standard regression model is used, defined as follows for observation (bank) i, with the capital adequacy ratio score as the dependent variable. This study extends equation (1) and estimates the following model:

Where $$CAR_{it} = \alpha_0 + \beta X_{it} + \varepsilon_{it} \; i = 1 \ldots\ldots N \qquad (1)$$

CAR_{it} is the capital adequacy ratio of ith bank in the period t

(α_0, β) is a vector of parameters

Xit is a vector of explanatory variables, ε_{it} is a stochastic error term

The descriptions of the variables and their measurements are given in Table 1.

Table 3. Description of the Variables Used in the Regression Models

Variable	Description	Proxy	Hypothesized Relationship
Dependent			
CARit	Capital to Risk-weighted Assets Ratio		Not applicable
Independent			
Bank-specific characteristics(internal determinants)			
SIZEit	Natural logarithm of Total Assets	Bank size	+
LTAit	Loan divided by Total Assets	Default risk	+
NPLit	Non-performing loans divided by Total Assets	Default risk	+
EQUITTAit	Total equity/Total assets		–
IRS/LSit	Lending spread: the difference between the interest rate on loans and the interest rate on deposits		+
LD/ADRit	Advance to deposit ratio		+
EOAit	Net income/total Assets		+/-
NIMit	Net Interest margins		
CGRit	Credit growth		
Macroeconomic variable			
GDPGRt	Real GDP growth rate per cent in year t.	Business cycle	+/--
INFLt	CPI Inflation rate per cent in year t	Business cycle	+/-

Variable Definitions

$CAR_{i,t}$ = Capital to Risk-weighted Assets Ratio of bank i in year t

$SIZE_{i,t}$ = Natural logarithm of Total Assets of bank i in year t

$LTA_{i,t}$ = Loan/Total Assets of bank i in year t

$NPL_{i,t}$ = Non-performing loans/Total Assets of bank i in year t

$EQUITTA_{i,t}$ = Equity capital /Total Assets of bank i in year t

$LS_{i,t}$ = Lending spread: difference between interest rate on loans and interest rate on deposits of bank i in year t

ADRit = Advance to deposit ratio of bank i in year t

EOAit = Net income/total assets of bank I in year t.

NIMit= Net Interest margins of bank I in year t

CGRit= Credit growth rate of bank i in year t.

$GDPGR_{t}$ =. Real GDP growth rate per cent.

INFLt = CPI Inflation rate per cent in year t

4. Findings and Analysis

4.1 Descriptive Statistics of Study Variables

Table 4. Descriptive Statistics of Study Variables (N = 586)

Variable name	N	Mean	St. dev	Minimum	Maximum
CARit	586	11.64	27.43	-133.20	220.70
SIZEit	586	11.55	1.45	4.03	15.90
NPLit	586	9.81	15.63	0	100.00
LTAit	586	2.70	41,96	.04	1015.21
EQUITTAit	586	5.29	318.87	-3089.67	2837.21
IRS/LSit	586	4.74	1.85	-3.10	11.65
LD/ADRit	586	88.96	61.74	2.08	1212.87
EOAit	586	0.58	13.74	-139.08	158.66
NIMit	586	2.53	20.05	-33.43	298.92
CGRit	586	11.10	1.43	3.56	14.93
GDPt	586	6.46	1.22	3.51	8.15
INFLt	586	6.75	1.52	5.44	10.91

Source & Note: Data source Bangladesh Bank; Analysis by the author

4. 2 Correlation Matrix of Study Variables

Table 5. Correlation Matrix of study variables.(N=586)

	SIZE	NPL	LTA	EQTA	IRS	ADR	EOA	NIM	CGR	GDP
SIZE	1									
NPL	-.188	1								
LTA	-.189	.211	1							
EQTA	-.166	-204	-0.201	1						
IRS	-,109	.111	0.010	-0.059	1					
ADR	-.171	-011	0.032	0.318	-0.046	1				
EOA	-.172	-.146	0.037	-0.157	-0.147	0.231	1			
NIM	-.386	-0.059	0.294	0.613	-0.032	0.275	0.592	1		
CGR	.887	-0.099	0.011	0.856	-0.050	-.014	-.105	-.224	1	
GDP	.006	0.039	0.061	0.037	0.097	0.042	0.022	0.074	0.044	1
INFL	-.086	0.0732	-0.041	-0.003	0.224	-.048	-.018	-.018	-.126	-.106

Source & Note: Author's analysis. Any correlation coefficient higher than 0.105 is statistically significant at the 5 percent level.

Regression Analysis

Table 6: Regression Results of Capital Adequacy Ratio (CAR)

Independent Variables	Expected sign	Regression coefficient(standard error)		
		Pooled OLS	GLS Random Effects. Group variable(Banks)	GLS Fixed effect. Group variable(Banks)
Model		(1)	(2)	(3)
SIZEit	+	11.88*** (1.99)	6.76*** (1.83)	2.39 (1.78)
NPLit	-	-.54*** (.05)	.940* (.420)	-.027 (.08)
LTAit	+	.0003 (.0002)	.0003 (.0002)	.0003 (.0002)
EQTAit	–	.023*** (.004)	.015*** (.004)	.015*** (.004)
IRS it	+	-.99** (.45)	-1.03** (.423)	-1.17** (.40)
ADRit	+	-.014 (.015)	-.001 (.03)	. 02 (.01)
ROAit	+	.17** (.07)	.111* (.06)	.10* (.05)
NIMit	+	-.20*** (.06)	-.145** (.06)	-.133** (.06)
CGRit	-	-18.77*** (1.83)	.-16.18*** (1.70)	-16.71*** (1.66)
GDPt	+/	1.10 (.65)	.88 (.53)	.69 (.49)
INFLt	+/-	-2.90*** (.53)	-2.70*** (.46)	-3.2*** (.45)
CONSTANT		109.70*** (10.28)	137.34** (12.27)	193.59*** (15.44)
R square		.5353	.4600	.2507
Sigma_u			9.8552	22.98
Sigma_e			13.8613	13.8613
rho			.3357	.7332
Wald Chi2(11)			323.00	
F (11,574)		60.11		
F (11,516)				25.76
P value		.0000	.0000	.0000
D-W Statistic				
N		586	586	586

Source & Note. Author's analysis. * Statistically significant at 10 percent level, ** statistically significant at 5 percent level, *** statistically significant at 1 percent level. The models were estimated by STATA 14

Bank Size

The Size of a bank has historically been a key determinant in the capital structure/ level. Researchers have argued that large firms are less susceptible to bankruptcy because they tend to be more diversified than smaller firms. Bateni L. et al. (2014), in their study of 6 private Iranian Banks during the period 2006 – 2013, found that CAR is adversely affected by bank size, concluding that large Iranian banks have weaker supervisory control over their capital adequacy ratios and that large banks maintain a high-risk asset portfolio. Amidu M (2007) investigates the determinants of Capital Structure in Banks in Ghana and concludes that profitability, corporate tax, growth, asset structure, and size influence banks' capital structure decisions. Ghoshi et al. (2003) find that Indian public sector banks have not resorted to asset substitution across risk-weight categories, but instead have substituted low-risk government securities for high-risk loans to meet their capital requirements. This shows that capital regulation does influence the banks' decision-making. Bank Size is an important bank-specific determinant of bank profitability (Hirindu & Kushani, 2017). The natural logarithm of total assets is used as a proxy for the bank's size. The relationship between bank size and capital adequacy may be positive or negative. According to the results, Shingjergji and Hyseni (2015) found a positive relationship between bank size and capital adequacy ratio. On which they state that Albanian banks with higher total assets tend to have a higher capital adequacy ratio. The results in Table 5 show that bank size has a positive and significant effect on bank capital in the pooled OLS and GLS-random-effect models. But its effect on CAR was not statistically significant in the GLS fixed-effects model. Various studies across countries have shown both positive and negative effects on banks' capital adequacy. A study by Shingjergji and Hyseni (2015) on Albanian banks found that bank size positively affects the capital adequacy ratio. Almazari (2013), in his study of Saudi Arabian banks, found a positive relationship between bank size and capital adequacy. On the other hand, Bateni et al. (2014) found a negative relationship between bank size and capital adequacy in Iranian banks. Jim Wong, Ka-fai Choi, and Tom Fong (2005) conducted research on Hong Kong banks, and their estimation results show a statistically significant negative relationship between CAR and bank size, indicating an increase in capital adequacy.

Non-performing Loans NPLit

NPLit is a measure of non-performing loans. Rottke and Gentgen (2008) documented high levels of NPLs in banks' balance sheets during a banking crisis, when an economy experienced distressed debt cycles. Lin and Mei (2006) attributed the main cause of a bank failure to a large number of NPLs. The variable NPLit had a significant negative effect on the capital adequacy ratio in the pooled OLS model and a moderately significant ($P<.10$) positive effect

in the GLS-random effect model. Its effect on the capital adequacy ratio in the GLS-fixed effect model was statistically insignificant. The positive effect was statistically significant at the 5 percent level in models (1) and (2), but its effect on provisioning was highly significant(P<.01) in model(3).

Total Loan Ratio LTA_{it}

Thampy (2004) explains the impact of capital adequacy regulation on loan growth. Since loans have the highest risk weight, a capital-constrained bank would want to conserve its capital by allocating fewer assets to loans. This trend becomes more severe as the capital constraint binds, as is the case for banks below the required capital level. However, for banks with high capital adequacy ratios, loan growth is little affected. He also shows that, in a capital-constrained environment, banks will reduce loan supply. It also provides an explanation for the high proportion of investments held by banks. The reduction in loan supply is greater for inefficient banks. The impact of higher capital standards on the supply of bank credit would be greater in economies with a bank-dependent or dominated financial system than in those with a capital markets-dominated system. Abdioglu and Ahmet (2011) investigate the determinants of capital adequacy in Turkish banks and find a positive relationship between asset quality and capital adequacy, particularly the loan-to-total-asset ratio. The Total Loan Ratio is the ratio of total loans to total assets and serves as a proxy for the bank's risk profile. Fernando and Ekanayake (2015) have found that a negative and significant relationship between loan loss provision and total loans in public licensed commercial banks. The loan-to-asset ratio(LTA) is a proxy for the bank's risk profile--the greater the loan extension, the higher the risk tolerance of bank managers (the alternative is to invest in risk-free government bonds(Ghosh, 2007). However, Dhakal (2015) found a significant, positive relationship with loan loss provisions. We would expect to have a positive relationship between the total loan ratio and the loan loss provision. The loan-to-asset ratio is the ratio of total loans to total assets. At the bank level, loans are assets with risk, and their large share of the bank's assets increases the bank's exposure to risks, especially credit risk. Thus, a high indicator value could also indicate deterioration in the quality of bank assets, with a negative effect on profitability. On the other hand, we consider bank loans to be the main source of income for a bank; thus, a high level of this indicator is expected to positively impact profitability, as the bank records growth in interest income. The LTA is a metric that measures the ratio of total loans outstanding to total assets. This ratio specifically helps investors gain a comprehensive analysis of a bank's portfolio. Banks with a moderately higher LTA get more of their income from loans and investments, whereas those with a lower LTA level derive more of their income from asset management, noninterest-earning sources, or trading. These banks with lower LTA are also

considered to achieve better results throughout any economic downturns. Our findings indicate that *LTA* has a significant positive impact on the capital adequacy ratio. The regression analysis results shown in Table 5 indicate that the variable LTA did not exert a significant influence on the capital adequacy ratio in any of the models considered.

Total Equity to Total Assets (EQTAit)

There are several ratios to assess a company's or a bank's leverage. Leverage ratios are important, particularly for banks, since they equate core capital to total assets. The Tier 1 capital ratio is used to calculate a bank's leverage relative to its total assets. Tier 1 assets are those that can be easily liquidated if, in a time of financial crisis, the bank needs capital. Thus, the bank's financial strength is measured. The BCBS proposed a leverage ratio as part of the Basel III reform package in 2010. The Basel III leverage ratio is calculated by dividing the capital measure by the exposure measure. The capital measure is known as Tier 1 capital, which has a leverage ratio requirement of at least 3%. When a bank's Tier 1 leverage ratio is higher, it's more likely to withstand negative shocks to its balance sheet. (Keqa, 2021)

Our empirical findings show that the leverage ratio (EQTAit) has a highly significant positive impact ($P<.01$)on the capital adequacy ratio.

Spread between Lending and Deposit Rate (IRSit)

The variable IRSit had a significant ($P<0.05$) negative effect on the capital adequacy ratio in all three models shown in Table 5.

Advance Deposit Ratio. ADRit

The variable ADRit did not exert any significant effect on the capital adequacy ratio in any of the models considered in Table 5.

Profitability (ROAit)

For the purposes of the study, ROA and NIM are used as proxies for profitability. The research conducted by Shingjergji and Hyseni (2015) on Albanian banks found that profitability has no significant impact on capital adequacy. Ahmet and Hasan (2011) state that profitability and the capital adequacy ratio are most likely positively related, because banks are expected to increase asset risk to achieve higher returns in most cases. This situation is also supported by the research of Mohammed T. et al. (2013), which shows that profitability has a significantly positive effect on the capital adequacy ratio. Therefore, this study expects a positive relationship between profitability and capital adequacy. The regression results given in Table 5 indicate that both ROA had a statistically significant positive effect on the capital adequacy ratio.

Profitability (NIMit)

Net interest margin is the ratio of net interest income to average earning assets. The ratio is used to assess a bank's management capabilities and its ability to generate net income. The greater the ratio, the more it affects the interest income earned on the bank's earning assets, as shown by Yohanna Karina and Herlanto (2014). The regression results given in Table 5 indicate that both ROA had a statistically significant positive effect on the capital adequacy ratio. The regression results given in Table 5 indicate that NIM had a statistically significant negative effect on the capital adequacy ratio.

Financial Development (CGRt)

The variable financial development measured by credit growth had a highly significant ($P<0.01$) negative impact on the capital adequacy ratio in all the models shown in Table 5.

Growth of GDPt

The variable real growth rate of gross domestic product did not have any significant effect on the capital adequacy ratio in our analysis.

CPI Inflation (INFLt)

The CPI inflation rate had a highly significant negative effect ($P<0.01$) on the capital adequacy ratio in all the models considered. The CPI inflation rate has a negative relationship with CAR, meaning that as inflation rises, banks' capital adequacy requirements decrease. High inflation increases economic uncertainty, so banks face higher capital requirements. The CPI inflation rate has a negative relationship with CAR, meaning that if inflation rises, banks' capital adequacy requirements decrease. High inflation increases uncertainty in the economy, and banks have more capital requirements

5. Conclusion

The paper contributes to further researchers taking into account the lack of studies within the scope of research on bank capital adequacy in Bangladesh, both at the aggregate and individual levels. New research could examine capital adequacy, disclose potential challenges to regulatory authorities, and raise their awareness of the need for deeper supervisory activities and for prompt amendments to prudential regulations. The main objective of the study is to empirically investigate the determinants of CAR in commercial banks. The study period covered 2010-2020, during which all 59 banks were considered. The study uses secondary data from banks' balance sheet statements and profit-and-loss accounts. Panel data regression is used in this study to analyze the relationships between bank-specific and macroeconomic variables and the capital adequacy ratio. The results show that bank size, equity-to-asset ratio, and earnings on assets had a

significant positive effect on the capital adequacy ratio, whereas nonperforming loans, interest rate spread, credit growth, net interest margin, and inflation rate had negative and statistically significant effects. The results show that bank size, equity-to-asset ratio, and earnings on assets had a significant positive effect on the capital adequacy ratio, whereas nonperforming loans, interest rate spread, credit growth, net interest margin, and inflation rate had negative and statistically significant effects. The commercial banks of Bangladesh, in order to improve the CAR, other than the obvious option of infusing capital, may concentrate on creating greater exposure to higher-rated customers, thereby lowering risk-weighted assets, improving the efficiency of earning assets, which in turn would translate to greater capital build-ups and thereby improvements in the CAR.

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