

Report On  
The Impact of Bank Specific and Macroeconomic Determinants on  
Banks Liquidity: An Empirical Study on Listed Commercial Banks  
in Bangladesh

By

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An thesis report submitted to the BRAC Business School in partial fulfillment of the  
requirements for the degree of  
Bachelor of Business Administration

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## **Declaration**

It is hereby declared that

1. The thesis report submitted is my/our own original work while completing degree at Brac University.
2. The report does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The report does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

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## Letter of Transmittal

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**Subject:** Submission of the project paper on “**The Impact of Bank Specific and Macroeconomic Determinants on Banks Liquidity: An Empirical Study on Listed Commercial Banks in Bangladesh**”

Dear Sir,

It is a great pleasure and an honor for me to submit this project report on “**The Impact of Bank Specific and Macroeconomic Determinants on Banks Liquidity: An Empirical Study on Listed Commercial Banks in Bangladesh**”. This paper is prepared as the BBA program’s partial requirement under the BRAC Business School, BRAC University. I have put my best effort into preparing this report by following thoroughly the guidelines of formal report writing. I have assessed the secondary information of the commercial banks which helped me to gather some real knowledge regarding the country’s banking sector which will certainly help me for my future career advancement. I hope you will find the reflection of my dedicated hard work in this study and will consider unwillingly done mistakes as an upshot of human limitations.

I would like to express my heartiest gratitude to you for providing me with precious advice and appropriate guidelines that helped me to prepare this study thoroughly. I sincerely supplicate you to call me if you perceive further study should be conducted on this thesis.

Sincerely yours,

---

Nishat Tasnova

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Date: 9th September 2021

## **Non-Disclosure Agreement**

N/A

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## **Abstract**

This study examines the influences of bank-specific and macroeconomic determinants on liquidity on 29 listed commercial banks of Bangladesh. To analyze the relationship, this study performs Pooled Ordinary Least Square method, fixed and random effect estimates on strongly balanced panel dataset over the 2014 to 2019. Capital adequacy, nonperforming loans and profitability are considered as bank specific factors while GDP, Monetary policy interest rate, and Interest rate spread are considered the macroeconomic factors. Business cycle and monetary policy interest rate inversely affected bank liquidity. Contrary, bank liquidity has positive association with profitability, nonperforming loans, capital adequacy and interest rate spread. According to the findings, capital adequacy and business cycle have significant impact on liquidity. This study infers that banks need to monitor the factors cautiously to avoid the liquidity crisis in future.

**Keywords:** Bangladesh, Banks liquidity; Bank specific; Macroeconomic; Fixed and random effect; regression analysis

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## List of Acronyms

LIQ	Liquidity
NPL	Non-performing loans
CAR	Capital Adequacy Ratio
ROA	Return on Assets
MIR	Monetary Policy Interest Rate
GDP	Gross Domestic Product
IRS	Interest Rate Spread
ROBOR	Romanian Interbank offer rate
VIF	Variance Inflation Factors
SD	Standard Deviation
FEM	Fixed Effects Model
REM	Random Effects Model
OLS	Ordinary Least Square
GMM	Generalize Method of Moments
REPO	Repurchase Rate
IMF	International Monetary Fund
WDI	World Development Indicator
MENA	The Middle East and North Africa region

## Glossary

Panel Data	Panel data, sometimes referred to as longitudinal data, is data that contains observations about different cross-sections across time. Examples of groups that may make up panel data series include countries, firms, individuals, or demographic groups
Pooled OLS	Pooled OLS is employed when the study selects a different sample for each year/month/period of the panel data. If the study is using the same sample along all periods then study results are correct by now and Fixed or Random effects models are recommended.
Regression coefficients	Regression coefficients are estimates of the unknown population parameters and describe the relationship between a predictor variable and the response. In linear regression, coefficients are the values that multiply the predictor values.
Fixed Effects Model	A fixed-effects model is a statistical model in which the model parameters are fixed or non-random quantities.
Random Effects model	In statistics, a random-effects model, also called a variance components model, is a statistical model where the model parameters are random variables. In econometrics, random effects models are used in panel analysis of hierarchical or panel data when one assumes no fixed effects.

# **Chapter 1**

## **Introduction**

### **1.1. Origin of the Study**

Bank liquidity refers to the banks' ability to meet the financial short-term obligations without having any substantial losses (Ojo, 2010). Liquidity risk occurs when the bank fails to meet adequate liquidity requirements. The increased risk causes a liquidity crisis and banks become unable to encounter their obligations. In the course of the financial crisis, many banks were on the verge of failing to meet the adequate liquidity requirements stated by the Bank for International Settlements (Committee, 2009). To survive in the financial system, banks are required to have an unprecedented amount of liquidity assistance from central banks (Malik & Rafique, 2013). Although the central bank supported extensively, evidence found that a significant number of bank failures and afterward those banks were necessitated to merge or indispensable to resolution. This crisis pushed to convert the market circumstances and consequently demonstrated the significance of maintaining adequate liquidity management.

Banks need to preserve satisfactory liquid assets to respond the demand aroused by the customers immediately with a rational cost. It is the art of bank management to keep liquidity at an optimal level. The entire banking operation is highly dependent on holding a satisfactory level of liquidity since if a particular bank revealed liquidity shortage, the entire banking framework will be affected, according to the bank contagion effect, and eventually, it will result in to increase the systemic risk.

When banks try to achieve the optimal level of liquidity, liquidity becomes exceedingly dependable on some properties like the size of the bank, banking nature and characteristics, banking involvement of complex activities. To manage the liquidity risk, the bank must have

to follow a strict decisional structure, a suitable funding strategy, limiting the risk exposure factors as well as synchronized regulation to arrange liquidity just in case required (Van Greuning & Bratanovic, 2020). It is necessary to have a comprehensible liquidity management policy and a well-defined liquidity control strategy to manage banks' assets, liability as well as liquidity.

The position of the banking system is significantly crucial for growing and developing the economy. The financial institutions of Bangladesh experienced remarkable changes in the past few years as the number of the scheduled bank increased, technological innovation took place and thus it escalated the competition. The modifications demand to improve the performance to continue and compete in the banking industry. Banks of Bangladesh are also in the part of the DSE-30 index and being the market movers, banks contributed to market capitalization. Therefore, maintaining an optimal level of liquidity is the highest concern to create an efficient banking system as well as keep the banks away from insolvency or lower profitability otherwise it will destroy the shareholder's wealth and consequently the whole financial system framework.

This study attempts to address the gap empirically through assessing the bank-specific and macroeconomic factors influencing the liquidity of commercial banks of Bangladesh therefore, constructing a notable addition to the existing literature body as well as showing a strong value of originality. The evidence suggests that banks' liquidity becomes much significant issue and therefore this study aims to identify the influence of liquidity determinants on 29 listed commercial banks of Bangladesh. The paper obtains the following structure: Section 1 incorporates the overview of the banking structure of Bangladesh. The next section presents the literature from empirical evidence. Section 3 focuses on the research methodology and study framework. Section 4 looks into the data interpretation and findings. After that, section

5 deals with the discussion and the results of the study. Finally, the last section is wrapped up with the concluding remarks.

## **1.2. Study Objectives**

### **1.2.1. Broad Objective**

The purpose of the study is to explore the influence of bank-specific and macroeconomic variables on listed commercial banks in the Bangladesh context.

### **1.2.2. Specific Objectives**

- To examine the bank-specific variables on the Bangladeshi commercial banks liquidity
- To investigate the external determinants on the liquidity of listed commercial banks
- To assess the significance of relationships between the internal and macroeconomic variables on the liquidity of scheduled commercial banks of Bangladesh.

## **1.3. Limitations**

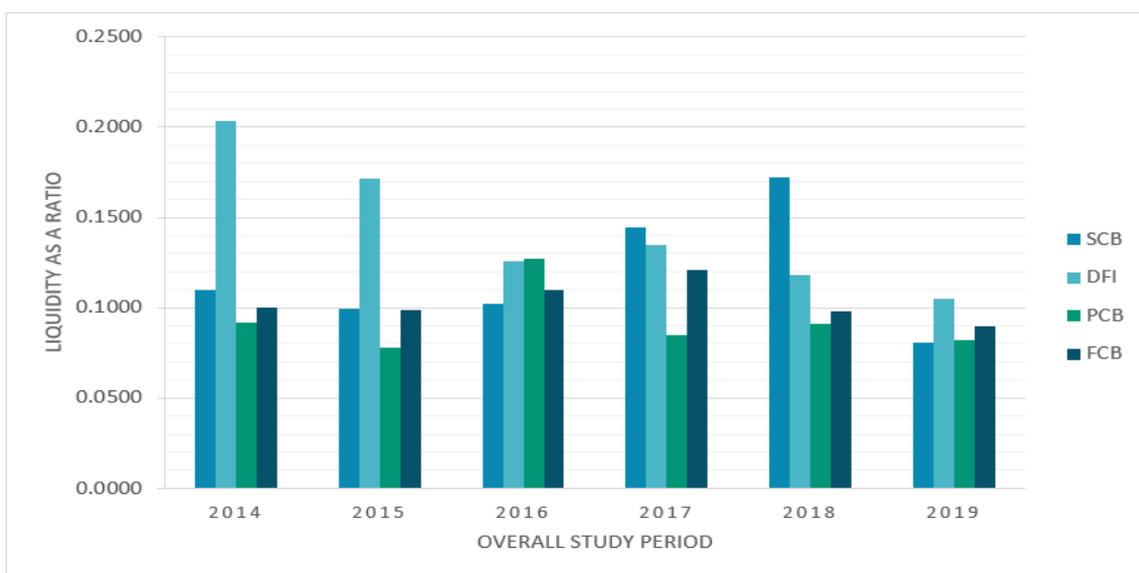
The study considered 6 years' period and could not cover all the listed banks because of either unorganized data or resource constraints. Additionally, more variable inclusion and the rigorous study did not possible due to limited time frame. As this study did not have financial support, therefore, important data access and access to the literature was a barrier to conduct this paper.

## Chapter 2

### Literature Review

#### 2.1. Banks in Bangladesh: An Overview

<sup>1</sup>In 1846, before the independence of Bangladesh, the first bank in Bangladesh was named Dacca Bank, and headquarter was located in Dhaka (Bank, 2012). The bank had limited business operation and was not involved in issuing banknotes. After the independence of Bangladesh (1971), 12 financial institutions took the operation of the banking system and the Government of the People’s Republic of Bangladesh nationalized those banks. The central bank of Bangladesh – Bangladesh bank was established on 7<sup>th</sup> April 1972, after the liberation war of Bangladesh, and is in charge of developing and executing rules and regulations for the



*Figure 1 Liquidity Trend of Commercial Banks in Bangladesh<sup>1</sup>*

financial industry (Mahmood & Islam, 2015). Complying with the Basel accord, the Basel III program was implemented by Bangladesh bank to reduce the shocks of liquidity as well as reinforcing liquidity buffer in opposition to risky investment. Increased capital requirements

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<sup>1</sup> SCB – State-owned Commercial Bank  
DFI – Development Financial Institution  
PCB – Private Commercial Bank  
FCB – Foreign Commercial Bank

strengthen the liquidity base and decrease the bank leverage. Around 50 years of banking operations are taking place in Bangladesh with 60 scheduled commercial banks (Zaman & Rahman, 2018).

## **2.2. Empirical Literature**

A wide range of studies analyzed the impact of macroeconomic and microeconomic variables on banks' liquidity in recent years using numerous statistical techniques. While microeconomic factors include bank-specific determinants and those are under bank managements' control, macroeconomic variables are not under the dominance of bank management and considered as external factors. This study focused on determining the effect of both internal and external factors of the bank on bank liquidity in the Bangladesh context. This section presented a literature summary of bank liquidity on bank-specific and macroeconomic determinants that were studied in past.

Munteanu (2012) examined determinants of liquidity on 27 commercial banks of Romania during pre-crisis (2002-2007) and crisis period (2008-2010). During the crisis year, the empirical results showed that Z-score and bank stability significantly influenced liquidity. Except for loan loss provisions, Tier 1 capital, interbank funding, and impaired loans impacted negatively during pre-crisis on L1 (Net Loans/Total Assets). In the crisis period, Z-score found a positive link nonetheless impaired loans had negative influences over L1. Credit risk rate under macroeconomic variable impacted positively on liquidity. Over the study period, tier 1 capital, loan loss provisions, funding costs, and unemployment influenced positively however ROBOR 3m (months) had negatively influenced L2.

Vodova (2011) explored the macroeconomic and bank-specific determinants on commercial banks of the Czech Republic covering the period of 2001-2009. The author found nonperforming loans, capital adequacy, interbank transaction, the interest rate on loans

positively impacted liquidity. On the contrary, negative influences of the financial crisis, business cycle, and inflation recorded on liquidity. The relationship between bank size and liquidity was found ambiguous.

Similarly, the author examined bank-specific and external factors of commercial banks in Poland during 2001-2010 (Pavla Vodova, 2012). The researcher implemented panel data regression approach on the unbalanced dataset and the empirical results suggest that all the variable significantly impacts on liquidity except money market interest rate. The author found that a higher capital adequacy ratio, rate of inflation, nonperforming loans, loan interest rate (lending rate), and interbank bank transaction increase the liquidity of a bank. In contrast, larger bank size, higher return on equity, increased interest rate margin decrease bank liquidity. However, Lartey, Antwi, and Boadi (2013) investigated the association with the profitability and liquidity over listed commercial banks in Ghana and argued that banks' liquidity has positive influence.

Singh and Sharma (2016) explore the relationship between liquidity and both bank-specific and macroeconomic determinants on 56 banks of India throughout 2000-2013. The study conducted Ordinary Least Square, fixed and random estimates on an unbalanced panel dataset of 816 observations. The findings revealed that return on assets, inflation, deposits and capital adequacy impacted positively and significantly over the bank's liquidity. However, unemployment and the cost of funds insignificantly impacted liquidity. Business cycle and bank size have impacted inversely but significantly on Indian banks' liquidity.

Malik and Rafique (2013) studied determinants of Pakistani banks' liquidity in 2007-2011 covering the Asian financial crisis in 2008. Using a fixed-effect model, the study was conducted over 26 listed commercial banks. NPL, TOA, and monetary policy rate positively

impacted the liquidity whereas inflation impacted negatively on liquidity. However, the study reported negative but significant effects of the financial crisis over banks' liquidity.

Al-Harbi (2017) analyzed key liquidity affecting determinants over 686 conventional banks from OIC countries. He performed fixed effect estimates from the Ordinary Least Square method on an unbalanced panel dataset during 1989-2008. Study results found that capital ratio, foreign ownership, rate of inflation, deposits insurance, credit risk, and monetary policy significantly and negatively impacted liquidity. On the contrary, efficiency, bank size, market capitalization, and off-balance sheet activities have a significantly positive relationship with liquidity. However, concentration showed a positive but statistically insignificant relationship with banks' liquidity.

Al-Homaidi et al. (2019) explored the influences of micro and macro-economic variables of liquidity on 37 listed Indian commercial banks by applying GMM and Pooled OLS model over the 2008-2017 years period. The results showed that from bank-specific variables; capital adequacy ratio, operation efficiency ratio, bank size, deposits ratio return on assets and macroeconomic variables impacted positively and significantly on liquidity nonetheless, asset management ratio, net interest margin and profitability founded significantly negative impact on liquidity. Interest rate and exchange rate from macroeconomic variables significantly affected banks' liquidity. The study suggested that to boost the banks' performance, assets quality needs to be considered carefully.

Lee et al. (2013) investigated on influencing bank-specific and macroeconomic factors of liquidity on 15 commercial banks of Malaysia covering the year 2003-2012. Performing panel data analysis, the study concluded GDP, nonperforming loans, profitability have positive influence whereas capital adequacy, financial crisis, bank size, and interbank impacted negatively. Except interbank, all factors showed significant effects on banks' liquidity.

Tesfaye (2012) explored the impact of bank-specific and macroeconomic variables on liquidity on banks of Ethiopia. Implementing the panel data approach, the author performed a fixed effect model on 8 commercial banks covering the period 2000-2011 and found that nonperforming loans, inflation, capital adequacy, interest rate margin, short-term rate of interest, and bank size impacted positively on banks' liquidity while loan growth and business cycle found statistically insignificant.

Similarly, Melese (2015) conducted a study on 10 Ethiopian commercial banks during 2007-2013 using a balanced fixed-effect model. The outcome revealed that bank size impacted positively while GDP, capital adequacy, and profitability impacted negatively on banks' liquidity. During the study period, the research found no impact of inflation, loan growth, interest rate margin, and nonperforming loans on Ethiopian banks' liquidity.

Rafique et al. (2020) Conducted a study on Pakistani banks from 2006 through 2016 and identified the determinants of macroeconomic and bank-specific factors over banks' liquidity reserve. Through the panel data method, the study implemented random-effects estimates over 20 banks dataset. The study results found that the size of the bank, business cycle, inflation, and credit risk has negative but significant effects on bank liquidity whereas capital revealed insignificant effect. The market competition also considered and showed a positive impact on banks' liquidity reserves.

Al-Qudah (2020) investigated the macroeconomic and bank-specific variables over Jordanian Banks liquidity and analyzed GDP and inflation from external factors, and profitability, CAR, NPLs, deposit growth from bank-specific factors. The study covers 13 scheduled commercial banks over 2011-2018. The author used pooled least square method along with fixed and random estimators along with Hausman and Lagrange multiplier test. The empirical results identified a significantly positive relationship with inflation, capital adequacy, deposit growth

but a negative impact on GDP, nonperforming loans, and bank size. However, profitability reported a negative and insignificant effect on liquidity. The study reported banks to need to carefully overlook economic as well as microeconomic variables to keep required levels of liquidity.

A number of studies also highlighted the macroeconomic and bank-specific determinants of banks' liquidity risk. The researchers found liquidity risk increases during unfavorable economic conditions and when there is a significant gap between the demand and supply.

Ahamed (2021) examined key bank-specific and macroeconomic factors of liquidity risk based on selected commercial banks in Bangladesh. Using the panel data method, the study implemented a fixed effect regression model over 23 listed banks covering the year 2005-2018. The study stated larger banks size have less exposure to liquidity risk and found a negative impact on liquidity. Capital adequacy, return on equity, loan deposit ratio, GDP and domestic credits impacted positively whereas inflation impacted negatively on liquidity risk.

Cucinelli (2013) explored the liquidity risk determinants based on 1080 Eurozone banks using OLS panel data regression technic. The empirical study suggests that larger banks are more exposed to liquidity risk and higher capitalization leads to higher liquidity. Additionally, the study found that higher specialized lending activity showed better funding structure vulnerability.

Jedidia and Hamza (2015) conducted a panel study during 2004-2012 and analyzed the factors of liquidity risk on the Middle East and North Africa region (MENA) and Southeastern Asian Countries' Islamic banks only. The study concluded that profitability affects positively but the bank's investment, capital adequacy ratio, GDP impacted negatively over liquidity risk.

## **Chapter 3**

### **Methodology**

#### **3.1. Data Sources & Samples**

This study examined a panel dataset of 29 out of 61 scheduled Bangladeshi banks for 2014 – 2019. However, to make this dataset strongly balanced, banks with a partial dataset were eliminated. The included banks are state-owned, foreign, conventional private and Islami Shariah banks with 174 observations. The essential bank-specific figures were collected from the financial report of the bank and the data of macroeconomic determinants was collected from World Bank and IMF database. Other secondary information was retrieved from the Bangladesh Bank report.

#### **3.2. Variable Description**

The above literature revealed that the crucial part is to choose suitable explanatory variables. All the selected variables have been taken from previous appropriate studies. The variables that have been chosen, considered economic relevance in Bangladesh's condition. That being the case, this study removed the variables like economic reforms, exchange rates, or political incidents from consideration. Additionally, this study included some factors that might influence the liquidity condition in the banking sector of Bangladesh.

Table 1 Description of the Study Variables

Variables	Notations	Proxy/Calculation	Effect Estimation	Source
<i>Dependent Variable</i>				
Liquidity	LIQ	Cash and cash equivalents over total assets		Annual Reports
<i>Explanatory Variables</i>				
Bank-specific				
Nonperforming loans	NPL	% of classified loans on total assets	-	Annual Reports
Capital Adequacy Ratio	CAR	Tier 1 & Tier 2 Capital over Risk-weighted Assets	+	Annual Reports
Return on Assets	ROA	Profitability	-	Annual Reports
Macroeconomic				
Gross Domestic Product	GDP	Business Cycle	-	WDI
Monetary Policy Interest Rate	MIR	Repurchase Agreement (repo)	-	IMF
Interest Rate Spread	IRS	Gap of Lending Rate and Deposit Rate	-	

Source: Author's own compilation

### 3.2.1. Dependent Variable

#### 3.2.1.1. Liquidity

Banks' liquidity ratio can be estimated as liquid assets (cash and cash equivalents) over total assets (Delechat et al., 2012). Banks provide liquidity whenever demanded by the depositors (Diamond & Rajan, 2001a), and banks need adequate liquidity to conduct their daily operations. This study used liquidity as dependent variable and explanatory variables are considered as the rest of the variables.

## **3.2.2. Explanatory Determinants**

### **3.2.2.1. Bank-specific determinants**

#### **3.2.2.1.1. Non-performing Loans**

Non-performing loans are those defaulted by borrowers due to not making scheduled payments within a specified duration. The views demonstrated in IMF, interest and principal amount are not being paid by a minimum of 90 days period (IMF, 2005). When non-performing loans increase, banks face liquidity problems and vice versa. This study takes the nonperforming loans to total loans ratio to measure nonperforming loans.

#### **3.2.2.1.2. Capital Adequacy Ratio**

The capital adequacy ratio measures the capital availability of banks to absorb unanticipated losses and thus it ensures the level of soundness along with capital solvency. It can work as a buffer against uncertain shocks encountered by businesses (Munteanu, 2012). To handle the unexpected financial distress, Bangladesh bank instructed to keep at least 11.6% CAR as of 2020 (CEIC DATA, 2020). According to Basel III, banks are required to maintain an 8% minimum capital to abstain from bank insolvency (Bateni et al., 2014). The liquidity of a financial institution increases when it keeps a higher level of capital. For this study, core capital (Tier 1) and secondary capital (Tier 2) over risk-weighted assets are considered for capital adequacy ratio.

#### **3.2.2.1.3. Return on Assets**

Return on asset measures a firm's profitability in response to its total assets and it states banks' ability to convert assets into earnings. Return on assets can also be used to measure per dollar of profit from assets perspectives (Ross et al., 1998). This study has taken return on assets as a proxy of profitability. Although the higher ratio of return on assets refers to higher profitability

(Sandhar & Janglani, 2013), it is found by Bonfim & Kim (2012) that, the bank that earns more return likely to have a low liquidity buffer. If a bank's profitability increases, financial institutions tend to invest more in risky projects which may create a liquidity crisis.

### **3.2.2.2. Macroeconomic Variables**

#### **3.2.2.2.1. Gross Domestic Product**

For this study gross domestic product has been taken as a proxy of the business cycle. When the economic growth of a country increases, business and other economic activities demand more money therefore banks' liquidity decreases. On the contrary, when the economy goes downward, business and economic activity shrink hence, the bank holds more liquid assets as it is unable to lend money for the time.

#### **3.2.2.2.2. Monetary Policy Interest Rate**

This study considered the repurchase rate (Repo) as the monetary policy interest rate. When Bangladesh bank lends money to other commercial banks in case of liquidity shortage that is known as repo rate. By increasing or decreasing this rate, the Bangladesh bank manages the money supply and control inflation (Bekaert et al., 2013). When the central bank decides to control inflation, it increases the repo rate, therefore the cost of bank loans increases hence, demand for money decreases. On the contrary, when the central bank decreases the rate, there is more money supply in the market that helps to expand economic growth.

#### **3.2.2.2.3. Interest Rate Spread**

The difference between the rate bank reimburses to its creditors and the rate bank collects from loans to clients can be stated as interest rate spread. This study considered lending rate subtract deposit rate as interest rate spread. It is often interpreted as banks profitability and denotes characteristics of market microstructure for the banking sector (Ngugi, 2001). Banks with risk

aversion tend to have a lower spread than that of risk-neutral commercial banks because bank interest rate upraises with risk aversion hence it decreases the supply of credit (Ng’etich Joseph Collins, 2011).

### 3.3. Conceptual Framework and Hypothesis

#### 3.3.1. Study Framework

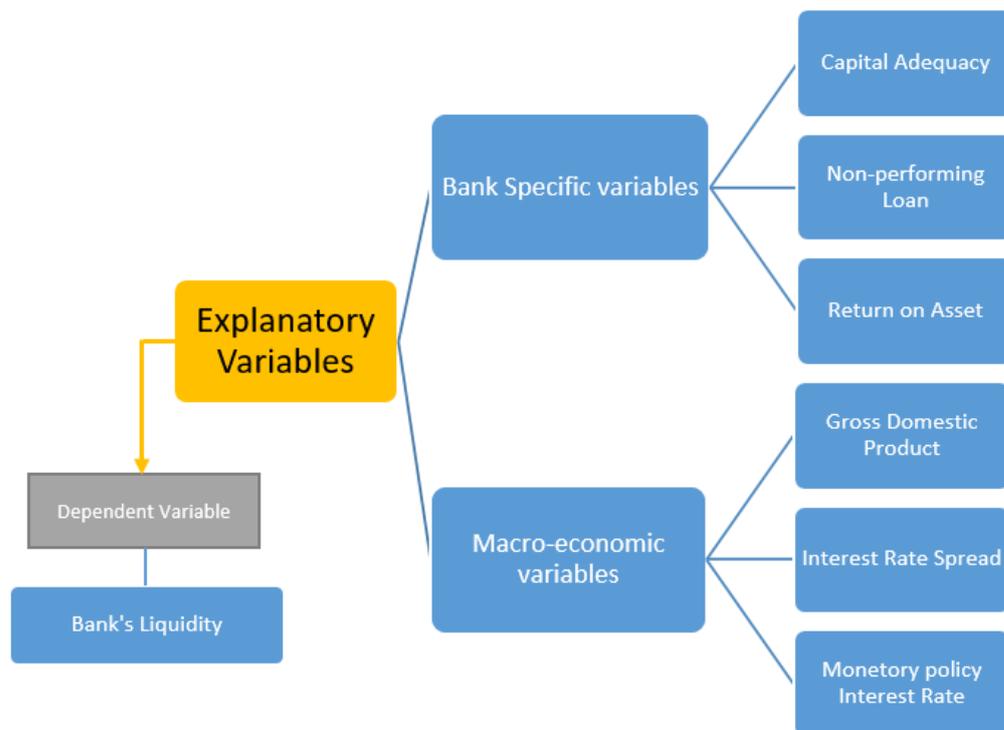


Figure 2 Framework of the Study

### 3.3.2. Generation of Hypothesis

From the above literature thus the study can hypothesize that:

H1	There is a positive relationship between capital adequacy and banks' liquidity
H2	There is a negative relationship between the non-performing loans and banks' liquidity
H3	There is a negative relationship between the return on assets and banks' liquidity
H4	There is a negative relationship between the gross domestic product and banks' liquidity
H5	There is a negative relationship between the interest rate on loans and banks' liquidity
H6	There is a negative relationship between the monetary policy interest rate and banks' liquidity

### 3.4. Model Specification and Econometric Framework

To explore the impact of explanatory variables on Bangladeshi banks liquidity, the following equation is formulated:

$$LIQ_{it} = \beta_0 + \beta_1 NPL_{it} + \beta_2 CAR_{it} + \beta_3 ROA_{it} + \beta_4 GDP_{it} + \beta_5 MIR_{it} + \beta_6 IRS_{it} + \epsilon_{it}$$

Where  $\beta_0$  is the intercept and  $\beta_1$  to  $\beta_6$  are the coefficients of determinants,  $\epsilon$  indicates error term.

'i' = Number of banks (1, 2, ... ,29)

't' = Timespan (1,2, ... ,6)

Where,

LIQ = Liquidity

NPL = Nonperforming Loans

CAR = Capital Adequacy Ratio

ROA = Return on Assets

GDP = Gross Domestic Product

MIR = Monetary Policy Interest Rate

IRS = Interest Rate Spread

### **3.5. Data Analysis Technique**

This empirical study analyzes dependent and independent determinants from the period of 2014 to 2019 for commercial banks in Bangladesh. Panel Multiple Linear Regression method is used as the dataset contains both cross-sectional and time-series combinations. Nonetheless, regression of cross-sectional and time-series expected to correspond towards residuals and Pooled Ordinary Least Square method will be inconsistent and the outcome will be biased. Panel data regression model is preferred as the dataset of this study contains individual and common behaviors, more variability, and degree of freedom. Stata 13.0 software package was used to estimate the model.

This study implemented Pooled OLS method for diagnosing the existence of multicollinearity problems by testing Variance inflation factors. Further, a correlation matrix was conducted to examine whether two independent variables are highly correlated or not. The model of the study applied both fixed-effect estimates and random effect estimates. After that, the Hausman test was performed to compare FEM and REM to find the consistency of a suitable estimator. To check the heteroscedasticity in the dataset, the Breusch-Pagan test of heteroscedasticity has

been conducted in the linear regression model to check whether the error term variance depends on any of the predictor variables. This micro panel dataset contains time elements therefore Wooldridge test has been used to detect serial correlation. As the dataset has both heteroscedasticity and autocorrelation problems, therefore, robust cluster standard errors are applied as it automatically corrects heteroscedastic and autocorrelated disturbances of the dataset.

## Chapter 4

### Findings and Data Interpretation

#### 4.1. Descriptive Statistics

The basic information of the dataset and the behavior of the data set over study period is illustrated on descriptive statistics. The table of descriptive statistics summarizes the variables, total observations, maximum values, minimum values, and the value of standard deviation.

*Table 2 The Summary of Dataset*

Variable	Obs	Mean	Std. Dev.	Min	Max
LIQ	174	.113	.034	.057	.25
NPL	174	.073	.063	.021	.353
CAR	174	.124	.018	.076	.179
ROA	174	.009	.005	-.011	.024
GDP	174	.072	.007	.061	.082
MIR	174	.058	.024	.006	.072
IRS	174	.034	.005	.028	.042

Source: Author's own calculation using Stata 13.0

The results of descriptive statistics contain dependent and independent variables and each of which contains 174 observations from 29 banks over the period of 2014-2019. The table shows that the minimum value of dependent variable liquidity has 5.7% whereas the maximum value is around 25% with a mean of 11.3%. The standard deviation for liquidity is nearly 7.8% which indicates the spread from the mean. The independent variable non-performing loans (NPL) has moderate variability a maximum value of 35% and a minimum value of 2.1% with a mean of 7.3% and 6.3% disparity. The capital adequacy ratio (CAR) has a low variability with a least value of 7.6% and highest value of 17.9% and a standard deviation of 1.8%. In this study period, CAR has an average of 12.4% which is higher than the minimum percentage of 11.6% set by the Bangladesh bank. Return on asset (ROA) indicates the bank's profitability over the study period and it records a least value of -1.1% and the highest value of 2.4% with a mean of 0.9% and standard deviation of 0.5%. Gross Domestic Product (GDP) has a 7.2% mean and 0.7% of

standard deviation and values are ranging from 6.1% to 8.2%. Finally, indicators of Monetary policy interest rate (MIR) and Interest rate spread ranges from 0.6% to 7.2% and 2.8% to 4.2%.

## 4.2 Correlation and Multicollinearity Diagnostics

### 4.2.1 Correlation Matrix

The correlation matrix examines whether two independent variables are highly correlated or not. It cannot be accepted if two independent variables have high collinearity (Singh & Sharma, 2016). A multi-collinearity problem occurs if the two independent variables are highly correlated with each other because statistically, it undermines the significance of an independent variable (Mansfield & Helms, 1982). It creates difficulties to declare a particular variable significant although it has a strong relationship with other variables. Such variables are recommended to be exempt to become free from high correlation coefficients (AL-QUDAH, 2020).

*Table 3 Matrix of Correlation*

Variables	LIQ	NPL	CAR	ROA	GDP	MIR	IRS
(1) LIQ	1.000						
(2) NPL	-0.031	1.000					
(3) CAR	0.187	-0.389	1.000				
(4) ROA	0.106	-0.439	0.291	1.000			
(5) GDP	-0.146	0.132	0.298	-0.303	1.000		
(6) MIR	0.089	-0.112	-0.142	0.186	-0.581	1.000	
(7) IRS	0.097	-0.068	-0.181	0.112	-0.290	0.418	1.000

Source: Author's own calculation using Stata 13.0

This study data shows no multicollinearity between any independent variables as no values of the correlation coefficient is higher than cut off level 80% (Kennedy, 2008). Table 3 shows the highest collinearity between monetary policy interest rate (MIR) and gross domestic product (GDP) is 58%, which is less than 80% level hence, this balanced panel dataset is free from multicollinearity.

### 4.2.2 Variance Inflation Factor (VIF) Test

The variance inflation factor diagnoses collinearity for multiple regression model (Craney & Surles, 2002). VIF indicates how the variance of bank-specific and macroeconomic independent variables is inflated by another predictor variable with its correlation. The multi-collinearity problem occurs if the VIF of any variable exceeds 10 (O'brien, 2007). Table 4 shows the VIF of all the explanatory determinants is below the cut off value of 5 (cut-off). Tolerance level is identified by the reciprocal of VIF (Miles, 2014).

*Table 4 Variance Inflation Factor*

	VIF	1/VIF
GDP	1.896	.528
MIR	1.693	.591
ROA	1.609	.622
CAR	1.546	.647
NPL	1.473	.679
IRS	1.264	.791
Mean VIF	1.548	.

Source: Author's own calculation using Stata 13.0

Table 4 shows the tolerance value of predictor variables exceeded statistical cut-off tolerance of 0.10 and all the explanatory variables values are within the VIF standard of  $0.05 < \text{VIF} < 5$  hence, the multi-collinearity problem is absent.

### 4.3 Heteroscedasticity Test

Breusch-Pagan test of heteroscedasticity has been conducted in the linear regression model to check the joint significance of all the coefficients in the model and whether the error term variance depends on any of the predictor variables (Baum & Wiggins, 1999). The outcomes are:

Variables: NPL CAR ROA OE GDP MIR IRS

$$F(7, 166) = 2.64$$

$$\text{Prob} > F = 0.0130$$

It is focused on whether or not the coefficients on predictor variables are jointly significant when regression has run. In this test, the null is that those coefficients are zero (0) which would correspond to a homoscedastic error term without variability therefore, changes in that error variance cannot be predicted. The F statistics is 2.64 and the associated p-value is below 0.02 (cut off 5%), so null that those coefficients are 0 can strongly be rejected. Therefore, it has predictability in that error variance and evidence of heteroscedasticity.

#### **4.4 Autocorrelation Test**

This panel data has diagnosed autocorrelation test to identify whether there is a serial correlation. This micro panel dataset contains time elements, therefore, the Wooldridge test has been used to detect whether there is a higher value of R-squared and smaller standard errors of coefficients in comparison to the actual value. The test results is shown below:

$$F( 1, 28) = 17.357$$

$$\text{Prob} > F = 0.0003$$

The alternative hypothesis states there is an existence of first-order correlation and the outcome shows 0.03% probability which means we fail to accept the null hypothesis as it is below the level of significance. The result concludes the serial autocorrelation problem in the model.

#### **4.5 Regression Analysis**

After conducting the Pooled OLS (*Appendix A*) and multicollinearity test, to select the most appropriate regression between the fixed-effect model (FEM) and random effect model (REM), this study conducted the Hausman test to decide which test to diagnose for this econometric model. The results of the random effect concluded that CAR and GDP significantly affected banks' liquidity (*Appendix B*). Although the impact of NPL, CAR, ROA, and IRS was positive, GDP and MIR impacted negatively on liquidity. Results indicate an insignificant effect of NPL, ROA, MIR, and IRS on liquidity. Fixed effect estimates found dissimilar results than that of

random effect estimates. Even though FEM demonstrates similar results as REM that NPL, CAR, ROA, and IRS impact positively, MIR and GDP impacted negatively on liquidity (*Appendix C*). FEM estimates except for GDP, all other variables have an insignificant effect on bank liquidity. R-squared for REM is higher than the FEM which indicates model fitness.

#### 4.6 Hausman Specification Test

To determine the effects of individuality on fixed or random effects this study diagnosed the Hausman test. *Appendix 2* and *Appendix 3* contain both of the regression outcomes. The equation of the Hausman test is  $\chi^2(7) = (\mathbf{b}-\mathbf{B})'[(\mathbf{V}_b-\mathbf{V}_B)^{-1}](\mathbf{b}-\mathbf{B})$ . This test decides whether coefficients and fixed or random estimates are statistically indifferent.

*Table 5 Hausman Specification Test*

	Coef.
Chi-square	8.697
P-value	.275

*Source: Author's own calculation using Stata 13.0*

Hausman test suggests a random effect estimator over fixed effect estimator as the p-value of the test is .275, which is more than 0.05 level of significance. Therefore, this study accepted the null hypothesis, least-square models of random effect (REM) as an appropriate model.

#### 4.7 Robust cluster Random Effect Regression Outcome

The above outcome manifests that the dataset is free from multicollinearity problems but heteroscedasticity and serial autocorrelation remain in this strongly balanced panel dataset. Hence, robust cluster standard errors for the random effect regression model is applied as it automatically corrects heteroscedastic and autocorrelated disturbances of the dataset.

Table 6 Regression Outcome

LIQ	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NPL	.031	.05	0.62	.535	-.067	.128	
CAR	.306	.144	2.12	.034	.023	.589	**
ROA	.761	.945	0.81	.421	-1.091	2.612	
GDP	-.9	.517	-1.74	.082	-1.912	.113	*
MIR	-.039	.077	-0.50	.618	-.19	.113	
IRS	.408	.262	1.56	.12	-.106	.921	
Constant	.074	.05	1.48	.14	-.024	.172	
Mean dependent var		0.113	SD dependent var		0.034		
Overall r-squared		0.179	Number of obs		174		
Chi-square		19.662	Prob > chi2		0.006		
R-squared within		0.095	R-squared between		0.285		

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

Source: Author's own calculation using Stata 13.0

Table 6 shows the findings from robust cluster standard errors of random effect regression model and it reveals:

$$\text{LIQ} = .074 + .031 \text{ NPL} + .306 \text{ CAR} + .761 \text{ ROA} - 0.9 \text{ GDP} - 0.039 \text{ MIR} + 0.408 \text{ IRS}$$

The output of robust cluster random effect is statistically significant as it shows 0.6% that is below the threshold 5% level of significance. There is a 17.9% variation in liquidity indicated by r squared. Empirical findings point up that at the 5% level of significance, CAR has a positive impact nonetheless GDP has a negative impact on bank liquidity. Insignificant but positive impact has found on non-performing loans, return on assets and interest rate spread, by contrast, monetary policy interest rate impacted negatively on liquidity.

## Chapter 5

### Discussion

Although this study expected a negative influence of non-performing loans on bank liquidity, the results reveal a positive but insignificant influence with a coefficient of 0.031 and a p-value of 0.535. The outcome exhibits banking sector of Bangladesh is highly concerned with credit risk and therefore they maintain a strong risk management policy. The findings are in harmony with studies (Malik & Rafique, 2013), (Pavla Vodova, 2011), (Moussa, 2015). Banks are acting cautiously to offset the credit risk (Pavla Vodova, 2011).

The capital adequacy ratio exhibits a significantly positive statistical impact with a coefficient of 0.306 and a p-value of .03. The finding shows the liquidity of bank increases when the bank holds more capital to handle unanticipated customer demands, losses, or before being insolvent. The result is consistent with Vodova (2011), Tesfaye (2012), Laurine (2013) and Vodová (2013). When the bank has a capital buffer, it can absorb losses and become less fragile (Diamond & Rajan, 2001b). Risk absorption theory states a positive relationship with bank liquidity (Berger & Bouwman, 2009). This inferred that liquidity creation is impacted by higher capital levels and holding a high level of capital declines anticipated debt obligations.

Return on assets impacted positively but insignificantly with the coefficient of 0.761 and p-value of 0.421. The findings imply that more profitable commercial banks of Bangladesh have more liquidity bank holds. In accordance with the researchers' expectations, the relationship between a bank's profitability and liquidity is positive and the outcomes exhibited by Vodová (2013), Al-Homaidi et al. (2019), and Ahamed (2021). When the bank invests more in risky projects, it increases the probability of earning more profit. Therefore, an adequate liquidity buffer is highly required to handle the risk involved in investment (Singh & Sharma, 2016).

With the probability of 0.08 and coefficient of -0.9, GDP has impacted significantly at a 10% level of significance but negatively on the banks' liquidity. The findings share similarities with most researchers Aspachs et al. (2005), Pilbeam (2018), Bordo et al. (2001), Lee et al. (2013), Paineira (2010), Vodova (2011). According to this study's anticipations, the business cycle is inversely related to liquidity. This is because when economic expansion takes place, the borrowers demand more loans from the bank. Banks, in contrast, try to satisfy the increasing demands of borrowers and encounters liquidity shortages. When economy goes to downward, banks hold higher portion of liquid assets due to less demand of loan request. However, Bunda & Desquilbet (2008), S. Bhati et al. (2015), Ahmad & Rasool (2017), Moussa (2015), found positive relationship between GDP and liquidity.

The regression results found that monetary policy interest rate has a negative and insignificant impact on the bank liquidity. This result is symmetrical with standard inferences in the literature due to the stringent effect of monetary policy on the bank (Vodová, 2013), (S. S. Bhati & De Zoysa, 2012), (Al-Harbi, 2017), (Laurine, 2013), (Valla et al., 2006), (Chen et al., 2014), (Malik & Rafique, 2013). Tighten monetary policy environment reduces money supply as the central bank increases federal funds rate and sell securities, liquidity reserve in banking system declines. Thus, the fed takes this step to slow down inflation.

The result of Interest rate spread infers that an increase in the interest rate spread positively increases liquidity. The coefficient of 0.408 indicated that if IRS increases by 1%, liquidity will increase by 40.8% considering the ceteris paribus condition. The outcome is quite unexpected as it represents that banks are not encouraged to lend money when there is a higher interest rate spread preferably bank holds more liquid. Yet, similar outcomes are depicted by Tesfaye (2012), Melese (2015), Vodova (2012), Subedi & Neupane (2013). This is in line with the credit crunch and credit rationing problem, which means credit markets are having sudden but serious fund crises and limiting the lending activity as banks are alarmed of being bankrupted.

However, with a p-value of 0.12, the result is not statistically significant and this confirms the findings of Vodova (2011), Melese (2015).

## Chapter 6

### Conclusion

The study aimed to assess the bank-specific and macroeconomic determinants influencing the commercial banks liquidity of Bangladesh. To conduct the study, this paper implemented panel data regression analysis for liquidity and the study depicted that external factors have the most effect on liquidity. Nonetheless, these studied indicators impacted positively in some cases and negatively in others based on the microeconomic and macroeconomic environment.

To summarize the results, the study presented that the liquidity of Bangladeshi commercial banks has a positive influence on CAR and it indicates increased CAR leads the way to higher liquidity. The outcome is consistent with the Basel III accord and shares similarities with other studies for instance Alger and Alger (1999), Vodová (2013), Tesfaye (2012), Vodova (2011). Notwithstanding, Lee et al. (2013), Munteanu (2012) contradicted the findings. When banks keep a higher CAR, it is expected that banks will have a better position to absorb the liquidity shock thus it provides greater safety for the banks. Additionally, Horváth et al. (2014) stated higher liquidity reserve leads to greater distance from bank insolvency and exhibits the presence of a snowball effect in support of stringent capital requirements.

Increased economic growth enhances the business and other economic activities that lead to a decrease the liquidity as other economic activities demand more money. This study shows that the business cycle influenced negatively the bank liquidity. Singh and Sharma (2016) also shared similarities with findings. This is due to borrowers demand more loans from banks in the condition of the growing economy. Banks, in contrast, try to satisfy the increasing demands of borrowers and encounters liquidity shortages.

Apart from the above-mentioned variables, this paper examines the association of bank liquidity with NPL, ROA, MIR, and IRS. The study depicted bank liquidity increases with higher NPL, ROA, and IRS while MIR had a negative influence over bank liquidity. Nevertheless, there is no study that examines these determinants with liquidity in the Bangladeshi context. This remarks the significance of the present paper as this study put an attempt to analyze bank-specific and macroeconomic determinants with bank liquidity in the Bangladeshi context has not been conducted before.

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## Appendix A. Pooled OLS

### Linear regression

LIQ	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NPL	.025	.046	0.54	.589	-.065	.115	
CAR	.7	.168	4.18	0	.369	1.031	***
ROA	.745	.652	1.14	.255	-.543	2.033	
GDP	-1.277	.456	-2.80	.006	-2.178	-.377	***
MIR	-.063	.131	-0.48	.633	-.322	.196	
IRS	.485	.523	0.93	.355	-.547	1.518	
Constant	.023	.044	0.51	.613	-.065	.11	
Mean dependent var		0.113	SD dependent var		0.034		
R-squared		0.200	Number of obs		174		
F-test		5.928	Prob > F		0.000		
Akaike crit. (AIC)		-704.516	Bayesian crit. (BIC)		-679.243		

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

## Appendix B. Random Effect Estimates

### Regression results

LIQ	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NPL	.031	.045	0.68	.494	-.058	.119	
CAR	.306	.151	2.03	.042	.011	.601	**
ROA	.761	.594	1.28	.2	-.403	1.924	
GDP	-.9	.329	-2.74	.006	-1.544	-.256	***
MIR	-.039	.091	-0.42	.673	-.217	.14	
IRS	.408	.367	1.11	.266	-.311	1.127	
Constant	.074	.036	2.03	.042	.003	.145	**
Mean dependent var		0.113	SD dependent var		0.034		
Overall r-squared		0.179	Number of obs		174		
Chi-square		21.059	Prob > chi2		0.004		
R-squared within		0.095	R-squared between		0.285		

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

## Appendix C. Fixed Effect Estimates

### Regression results

LIQ	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NPL	.045	.05	0.90	.37	-.053	.143	
CAR	.17	.161	1.05	.294	-.149	.488	
ROA	.552	.633	0.87	.385	-.7	1.804	
GDP	-.808	.328	-2.46	.015	-1.458	-.159	**
MIR	-.029	.09	-0.32	.748	-.208	.15	
IRS	.403	.365	1.10	.272	-.319	1.125	
Constant	.099	.038	2.60	.01	.024	.174	**
Mean dependent var		0.113	SD dependent var		0.034		
R-squared		0.100	Number of obs		174		
F-test		2.193	Prob > F		0.001		
Akaike crit. (AIC)		-868.088	Bayesian crit. (BIC)		-842.815		

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

## Appendix D. Hausman Test Difference

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	Fixed	Random	Difference	S.E.
NPL	.0446377	.0308681	.0137695	.0206119
CAR	.169534	.3060119	-.1364779	.0567621
ROA	.5516122	.7605326	-.2089204	.220282
OE	.062588	.0912239	-.0286359	.0183301
GDP	-.808156	-.8995898	.0914338	.
MIR	-.0290968	-.0385117	.0094149	.
IRS	.4029651	.4077771	-.004812	.
	---- Coefficients ----			

