

# Bank-specific and Macroeconomic Determinants of Profitability: A Study on Commercial Banks of Bangladesh

Jesmin Ara, Mahbuba Aktar, Ayrin Sultana, Rony Kumar Datta, & Ashrafuzzaman Sohag

## Abstract:

The current study is analyzing various factors that determine the profitability of a bank. More importantly, this article has tried to evaluate the relationship between bank-specific and macroeconomic variables with banks profitability. To quantify the profitability of the banking industry of Bangladesh, Return on Equity (ROE) and Return on Assets (ROA) are used as dominated variables. Independent variables are IRS, CAR, NIITA, CR, LTD, DG, SIZE, GDP, INF and NETWORK. Relevant data comes from 30 Bangladeshi commercial banks. Panel data regression result describes Capital Adequacy Ratio (CAR), Total Assets (SIZE) and Inflation (INF) has a positive association with bank profitability in Bangladesh. Credit Risk (CR) has the highest influences on the dependent variables and Non-interest Income to Total Assets (NIITA) has the lowest. The study provides guidelines to the goal setters of financial institutions. It provides a direction for the governing body to formulate and improve relevant policies and the outcomes suggest that banks should manage credit risk and utilize deposits in more productive segments of the economy of the country to ensure sustainable benefits.



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**Introduction:**

The banking industry of Bangladesh is relatively developed than other financial sectors. The banking sector dominates the financial system of this country and it accounts for around 96 percent of the total assets of the financial sector (Mujeri and Yunus, 2009). There are 60 scheduled banks in Bangladesh. Out of them, state-owned commercial banks (SOCBs) are six in number, specialized banks are three, private commercial banks (PCBs) are about 42, and foreign commercial banks (FCBs) are a total of nine (Bangladesh Bank, 2020). As a financial institution, a bank transfers money from surplus unit to deficit unit. That is why the prime task of a bank is to collect deposits from individual or institution having excess money at a decent interest rate and lending to whom are looking for money at relatively higher interest rate than that of depositors. Interest rate is the cost of borrowing from the borrower's point of view and fee of lending from the lender's point of view (Alam and Uddin, 2009).

The difference between the interest rate that banks receive from the loans to customers and the interest rate that the banks provide to depositors is interest rate spread. Usually, banks make a profit from interest of money transfer, investment, and service fees. Notably, about 45% profit of banks obtained from interest rate spread (Owusu-Antwi et al. 2017). That means, a financial institution's profitability of banks vastly depends on the net interest rate spread. Profitability is the capability of a bank to earn more than its expenses. Low-interest rate harms bank performance and squeezes net interest margins (Bikker and Vervliet, 2017). To ensure a sound and sustainable banking sector, bank profitability plays a role of a predominant indicator. The interest rate spread and margins of Bangladesh financial institutes are high because of relatively high administrative costs, non-performing loan ratio, market power, small share deposits, and some other macroeconomic factors (Hossain, 2012). The world economy experiencing a downward interest rate spread since 2000 because of moderate economic growth and a lower rate of return on investment (Bikker & Vervliet, 2017). Though the world and regional standards of interest rate spread remain low, Bangladesh has been practicing a relatively higher interest rate since independence in 1971 (Mujeri and Yunus, 2009). The degree of market competition and interest rate risk are the driving factors of determining interest margin (Robin et al., 2018).

This study explores the relationship between interest rate spread and profitability of the bank. This study also identifies the factors that have an impact on bank profitability. Our study makes notable contributions to bank profitability. This study extends the existing literature by considering interest rate spread (IRS), total assets (SIZE), capital adequacy ratio (CAR) and non-interest income to total assets (NIITA), loan to deposit ratio (LTD), deposit growth (DG), credit risk (CR), inflation (INF), and gross domestic product (GDP) as the driving force of the bank profitability. This paper considers these forces as driving factors of return on assets and return on equity of banking sector that is a novel contribution to the literature.

**Review of literature:**

Bank profitability depends on several factors such as interest rate spread, technology, socio-economic condition, life status of the inhabitants, inflation, etc. So, determining the indicators that affect the profitability of a bank is essential for sustain in the market. Existing studies on bank profitability focus on detecting the determinants of bank profitability and show the relationship of these determinants with bank profitability. Using 25 equity portfolios, Vassalou (2003) developed a model to determine the projected gross domestic product's effect on the equity return. Kosmidou (2008) analyzed the determinants of performance of 23 Greek banks for the time of 1990 to 2002. Brumm (2006) employed an econometric model to determine the relationship between central bank independence and inflation in 49

developing countries. Bennaceur and Goaid, (2008) investigated the financial structure and its impact on banks' interest margin and profitability. Conducting panel data from 18 banks of Pakistan from 2001 to 2010, Raza et al. (2013) examined the determinants that affect banks' profitability. They conducted a dataset from Tunisian banking sector from 1980 through 2000. The study of Bunea et al. (2019) detected the impact of financial factors on return on equity. Their study conducted 1253 companies' sample from the Romanian energy industry.

Besides capital markets income and fee-based income, interest rate spread (IRS) has a major impact on bank money-making. Prior studies determine the relationship between IRS and bank profitability. For instance, Mujery and Younus (2009) analyzed the interest rate spread of 48 banks of Bangladesh. Their study exhibited a negative relationship between the non-interest income to total assets ratio and the interest rate spread. Collins and Wanjau (2011) studied the effect of interest rate spread on the level of non-performing assets of commercial banks in Kenya. To examine the relationship between interest rate spread and non-performing assets, their study used quantitative and qualitative approaches. Sherriff and Amoako (2014) determined the influences of interest rate spread in Ghana by inflation, total deposit and public sector borrowing and treasury bills. Musah et al. (2018) detected the relationship between interest rate spread and bank profitability in Ghana. They measured interest rate spread using net interest income and net interest margin and bank profitability using the return on assets and return on equity of 24 commercial banks. Robin et al. (2018) applied a panel data regression model to determine the financial performance of the commercial banks in Bangladesh. Their study employed bank-level annual data of Bangladesh from 1983 to 2012.

Based on the mentioned above cited literature, the current study identifies the following research gap. Most of the existing studies on the financial performance of the banking sector deal with corresponding factors. That means, there is a scope to further think on the bank-specific factors such as interest rate spread (IRS), total assets (SIZE), capital adequacy ratio (CAR), non-interest income to total assets (NIITA), loan to deposit ratio (LTD), deposit growth (DG), credit risk (CR) and macroeconomic factors such as inflation (INF), and gross domestic product (GDP) those have an impact on the financial performance of banks. To cover this gap, this study will measure the rate of dependency of profitability on these indicators of the banking sector of Bangladesh.

### **Methodology:**

The study investigates the relationship of bank profitability with some bank-specific and macroeconomic variables through quantitative analysis of panel data. Only secondary data is used to analyze the relationship. Relevant data extracts from annual reports of commercial banks and from the official website of Bangladesh Bank's economic statistics department. The researchers use data of 30 scheduled commercial banks of Bangladesh covering eight years ranging from 2012 to 2019. Foreign banks are excluded for data unavailability and they constitute a minimal proportion of Bangladesh's banking sector. Privet commercial banks established after 2012 are also excluded from the sample to maintain data consistency. Data were processed or analyzed by using Stata 13.0.

### **Variables**

Return on assets (ROA) and return on equity (ROE) is representing bank profitability. These variables are the most used variables to measure bank profitability. The researchers use these two variables as dependent variables and the bank-specific independent variables are nterest rate spread (IRS), capital adequacy ratio (CAR), non-interest income to total assets

(NIITA), loan to deposit ratio (LTD), deposit growth (DG), total assets (SIZE), credit risk (CR) and number of branches (NETWORK). Macroeconomic variables are inflation (INF), and gross domestic product (GDP).

**ROA:** Return on assets is the ratio of earnings available for common stockholders and total assets. It measures the efficiency of management in generating profits with the organizations available assets. The calculated value of ROA indicates the company's earnings on each Taka of asset investment.

**ROE:** Return on equity is the percentage showing the earnings on common stockholder's equity. It measures the earning capacity or return of an organization's common stockholders' investment.

**IRS:** Interest rate spread is the weighted average spread between lending interest rate and borrowing interest rate of all branches. Banks have various types of deposit and credit schemes with different interest rates. For this study, monthly interest rate spread data of each bank were collected and then converted into average yearly interest rate spread.

**CAR:** The capital adequacy ratio (CAR) is a regulatory scale (proposed by the Bank for International Settlement in the Basle Accord) that determines a bank's capacity to absorb losses arising from various risks. Banks calculate their CAR based on the Basel II framework using both Tier -I and Tier – II capital requirements. CARs of Tier-I and Tier-II are added to get CAR for the bank.

**NIITA:** Non-interest income of a bank is the income other than interest income from loans or other credit schemes. Non- interest income includes commissions, investments, and service charges and so on. NIITA is the percentage showing how much non-interest income can be earned from the total assets of a bank.

NIITA= Non-interest income/ Total assets

Non-interest income= Investment income + Commission, exchange earnings and brokerage + other operating income

**CR:** Credit risk indicates the percentage of loan loss provision to the total loan amount. The amount of loan loss provision is determined upon anticipated loan default.

**LTD:** The loan to deposit ratio (LTD) is used to measure a bank's liquidity. LTD compares bank's total loans to its total deposits in a certain time. The LTD values express in percentage.

**DG:** Deposit Growth indicates the rate at which the deposit is increasing or decreasing from the previous year.

**SIZE:** It represents the natural log of total assets of a bank. Total assets include current assets and fixed assets. There are sizable differences in total assets among selected banks. Banks have different commencement dates, different ownership, different level of equity capital, different number of customers and different competence.

**GDP:** Gross Domestic Product is total product and services produced within the geographic area of Bangladesh. It is used to explain macroeconomic variables' impact on bank profitability.

**INF:** Inflation is a part of the nominal interest rate where the other part is the real interest rate. It is considered as another macroeconomic variable for this study.

**NETWORK:** Number of Branches of a bank within and outside the country. It is a dummy variable. Banks having more than 100 branches is equal 1 for this study.

Based on these variables, the following regression equations are estimated

$$ROA_{it} = \alpha_0 + \beta_1 IRS_{it} + \beta_2 CAR_{it} + \beta_3 NIITA_{it} + \beta_4 CR_{it} + \beta_5 LTD_{it} + \beta_6 DG_{it} + \beta_7 SIZE_{it} + \beta_8 GDP_{it} + \beta_9 INF_{it} + \beta_{10} NETWORK_{it} + \varepsilon_{it}$$

and also,

$$ROE_{it} = \alpha_0 + \beta_1 IRS_{it} + \beta_2 CAR_{it} + \beta_3 NIITA_{it} + \beta_4 CR_{it} + \beta_5 LTD_{it} + \beta_6 DG_{it} + \beta_7 SIZE_{it} + \beta_8 GDP_{it} + \beta_9 INF_{it} + \beta_{10} NETWORK_{it} + \varepsilon_{it}$$

Where,

i = 1 to 30 banks

t = 2012 to 2019

$\varepsilon_{it}$  = error term

### Result and discussion:

A panel-regression analysis is conducted to determine the effect of bank-specific and macroeconomic variables on the profitability of Bangladeshi commercial banks. The results are presented in Tables 1 and 2.

**Table 1 Regression results for ROA**

ROA	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]	Sig
IRS	.01	.08	0.13	.899	-.147 .167	
CAR	.141	.024	5.90	0	.094 .188	***
NIITA	-.003	.002	-2.01	.044	-.006 0	**
CR	-5.647	3.51	-1.61	.108	-12.527 1.232	
LTD	1.021	.812	1.26	.209	-.571 2.612	
DG	-.013	.165	-0.08	.939	-.336 .311	
SIZE	.057	.247	0.23	.819	-.428 .541	
GDP	-.434	.295	-1.47	.141	-1.013 .144	
INF	.194	.282	0.69	.491	-.358 .747	
NETWORK	.306	.286	1.07	.285	-.255 .868	
CONSTANT	-.096	4.334	-0.02	.982	-8.59 8.398	
Mean dependent var		1.024	SD dependent var		1.695	
Overall r-squared		0.206	Number of obs		239	
Chi-square		59.144	Prob > chi2		0.000	
R-squared within		0.186	R-squared between		0.912	

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

Source: Software output

In Table 1 it is crystal that the  $R^2$  for ROA is 18.6%. It signifies that the independent variables can explain 18.6% of the variations in ROA. The table indicates that IRS, SIZE, CAR, LTD, NETWORK and INF are positively correlated with the return on assets, while NIITA, CR, DG and GDP are negatively correlated. The influence of CR is commensurate with default risk, so the value -5.647 indicates if CR changes 1 unit, ROA will change 5.647 times in opposite direction. Deposit Growth also show negative relation which indicates that banks collect deposits larger than their investment opportunity. During the period 2012-2019, some banks profitability performance was very bad. Negative profitability of these banks affects the profitability of whole banking industry. However GDP of the country increased gradually, the banks profitability will not achieve the standard. As a result, the study finds negative relationship between GDP and bank profitability. Table 1 also shows that only CAR and NIITA are significant under 1% and 5% significance level which indicates that these variables have a greater impact on return on assets.

Table 2 illustrates that  $R^2$  is 0.348 which means the model can describe 34.8% of the variables. The Table shows that nearly half of the variables are significant. That means these variables influence the ROE. IRS, CAR, CR, LTD, DG, NETWORK have a significant influence on return on equity. SIZE, CAR, NIITA, GDP and INF have a positive relation with ROE. IRS, CR, LTD, DG and also Network show negative association. The table crystals that change in CR by 1

unit will negatively change the value of ROE 263.218 times. In recent past, many banks of Bangladesh suffered from negative ROE. It adversely affects other banks profitability. So that, some indicators can't appropriately define the direction of the profitability. Table 2 also shows that *t*-value of capital adequacy ratio is the highest positive (8.12) which means CAR has a greater impact on the return on equity of Bangladeshi commercial banks.

**Table 2 Regression results for ROE**

ROE	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]	Sig
IRS	-1.48	.882	-1.68	.093	-3.21 .249	*
CAR	2.145	.264	8.12	0	1.627 2.663	***
NIITA	.016	.017	0.96	.336	-.017 .049	
CR	-263.218	38.702	-6.80	0	-339.073 -187.363	***
LTD	-15.92	8.956	-1.78	.075	-33.475 1.634	*
DG	-3.215	1.817	-1.77	.077	-6.777 .346	*
SIZE	2.365	2.727	0.87	.386	-2.979 7.71	
GDP	2.726	3.255	0.84	.402	-3.653 9.105	
INF	3.21	3.11	1.03	.302	-2.885 9.305	
NETWORK	-7.648	3.158	-2.42	.015	-13.838 -1.458	**
CONSTANT	-52.109	47.786	-1.09	.276	-145.767 41.549	
Mean dependent var		8.565	SD dependent var		20.647	
Overall r-squared		0.350	Number of obs		238	
Chi-square		122.278	Prob > chi2		0.000	
R-squared within		0.348	R-squared between		0.415	

\*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$

Source: Software output

**Table 3 Descriptive Statistics**

Variable	Mean	Std. Dev.	Min	Max
ROA	1.023	1.691	-7.49	13.43
ROE	8.576	20.604	-259.94	55.38
IRS	4.728	1.675	-1.633	10.239
CAR	11.968	4.874	-29.08	27.26
NIITA	120.5	69.426	1	240
CR	.033	.04	.01	.215
LTD	.833	.161	.09	1.856
DG	.172	.668	-.094	10.404
SIZE	12.354	.606	10.395	14.203
GDP	6.945	.746	6.014	8.153
INF	6.161	.7	5.514	7.53
NETWORK	.688	.464	0	1

Source: Software output

Table 3 summarizes descriptive statistics of all dependent variables and independent variables. The table illustrates the average indicators of variables computed from the financial statements of 30 scheduled commercial banks of Bangladesh from 2012 to 2019. The intention of descriptive analysis is to detect some abnormalities in the dataset before the regression is carried out.

The summary of ROA informs that the average return on assets over the study period is 1.023, the maximum return on assets is 13.43 and the minimum of negative 7.49. The return on assets crystals how efficiently commercial banks are utilizing their assets to generate profit. The average return on assets is higher than the results of Musah et al. (2018) whose study shows an average return on assets of 4.2% and a maximum return on assets of 10%

using a sample of 24 commercial banks in Ghana from 2003 to 2016.

The mean value and maximum value of the second dependent variable, return on equity, are 8.576 and 55.38 respectively. The mean value of ROE seems good as it far outweighs the ROA. However, the average ROE is 8.5, the minimum value is -259.94. That means some banks profitability position was much worsen in previous years. On the independent variables, interest rate spread had a mean score of 4.728% and ranges from -1.633 to 10.239. SIZE has the highest mean value for 12.354 and the lowest mean is 3.3% for Credit risk.

**Table 4 Pairwise correlation coefficient**

Variable	(ROA)	(ROE)	(IRS)	(CAR)	(NIITA)	(CR)	(LTD)	(DG)	(SIZE)	(GDP)	(INF)	(NETW ORK)
ROA	1.000											
ROE	0.378**	1.000										
IRS	0.132**	0.123*	1.000									
CAR	0.327**	0.421***	-0.091	1.000								
NIITA	-0.023	0.158**	-0.042	0.271*	1.000							
CR	-0.144**	-0.306***	-	0.125*	0.054	1.000						
LTD	0.110*	0.119*	-0.006	0.204*	0.142**	0.202	1.000					
DG	-0.014	-0.007	0.021	0.070	0.001	-	-	1.000				
SIZE	-0.148**	-0.111*	-0.055	-	-0.132**	-	-	0.034	1.000			
GDP	-0.142**	0.036	-	0.172*	0.028	0.044	0.246*	0.084	0.410*	1.000		
INF	0.147**	0.023	0.223*	-	-0.003	-	-	-	-	0.858***	1.000	
NETWO RK	0.033	-0.016	0.026	0.009	-0.079	-	-	0.037	0.582*	0.350***	-	1.000

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Source: Software output

The correlation results indicate that ROA and ROE are positively correlated with IRS of commercial banks in Bangladesh. This positive relation is similar to findings from previous studies on correlation results. For instance, Musah et al. (2018) find a positive and strong relationship between profitability and net interest margin using the dataset of commercial banks of Ghana. Notably, capital adequacy ratio has a relatively higher correlation with the profitability of banks. At the 1% significance level CAR is associated with ROA for 3.27% and ROE is 4.21% respectively.

### Conclusion:

Banking industry of Bangladesh is generally large and profit seeking. There are many factors that determine profitability of bank. The paper tries to bring out the relationship between bank profitability with these influential bank-specific and macroeconomic factors like interest rate spread, total assets, capital adequacy ratio, inflation and so on. Data comes from annual reports of 30 commercial banks and the statistics department of the central bank of Bangladesh. The result shows that CAR, SIZE and INF are positively, whereas CR and DG are negatively bonding with ROA and ROE. These results will help the decision making authority in fixing various rates which are streamlined with their organizational goal. It helps banks to

correct their past business ideas of pursuing maximizing interest rate spread because other factors like credit risk (CR), loan to deposit ratio (LTD) have more influence on bank profitability. Other stakeholders can get their essential information about the banking industry. The study uses data from 2012 to 2019 which is the period before the COVID-19 pandemic. Further study is needed to identify the impact of indicators in bank profitability in the pandemic period.

## Reference

- Alam, M. M. and Uddin, M. G. S. (2009). Relationship between Interest Rate and Stock Price: Empirical Evidence from Developed and Developing Countries. *International Journal of Business and Management*, 4(3), 43-51.
- Bennaceur, S. and Goaid, M. (2008). The Determinants of Commercial Bank Interest Margin and Profitability: Evidence from Tunisia. *Frontiers in Finance and Economics*, 5(1), 106-130.
- Bikker, J. A. and Vervliet, T. M. (2017). Bank profitability and risk - taking under low interest rates. *International Journal of Finance and Economics*, 23, 3-18.
- Brumm, H. J. (2006). The effect of central bank independence on inflation in developing countries. *Economics Letters*, 90, 189-193.
- Bunea, O. Corbos, R. and Popescu, R. (2019). Influence of some financial indicators on return on equity ratio in the Romanian energy sector - A competitive approach using a DuPont-based analysis. *Energy*, 189, 116251.
- Collins, N. J. and Wanjau, K. (2011). The effects of interest rate spread on the level of non-performing assets: A case of commercial banks in Kenya. *International Journal of Business and Public Management*, 1(1), 58-65.
- Hossain, M. (2012). Journal of Asian Economics Financial reforms and persistently high bank interest spreads in Bangladesh : Pitfalls in institutional development ? *Journal of Asian Economics*, 23(4), 395-408.
- Kosmidou, K. (2008). The Determinants of Banks' Profits in Greece during the Period of EU Financial Integration. *Managerial Finance*, 34(3), 146-159.
- Le, T. DQ. and Ngo T. (2020). The determinants of bank profitability: A cross-country analysis. *Central Bank Review*, 20, 65-73.
- Molyneux, P. and Thornton, J. (1992). The determinants of European bank profitability. *Journal of Banking and Finance*, 16(6), 1173-1178.
- Mujeri, M. K. and Younus, S. (2009). An Analysis of Interest Rate Spread in the Banking Sector in Bangladesh. *The Bangladesh Development Studies*, XXXII (4), 1-33.
- Musah, A., Anokye, F. K. and Gakpetor, E. D. (2018). The Impact of Interest Rate Spread on Bank Profitability in Ghana. *European Journal of Business Economics and Accountancy*, 6(1), 27-39.
- Nguyen, C. V., Islam, A. M. and Ali M. M. (2010). Bangladeshi Lending-Deposit Rate Spread: An Econometric Analysis. *Global Economy and Finance Journal*, 3(2), 238-246.
- Owusu-Antwi, G., Banerjee, R. and Antwi, J. (2017). Interest Rate Spread on Bank Profitability: The Case of Ghanaian Banks. *Journal of Accounting, Business and Finance Research*, 1(1), 34-45.
- Rahman, D. M. and Akter, K. (2012). Interest rate convergence in Bangladesh. *The International Journal of Banking and Finance*, 9(1), 81-97.
- Robin, I., Salim, R. and Bloch, H. (2018). Financial performance of commercial banks in the post-reform era : Further evidence from Bangladesh. *Economic Analysis and Policy*, 58, 43-54.

- Sheriff, I. and Amoako, G. (2014). Macroeconomic determinants of interest rate spread in Ghana: Evidence from ARDL modelling approach. *Journal of Finance and Bank Management*, 2(2), 115-132.
- Sufian, F. and Kamarudin F. (2012). Bank-Specific and Macroeconomic Determinants of Profitability of Bangladesh's Commercial Banks. *The Bangladesh Development Studies*, 35 (4), 1-28.
- Vassalou, M. (2003). News related to future GDP growth as a risk factor in equity returns. *Journal of Financial Economics*, 68, 47-73.  
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