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Risk Management in Banks: Its Relationship with the Financial Performance of Commercial Banks in Bangladesh considering all Internal and External Factors

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ABSTRACT

Risk management is an essential element of bank and financial intermediation. Failure to effectively evaluating and managing the risks factors may lead to losses that threaten the health of the bank and the sustainability of the entire financial system. Most of Bangladesh's commercial banks have their own guidelines and procedures for managing the core risk areas i.e. Credit Risk, Market Risk, Operation Risk and Liquidity Risk to ensure the bank's sustainable development and manages all risks factors.

This study analyzes the impact of risk management factors on the financial performance of commercial banks operating in Bangladesh both in the short run and long run considering internal and external control factors. This study also review the existing risk management related policies, guidelines and practices in commercial banks operating in Bangladesh. After reviewing risk management related theories, Bangladesh Bank policies and guidelines related to risk management and empirical literatures, this study identify dependent variables as return of asset (ROA) and return on equity (ROE) as proxy of financial performance and independent variables including log of non-performing loan ratio (LnNPLR) as proxy of credit risk, log of net interest margin (LnNIM) as proxy of interest rate risk, log of foreign exchange gain/ losses (LnFexGL) as proxy of foreign exchange risk (both are component of market risk of the banks), loan to deposit ratio (LDR) as proxy of liquidity risk and log of cost to income ratio (LnCIR) as proxy of operational risk. This study include proxy variable related to type of banking operations in Bangladesh, i.e. Islamic banking or Conventional banking operation in to the econometric models. This study also includes Herfindahl–Hirschman Index (HHI) as proxy of within banking industry concentration control variable and GDP Growth Rate & Inflation Rate as proxy of macro-economic variables into the econometric models. The econometric models have been developed to examine both long run and short run effect of the independent variables on the dependent variables to establish the research questions.

The secondary data has been accumulated from the annual reports of all the local commercial banks operating in Bangladesh during the study period, i.e. from 2014 to 2019. After panel data set validation, this study used STATA – 12 version to test long term and short term impact of dependent variables on the independent variables to check the impact of risk factors on the financial performance of local commercial banks operating in Bangladesh during the period. To check the long run effect of the dependent variables on the independent variables, this study examine the output of both random effect

GLS regression model and fixed effect regression model for all the econometric models. Hausman Test result has been used to determine the appropriate model for analyzing long run effect of the econometric models. Two step system GMM model has been used to check the short run impact of the dependent variables on the independent variables for all the econometric models.

The empirical output of the econometric models shows that, the credit risk has a negative impact on both the dependent variables, i.e., the financial performance of commercial banks operating in Bangladesh during the study periods both in the long run and short run, which is also consistent with the statistical assumption of this study. So, when the credit risk of a commercial bank operating in Bangladesh increases the financial performance of the banks decreases. Both the long-term and short-term financial performance of commercial banks operating in Bangladesh during the research periods were positively impacted by the interest rate risk, which is also consistent with the study's statistical assumption. The other factor of market risk, i.e. foreign exchange risk showed negative correlation with ROA but positive correlation with ROE in the long run while positive correlation with both the dependent variables, i.e. financial performance of commercial banks operating in Bangladesh during the study periods in the short run means inconsistency with the statistical assumption of this study. So, we can summarized that, foreign exchange risk has negative correlation with ROA but have positive correlation with ROE in the long run while has positive correlation with both ROA & ROE, i.e. the financial performance of commercial banks operating in Bangladesh in the short run considering all the bank specific control factors, banking industry concentration control factors and macro-economic control factors in to the model. The foreign exchange risk behaves differently in the long run with two dependent variables, i.e. ROA and ROE due to different types of dividend payout policies and capital management policies of the commercial banks operating in Bangladesh, which may have influence on the ROE ratio calculation techniques for the Banks. The liquidity risk has positive impact of both the dependent variables, i.e. financial performance of commercial banks operating in Bangladesh during the study periods both in the long run and short run which is also in line with the statistical assumption of this study considering all the bank specific control factors, banking industry concentration control factors and macro-economic control factors in to the model. So, when the liquidity risk of a commercial bank operating in Bangladesh increases the financial performance of the banks also increases. Last but not least, operational risk has a negative effect on both the dependent variables, i.e., the financial performance of commercial banks operating in Bangladesh during the study periods, both in the long run and short run, which is also consistent with the statistical hypothesis of this study considering all the bank specific control factors, banking industry concentration control factors and macro-economic control factors in to the model. So, when the operational risk of a commercial bank operating in Bangladesh increases the financial performance of the banks decreases.

1.0 Introduction

Risk is described as an incident that can make disruption in the way of accomplishment of specific objectives. The type of risk occurring in a specific situation may depend on internal factors or external factors. Risk management is a measure used in the detection, review and subsequent response to a specific threat. It is a continuous process and a useful tool in decision-making. According to the "HEFCE", managing risk is not only minimizing the chances of adverse incidents, but also to increase the chances of positive things.

Risk- taking is an important part of banking and financial intermediation. Failure to effectively evaluati-

ng and managing risk may be directed to losses that threaten the health of each financial institution and the stability of the whole structure of the financial system. The competition between the Bangladeshi banking companies has greater than before due to adoption of new and multifaceted platforms in technology and services. As a result, the risk in the banking sector of Bangladesh was significantly higher than it had been before. To effectively operate as internationally recognized banks, to upgrade the financial soundness metrics for the banks up to satisfactory standards and to sustain financial constancy in the Bangladeshi banking industry, it is essential to ensure corporate risk management culture and practices.

Risk is an unanticipated unpredictability / inconsistency of profitability (Holton, 2004). Risk includes market, liquidity, operational & credit risk, which are main causes for the unpredictability of profitability (Tafri et al., 2009 & Dimitropoulos et al., 2010). The assumption is that, risk factors of a Bank influence the volatility of the financial performance, if not addressed properly. All Banks faces many risks including credit risk, risk of liquidity, market or price risks, operational risk, adherence and legal risk and strategic risk etc.

Credit risk management strategies of Commercial Banks established decision-making mechanisms, which are related to minimizing exposures in the non-performing credit assets and loan loss provision. The Basel Committee of Banking Supervision notes that, the bank risk management issues reduce the possibility of the bank when creditor or counterparty is not being able to fulfill its obligations under the agreed terms (BCBS 2003). The market risk includes the possibility of financial losses as a result of market price fluctuations.

Liquidity risk in commercial banks is characterized as an incident to fulfill the proviso or increases finance in acquisitions, as it come due without inacceptable losses and expenses (Ismail, 2010). Also, it can be considered as an asset risk. The inability to fulfill current cash commitments in a timely and cost-effective manner might have a negative impact on the interests of the bank's customers and other stakeholders, which raises the liquidity risk. Successful capital management ensures that, adequate cash reserves to be retained to minimize liquidity risk and as many funds as possible to be invested to optimize profits.

Tabari et al., (2013) stated that the protection of the banking industry depend on the capital adequacy and profitability of the bank. In market-based banking system, financial performance is a factor that explains the competitive position of the banks and its management approach. This factor helps the banking sector survive from some of the risks in the short term level. Risk management, size, location and time will influence the profitability of the Bank (Haslem, 1968

Bangladeshi Commercial Banks use a broad variety of techniques & methods to counter and minimize any risk factors in banking operations. Banks put the greatest emphasis on development, sustain and update the risk management infrastructure, processes and procedures. To develop the ability and skills of relevant banking professionals to effectively manage the risk, adequate resources allotted to commercial banks in Bangladesh. Policies and procedures will be accepted and reviewed annually by their respective Boards, so that it can be sufficient enough to properly and reliably handle and minimize risks. The Board of Directors of Commercial Banks will be solely responsible for approving all the related policies and guidelines for successful risk management practices in the bank. To determine the competence of the structure and make sure that the bank works as per approved structures & guidelines, the board and its committees including Audit Committee and Executive Committee develop guidelines and limits to evaluate and track different risks in banking operations. Management committees also monitor and

ensure the development of appropriate risk management programs, such as Asset Liability Committee (ALCO) and Credit Risk Management Committee etc., and implement them regularly to protect the bank's interests.

1.1 Research Question

Core risk factors play a significant role in the financial performance of banks. This study realized that the relationship between risk management and financial performance of commercial banks was of great importance. And there is very limited research found, that could clearly explain the relationship of all risk factors and financial performance considering both long run and short run effect for all the commercial banks operating in Bangladesh during the period 2014 to 2019. To understand the relationship among the risk management factors and financial performance (considering both long run and short run effect) of commercial banks in Bangladesh, the following question should be analyzed throughout the study:

RQ- 1: What are the relationship between the Risk Management factors and Financial Performance of commercial banks in Bangladesh?

RQ- 4: What are the long run effect (captured through random and fixed effect model) and short run effect (captured through two step system GMM application) of the Risk Management factors on Financial Performance of commercial banks in Bangladesh considering all the internal and external determinants including bank specific, within banking industry concentration and macro-economic factors?

1.2 Significance of the Study

Banks are usually required to manage their risk factors efficiently to avoid high level of risk and therefore deteriorating efficiency. Banks invest the depositors fund to create loans for their borrowers, which is the key source of their revenue generation. Risk management is an important issue for the sustainability of the banks. So, banks have to manage all the risk factors through implementation of up-to-date policies, guidelines, effective risk management structure or frameworks to ensure its sustainable performance.

Researchers have disagreement regarding the effects of risk management factors on the banks profitability. The key objective of this analysis is to assess the effects of different risk management factors on the profitability of the Banks. However, previous study findings give useful insights into different approaches for bank's risk management. This study intended to analyze the impact (both short run and long run) of risk management factors on the financial performance of commercial banks in Bangladesh considering all the internal and external determinants during the study period.

This study provides input to the regulator to identify the scope of risk management as well as to improve banking processes through development of policies and guidelines and to monitor its implementation for ensuring sustainable banking practices. By this study, the board of directors, shareholders, executives and investors of all the Bangladeshi scheduled commercial banks have been benefited to understand the overall practices for risk management and its effect on the profitability of the bank. The findings of this study will address the existing research gap to determine both the short run and long run effect of risk management factors on the profitability of Commercial Banks operating in Bangladesh during the period from 2014 to 2019.

1.3 Scope of the Study

This study determines the short run and long run impact of risk management factors on the profitability of commercial banks operating in Bangladesh. The definite context of this study is all the local

commercial banks operating in Bangladesh. The population of this study has been considered as all the local commercial banks operating during the full study period, i.e. from 2014 to 2019. Secondary data has been collected from the published financial reports of the local commercial banks operating in Bangladesh. The data collection period is from 2014 to 2019.

1.4 Limitation of the Study

This study has been carried out depending on secondary data analyses. So, the output of this study is dependent on the published annual reports of the banks. There are some banks, who obtained their license but yet to start commercial operation or could not complete their operation for full data period, so this study could not include those new Banks into the data set due to lack of adequate information. Moreover, Bangladesh Bank made some significant changes to different risk related policies and guidelines, which has a great impact on the overall financial performance of the bank.

2.0 Literature Review

Banks must find effective approaches in order to maintain required capital adequacy, increase profitability, strengthen balances, and improve organizational performance. Risk management in recent years has gained greater attention (Fatemi and Glaum, 2000). On the one hand, depending on developments in financial markets, there are external threats. Internal risks often apply when a company internally generates risks factors from its operations (Eichhorn, 2004). The motives for risk management of a bank are to mitigate or manage the risk factors for doing banking business.

Credit risk, liquidity risk and market risk are included in the financial risk and lead together to financial performance volatility (Tafriet et. al., 2009; Dimitropouloset et. al., 2010). The key risk factor which hampers banks' performance is credit risk.

Profitability provides information about the bank's capacity to accept and manage risk. ROE (net revenues/average equities) and ROA (net income/total asset) are the key metrics used in appreciating bank profitability (Dardac and Barbu, 2005). The amount of bank’s income is a common indicator of bank’s efficiency (Ceylan et al., 2008). Return on asset (ROA) is a ratio of a bank's income to its total assets that, determines the bank's profitability. The pre-tax profit-to-equity ratio (ROE) is another good indicator of bank profitability as banks with higher equity base will also have higher returns (Ceylan et al., 2008). Bank's success is related to its capability to generate an expected return from its assets and equity. A crucial aspect of assessing earnings efficiency is the comparison of financial performance measures, such as returns on assets and returns on equity, with industry benchmarks and peer group standards (Duca and McLaughlin, 1990).

The profitability of commercial banks in growing Asian nations including Vietnam, Malaysia, and Thailand was evaluated by DAO, B. T. T. et al. (2020). Ten banks in Vietnam, eight in Malaysia, nine in Thailand, i.e. total 27 commercial banks' panel data from the years 2012 to 2016 were used in this study. As profitability indicators, ROA, ROE, and TOBINQ were used in this study. They were influenced by three main types of independent variables: bank-specifics, such as CAR, NPL, Cost to income, Liquidity ratio, and Bank size; industry-specific variables, such as concentration HHI; and macroeconomic-specific variables, such as GDP growth and inflation. Panel data regressions were used to compare and contrast the empirical findings on the study models for each of the three nations, and the overall sample. The most outstanding similarity across these banks was that they have significantly negative relationship between operational risk and bank’s profitability. The bank size had a significantly negative impact on profitability on the models of Vietnam and Thailand, but not on the model of Malaysia. The most

contentious finding was that, a positive correlation between credit risk and banking profitability as well as a negative relationship between CAR and profitability measures.

The impact of credit risk on Bangladeshi banks' profitability was examined by Hanifa, A. et al. (2015). Secondary data set were collected from the published annual reports of 18 privet commercial banks operating in Bangladesh during the period from 2003 to 2013. The study uses NPL to gross loan (NPLGL), loan loss reserve ratio to gross loan (LLRGL), loan loss reserve to NPL (LLRNPL) and CAR as proxy of credit risk and ROA, ROE and NIM as proxy of profitability privet commercial banks operating in Bangladesh. The study found that, NPLGL and LLRGL had a strong negative and significant impact on all profitability measures using the OLS Random Effect Model, GLS, and system GMM. The study also found a significant and negative impact of CAR on ROAE.

The financial performance of Kenyan commercial banks was investigated by Muriithi, J. G. (2016) in relation to market risk. Secondary information was gathered from the 43 commercial banks' published annual reports covering the years 2005 to 2014 in Kenya. Market risk was assessed using the degree of financial leverage, interest rate risk, and foreign currency exposure, while financial performance was assessed using return on equity (ROE). This study used a panel data set using random effects, fixed effects estimates, and the generalized method of moments (GMM) in order to eliminate time-invariant unobserved firm-specific effects and to address potential endogeneity problems. The correlations between the variables were conducted pair wise. The coefficient of determination, both within and between R2, was used to assess how much variance in the dependent variable is explained by independent variables, while the F-test was employed to assess the significance of the regression. The results of this study demonstrated a negative and substantial relationship between financial leverage, interest rates, and foreign currency exposure and bank profitability.

The impact of liquidity risk on the financial performance of commercial banks in Kenya was examined by Muriithi, J.G. and Waweru, K.M. (2017). Secondary information was gathered from the 43 registered commercial banks operating in Kenya from 2005 to 2014 that have published into their annual reports. Return on equity (ROE) was used to measure financial performance, while the liquidity coverage ratio (LCR) and net stable funding ratio (NSFR) served as proxies for liquidity risk. The generalized method of moments (GMM) and random effects estimates were employed in this work to clear time-invariant unobserved firm-specific effects and to reduce the possibility of endogeneity issues. This study conducted pair wise correlations between the variables. With the use of Wald and F-tests, the significance of the regression was determined, and the within and between-group coefficients of determination were used to determine how much variance in the dependent variable can be accounted for by independent variable. The results show that NSFR is negatively correlated with bank profitability over the long term and in the short term, but LCR has no noticeable impact on the financial health of Kenya's commercial banks over the long term or short term. Overall, it was determined that liquidity risk had a negative impact on financial performance.

Muriithi, J. G. & Muigai, R.G. (2017) examined the effect of operational risk on profitability of commercial banks in Kenya. Secondary data were collected from the published annual reports of 43 registered commercial banks operating in Kenya during the period from 2005 to 2014. Operational risk was measured by CIR while profitability by ROE. The generalized method of moments (GMM) and random effects estimates were employed in this work to clear time-invariant unobserved firm-specific effects and to reduce the possibility of endogeneity issues. The significance of the regression was assessed using Wald and F-tests, and the amount of variation in the dependent variable that can be

accounted for by the independent variable was assessed using the within and between-group coefficients of determination. The results of this study showed that CIR was both a long-term and short-term negative predictor of bank profitability.

The impact of bank capital and liquidity ratios on banks' profitability was examined by Terraza, V. (2015). Secondary data were collected from the published annual reports of sampled 1270 nos. of European banks during the period from 2005 to 2012. To evaluate European banks based on size, three panels' data are taken into consideration: large, medium, and small banks. First, experiments show that large banks behave uniformly. Fixed effects regressions are used to add unique, distinct effects to the models for the other data. In this work, Generalized Methods of Moments (GMM) were applied to a dynamic panel model to account for profitability determination. The estimation findings demonstrated a medium-sized bank's assessment of positive and considerable profitability. Finally, this analysis showed no solid evidence that increased efficiency and bank profitability are positively correlated. Although capitalization levels boost bank profitability, liquidity risk is based on bank size.

Muriithi, J. G. et al. (2016) looked at how credit risk affected Kenyan commercial banks' financial performance. The published annual reports of the 43 commercial banks that operated in Kenya between 2005 and 2014 were used to gather secondary data. Capital to risk-weighted assets, asset quality, loan loss provision to loan and advance ratios were all used to evaluate credit risk while financial performance measured through return on equity (ROE). Fixed effects estimate and the generalized method of moments (GMM) were employed in this work to clean time-invariant unobserved firm-specific effects and to reduce the possibility of endogeneity issues. The correlations between the variables were conducted pair-wise. The coefficient of determination, both within and between R2, was used to assess how much variance in the dependent variable is explained by independent variables, while the F-test was employed to assess the significance of the regression. The results of this study demonstrated a negative and substantial link between credit risk and bank profitability. A high percentage of non-performing loans to total assets or low asset quality are both associated with poor bank performance, both in the short and long terms.

The effects of credit risk management and bank-specific variables on the profitability of South Asian commercial banks were studied by Siddique, A. et al. (2021). This study used the public annual reports of 19 commercial banks (10 from Pakistan and 9 from India) from 2009 - 2018 to analyze the impact of credit risk management and bank-specific characteristics on South Asian commercial banks' financial performance (FP). NPL and CAR were utilized as credit risk indicators in this study, while CER, ALR, and LR were employed as bank-specific variables and ROE and ROA were used as measures of financial performance. To counteract the impacts of some endogenous variables, the generalized method of moments (GMM) is used for coefficient estimation. According to the study's findings, CAR and ALR have a considerably positive relationship with the financial performance of Asian commercial banks, whereas NPL, CER, and LR have a significantly negative relationship with ROA and ROE. The study's findings recommended that policymakers in Asian countries should adopt monetary policies that raise interest rates, since doing so, will inevitably help to lower the high ratio of non-performing loans. This will help to establish a healthy financial environment. The company should have a strong liquidity position so that it can survive even in a highly competitive environment.

Ahmed, Z. et al. (2021) investigated the function of financial risk management in forecasting financial performance: a case study of commercial banks in Pakistan. Secondary information was gathered from the published annual reports of commercial banks in Pakistan from 2006 to 2017. Credit risk, interest

rate risk, and liquidity risk are used to assess risk management, whereas ROA, ROE, and ROI were used to measure financial performance. The empirical validity of the hypothesis was tested using the dynamic panel model and two step GMM panel estimators. The findings demonstrated that financial risk management substantially lowers the financial performance of Pakistani commercial banks. Results for projecting the financial performance of Pakistan's banking sector using alternative financial risk management metrics were conclusive.

The stability and profitability of the Chinese banking sector were examined by Tan, Y. and Anchor, J. (2016) using data from an auto-regressive distributed linear specification. The goal of this study was to look at the connections between stability and profitability in the Chinese banking sector. Secondary data were collected from a sample of Chinese commercial banks during the period from 2003 to 2013. An auto-regressive distributed linear model was employed in this study to evaluate the connections between the variables. The indicators of stability employed were Z-score and stability inefficiency, whereas the indicator of profitability was Return on Assets (ROA). Generalized Method of Moments (GMM) estimators of various types, such as difference GMM, one-step system GMM, two-step system GMM, and two-step robust GMM, were utilized. Alternative econometric methodologies, such as the ordinary least square (OLS) estimator, between effect estimator, and fixed effect estimate, were utilized to test the results' robustness. The results of this study demonstrated that higher insolvency risk/lower bank stability causes Chinese commercial banks to be more profitable, whereas higher profitability increases bank weakness.

Researchers Béjaoui and Bouzgarrou, (2014) looked at the factors that affect Tunisian banks' profitability and how they affect profit margins. For 16 Tunisian commercial banks, separated into 11 deposit banks and 5 development banks, this study used a dynamic panel model with the Generalized Methods of Moments (GMM) framework from 1999 to 2010. According to the estimations, there is strong evidence of profit persistence for both deposit and development banks from 2005 to 2010. Deposit banks, as opposed to development banks, are more competitive, according to this study. As a result, Tunisian banks continue to make extraordinary profits, but development banks are more protected by regulations than deposit banks. Profitability and capital have a good link, according to this study. According to the management of liquidity risk by those institutions, the excessive use of deposits to support loans is anticipated to have an adverse effect on the profitability of Tunisian banks. Finally, they demonstrated that, from 1999 to 2010, deposit and development banks suffered from poor loan quality and a lack of provisioning, which had a negative impact on bank’s profitability.

2.1 Literature Review Theoretical

As stated by Trochim (2006), theoretical structures direct researchers regarding the variables to calculate and their statistical relationships for analyzing the issues being studied. A theoretical structure is crucial for investigations that test deductive theories. Scientists are using theoretical structure in scientific thesis to establish a hypothesis. The theoretical structure is a basis for research strictures or limits.

This paper analysis its variables on the basis of three theories: (i) Shiftability Theory is linked with liquidity risk (ii) Finance distress theory related to liquidity risk and credit risk and (iii) Extreme value theory related to market risk.

2.2 Bangladesh Bank Guidelines Review

This study also review all the risk management related published guidelines of Bangladesh Bank, the Central Bank of Bangladesh including i) Bangladesh Bank Guideline on Risk-Based Capital Adequacy , ii) Bangladesh Bank Guidelines on Credit Risk Management (CRM) in Banks, iii) Bangladesh Bank

Guidelines on Assets Liability Management (ALM), iv) Bangladesh Bank Guidelines on Foreign Exchange Risk Management, v) Bangladesh Bank Guidelines on ICT Security in Banks, vi) Bangladesh Bank Guidelines on Internal Control and Compliance in Banks, vii) Bangladesh Bank Guidelines on Prevention on Money Laundering, viii) Bangladesh Bank Guidelines on Environmental & Social Risk Management for Banks, ix) Bangladesh Bank Guideline on Risk-Based Capital Adequacy.

2.3 Conceptual Framework

A conceptual framework is clearly articulated to help researchers understand subsequent results and has a possible utility as a guide. It specifies the potential connections between variables as part of the negotiation package that will be examined, checked, evaluated, and changed following an inquiry (Smith, 2004). The conceptual framework model displayed in Fig. 1.1 presents the interrelationship between the variables discussed above in order to provide direction for the study:

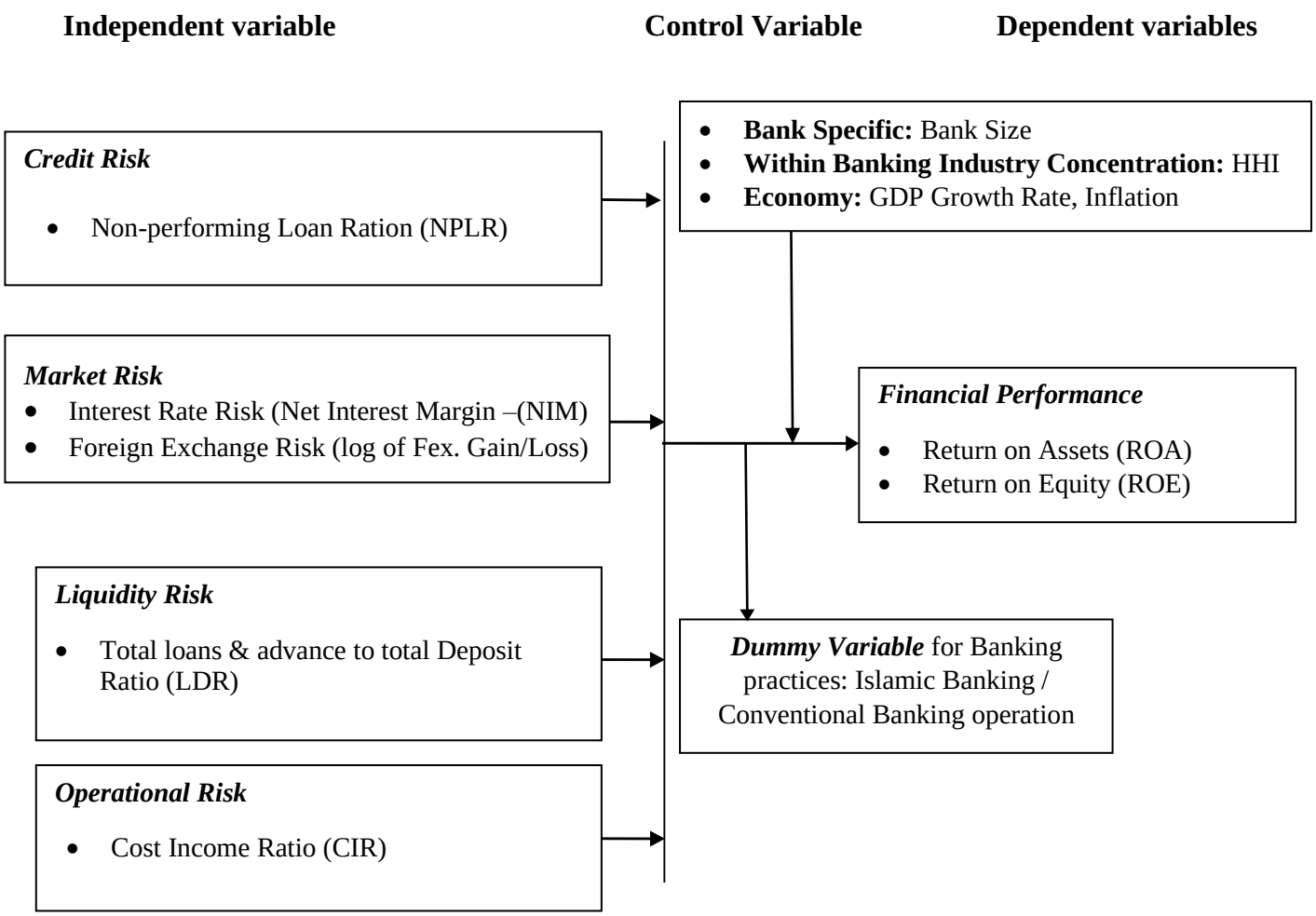

Figure – 1.1: Conceptual framework

3.0 Methodology

A quantitative research design technique has been used for this study. The required financial ratios have been collected or computed for each local commercial Bank in Bangladesh for the survey period from their published annual report/ financial statements and transformed into a balanced panel to identify and understand the impact of overall risk factors on the profitability of commercial banks operating in Bangladesh. Time Series Cross-Sectional panel data set has been considered for the analysis of this

study. The study also use financial ratio analysis as proxy of risk factors through a panel data set for regression analysis considered the time period from 2014 to 2019 to calculate, explain and analyze its effect on the profitability of commercial banks operating in Bangladesh. Although some foreign commercial banks operate their businesses in Bangladesh directly or through corresponding banking practices, the study excluded all those foreign commercial banks due to their globally practiced separate internal risk management system. Besides, this study also excluded all the Government-owned Specialized/ Development Banks in Bangladesh from its population due to their specialized purpose of doing business and separate risk management system.

3.1 Econometric Model

According to Baitagi, 1995, Panel data can include time effects and control individual heterogeneity of firm-specific fixed or random effects components. However, it produces biased conclusions due to ignorance of cross-section or time-series calculations. As a result, this study used short term dynamic panel models and long term statistical models to predict how commercial banks' risk variables affect its financial performance. The long-run model does not take into account lagged dependent explanatory variables. While the short-run model assumes that immediate last year performance, i.e., lagged dependent explanatory variable, influences the current period performance. The short-run models made the assumption that the performance process of a bank had not yet been fully adjusted. A partial modification is applied to the short-run model since, for instance, banks can leverage their past performance to safeguard their future performance.

In this study, ROA and ROE is considered as dependent variables for calculating the financial performance. The independent variables includes log of non-performance loan ratio (LnNPLR) as a measure of credit risk, interest rate risk or log of net interest margin (LnNIM) and log of foreign exchange gain/ loss (LnFexGL) are used to measure market risk, total loan to total deposit ratio (LDR) is used to measure liquidity risk, log of cost income ratio (LnCIR) is used to measure operational risk. A dummy variable *(IslamiConv)* is used to check the impact of two different types of banking system practices in Bangladesh, i.e. conventional banking and Islamic banking. The log of Bank Size or total assets is used as bank specific control variable. This study includes Herfindahl–Hirschman Index as proxy of within banking industry concentration variable. The Herfindahl-Hirschman Index, a widely used index of market concentration, is referred to as "HHI". It also includes GDP Growth Rate and Inflation Rate in Bangladesh for the study period, i.e. from 2014 to 2019 as proxy of economic concentration. This analysis assumed that the general functional relationship Cobb Douglas was generalized in all the independent variables and dependent variable, which has shown in equation 1.1 and 1.2

$$ROA = f\,(LnNPLR, LnNIM, LnFexGL, LDR, LnCIR, IslamiConv, LnBS, HHI, Inflation, GDPGrowth) \quad \text{.....(1.1)}$$

The loan run model was as follows:

$$ROA_{it} = \beta_0 + \beta_1 LnNPLR_{it} + \beta_2 LnNIM_{it} + \beta_3 LnFexGL_{it} + \beta_4 LDR_{it} + \beta_5 LnCIR_{it} + \beta_6 IslamiConv_{it} + \beta_7 LnBS_{it} + \beta_8 HHI_{it} + \beta_9 Inflation_{it} + \beta_{10} GDPGrowth_{it} + \theta_i + \varepsilon_{it} \quad \text{.....(1.1a)}$$

Where i =1,2,..... n and t =1,2....,6

The short-run model was as follows:

$$ROA_{it} = \beta_0 + \lambda\, ROA_{it-1} + \beta_1\, LnNPLR_{it} + \beta_2\, LnNIM_{it} + \beta_3\, LnFexGL_{it} + \beta_4\, LDR_{it} + \beta_5 LnCIR_{it} + \beta_6\, IslamiConv_{it} + \beta_7\, LnBS_{it} + \beta_8\, HHI_{it} + \beta_9\, Inflation_{it} + \beta_{10}\, GDPGrowth_{it} + \theta_i + \varepsilon_{it} \quad \text{.....(1.1b)}$$

Where i =1,2,..... n and t =1,2.....,6

Here, ROA_{it} refer to the financial performance of bank i on time t. β_0 is the constant of the model or intercept, β_i is coefficient of the independent variables. ROA_{it-1} is the lagged of bank's financial performance, $LnNPLR_{it}$ stands for log of non-performing loan ratio of Bank i at time t. $LnNIM_{it}$ stands for log of net interest margin ratio of bank i at time t. $LnFexGL_{it}$ stands for log of foreign exchange gain/ loss of bank i at time t. LDR_{it} is the loan & advance to deposit ratio of bank i at time t. $LnCIR_{it}$ is the log of cost income ratio of bank i at time t. $IslamiConv_{it}$ is the dummy variable added into the model for two types of banking system operating in Bangladesh i.e. islami banking and conventional banking system for bank i at time t and $LnBS_{it}$ stands for log of Bank Size (assets size) of bank i at time t. HHI_{it} is the Herfindahl–Hirschman Index as proxy of within banking industry concentration of bank i at time t. $Inflation_{it}$ is the Inflation Rate as proxy of macroeconomic concentration on bank i at time t. $GDPGrowth_{it}$ stands for proxy of macroeconomic concentration on bank i at time t. β_i stands for bank specific impact, which is anticipated to have normal distribution with constant variance, and ε_{it} is error term of the model, which is anticipated to be normally distributed.

$$ROE = f(LnNPLR, LnNIM, LnFexGL, LDR, CIR, IslamiConv, LnBS, HHI, Inflation, GDPGrowth) \quad \text{.....(1.2)}$$

The loan run model was as follows:

$$ROE_{it} = \beta_0 + \beta_1\, LnNPLR_{it} + \beta_2\, LnNIM_{it} + \beta_3\, LnFexGL_{it} + \beta_4\, LDR_{it} + \beta_5\, CIR_{it} + \beta_6\, IslamiConv_{it} + \beta_7\, LnBS_{it} + \beta_8\, HHI_{it} + \beta_9\, Inflation_{it} + \beta_{10}\, GDPGrowth_{it} + \theta_i + \varepsilon_{it} \quad \text{.....(1.2a)}$$

Where i =1,2,..... n and t =1,2....,6

The short-run model was as follows:

$$ROE_{it} = \beta_0 + \lambda\, ROE_{it-1} + \beta_1\, LnNPLR_{it} + \beta_2\, LnNIM_{it} + \beta_3\, LnFexGL_{it} + \beta_4\, LDR_{it} + \beta_5 CIR_{it} + \beta_6\, IslamiConv_{it} + \beta_7\, LnBS_{it} + \beta_8\, HHI_{it} + \beta_9\, Inflation_{it} + \beta_{10}\, GDPGrowth_{it} + \theta_i + \varepsilon_{it} \quad \text{.....(1.2b)}$$

Where i =1,2,..... n and t =1,2.....,6

Here, ROE_{it} refer to the financial performance of bank i on time t. β_0 is the constant of the model or intercept, β_i is coefficient of the independent variables. ROE_{it-1} is the lagged of bank's financial performance, $LnNPLR_{it}$ stands for log of non-performing loan ratio of Bank i at time t. $LnNIM_{it}$ stands for log of net interest margin ratio of bank i at time t. $LnFexGL_{it}$ stands for log of foreign exchange gain/

loss of bank i at time t. LDR_{it} is the loan & advance to deposit ratio of bank i at time t. CIR_{it} is the cost income ratio of bank i at time t. $IslamiConv_{it}$ is the dummy variable added into the model for two types of banking system operating in Bangladesh i.e. islami banking and conventional banking system for bank i at time t and $LnBS_{it}$ stands for log of Bank Size (assets size) of bank i at time t. HHI_{it} is the Herfindahl–Hirschman Index as proxy of within banking industry concentration of bank i at time t. $Inflation_{it}$ is the Inflation Rate as proxy of macroeconomic concentration on bank i at time t. $GDPGrowth_{it}$ stands for proxy of macroeconomic concentration on bank i at time t. $\square_i$ stands for bank specific impact, which is anticipated to have normal distribution with constant variance, and $\square_{it}$ is error term of the model, which is anticipated to be normally distributed.

4.0 Research Findings and Discussion

The long run and the short run version of model 1.1 has been estimated, where ROA is considered as dependent variable as proxy of financial performance while log of non-performing loan ratio (LnNPLR) is proxy of credit risk, log of net interest margin (LnNIM) and log of foreign exchange gain/ loss (LnFexGL) as proxy of market risk, loan to deposit ratio (LDR) as proxy of liquidity risk and log of cost income ratio (LnCIR) as proxy of operational risk, dummy variable "IslamiConv" represent two types of banking system Islamic Banking and Conventional Banking system operating in Bangladesh and control variable Bank Size is represented by log of Total Asset (LnBS), within banking industry concentration control variable is represented by Herfindahl-Hirschman Index (HHI) and Inflation Rate & GDP Growth Rate has been used as macroeconomic control variables. At first long run specification of model 1.1a has been examined by analyzing the output of the random effects GLS regression model, the fixed effect regression model and then the output has been finalized through the output of Hausman Test. After analyzing the long run effect this study analyzed the short run effect of model 1.1b through two step system GMM model, output of this has been shown in table – 1:

Table – 1: Output of Econometric Model 1.1a and 1.1b, where dependent variable is ROA:

Independent Variables	Long Run		Short Run		
	Random Effect	Fixed Effect	OLS Regression	Fixed Effect	Two Step GMM Model
	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)
L_ROA	--	--	0.440*** (0.064)	0.033 (0.077)	LnL_ROA: 0.384*** (0.087)
LnNPLR	- 0.111** (0.054)	- 0.116* (0.071)	-0.147*** (0.046)	-0.136* (0.079)	-0.202* (0.107)
LnNIM	0.136 (0.085)	0.077 (0.101)	0.115 (0.080)	0.077 (0.110)	0.167 (0.202)
LnFexGL	-0.027 (0.080)	-0.126 (0.119)	0.016 (0.060)	-0.149 (0.136)	0.145 (0.180)
LDR	0.006	0.009	0.003	-0.001	LnLDR: 0.892

Independent Variables	Long Run		Short Run		
	Random Effect	Fixed Effect	OLS Regression	Fixed Effect	Two Step GMM Model
	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)
	(0.005)	(0.007)	(0.005)	(0.010)	(0.931)
LnCIR	-1.306*** (0.233)	-2.359*** (0.393)	-0.415** (0.195)	-2.359*** (0.505)	-0.300 (0.351)
IslamiConv (Dummy)	0.422** (0.184)	Omitted	0.244** (0.118)	Omitted	Omitted
LnBS	0.019 (0.139)	-0.155 (0.346)	0.043 (0.100)	0.004 (0.429)	-0.331 (0.265)
HHI	0.015 (0.022)	0.012 (0.023)	0.025 (0.026)	0.003 (0.026)	LnHHI: 14.427 (9.174)
Inflation	-0.435 (0.280)	-0.390 (0.290)	-0.302 (0.355)	-0.260 (0.344)	LnInfa: -1.921 (1.628)
GDP Growth	-0.319** (0.159)	-0.239 (0.181)	-0.093 (0.190)	-0.275 (0.211)	LnGDPG : 0.600 (1.352)
Constant	4.404 (8.296)	11.934 (9.716)	-5.731 (9.594)	13.768 (11.340)	-82.793 (54.698)
	R-Sq:- Within: 0.3243 Between:0.5907 Overall:0.3839 Wald Chi2 (10): 119.24*** rho: 0.3720 Obser: 224 Group: 41	R-Sq:- Within: 0.3466 Between:0.4441 Overall:0.2914 F(9,174): 10.25 *** rho: 0.6477 Obser: 224 Group: 41	R-Sq: 0.5300 Adj R-Sq: 0.5016 F(11,182): 18.66*** Root MSE: 0.5717 Obser: 194	R-Sq:- Within: 0.3269 Between:0.4680 Overall:0.3117 F(10,143): 6.95*** rho: 0.6039 Obser: 194 Group: 41	Wild Chi2(9): 238.08*** Sargar test, Chi2(5)= 49.66*** Hansen test, Chi2(5)= 7.50 AR(1), z= -1.84* AR(2), z= -1.55 Obser: 139, Group: 31 Instruments: 16
	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *
Hausman Test	**Random Effect**		**$0.033 \leq \lambda \leq 0.440$, here $\lambda = 0.384$**		

Initially, the output of random effect GLS model has been analyzed to examine long run effect of model 1.1a. The analysis showed that, the P-value of Wald Chi Squire is less than 0.01, so the model is significant at 1% level and all the independent variables have negative or positive effects on the dependent variable ROA. The interclass correlation (rho) is 37.20% implying that 37.20% of the deviations in return in assets (ROA) are due to variation across the banks. The within R-square means 32.43% difference in ROA are because of variation within individual banks and between R-square means 59.07% of the difference are because of variation between the banks. The total R-square reveals that the factors taken into account in the model account for 38.39% of changes in ROA, whereas other variables that have not been taken into account in this model may be responsible for another 61.61% of these changes.

The fixed effects regression model is the alternate specification of econometric model 1.1a. As per findings of fixed effects regression model showed in Table – 1 above, the P-value of F is less than 0.01, so the model is significant at 1% level and all the independent variables have negative or positive effects on the dependent variable ROA. The interclass correlation (rho) is 64.77 %, which suggests that 64.77 % of the changes in return on assets (ROA) result from variances among banks. The within R-square means 34.66% difference in ROA are because of variation within individual banks and between R-square means 44.41% of the difference are because of variation between the banks. The overall R-square reveals that the factors taken into account in the model account for 29.14% of changes in ROA, whereas other variables that have not been taken into account in this model may be responsible for 70.86% of those changes.

The Hausman Test, commonly referred to as the Hausman specification test, is used to identify endogenous regressor (predictor variables) in this case. The values of endogenous variables are influenced by other variables in the system. The Hausman test will do this. The specification tests are performed by constructing a test of the hypothesis Ho: a = 0. In contrast to fixed effects, random effects may be estimated via partial pooling. When using partial pooling, the effect estimates for a group will be partially dependent on the more abundant data from other groups if the group has few data points.

Table – 2: Output of Hausman specification test for econometric model 1.1a, where dependent variable is ROA

```
                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |     random       fixed       Difference          S.E.
-------------+------------------------------------------------------------------
      LnNPLR |   -.1113519    -.1164104        .0050585               .
       LnNIM |    .1358988     .0771575        .0587413               .
     LnFexGL |   -.0265396     -.126148        .0996083               .
         LDR |    .0064996     .0085965       -.0020969               .
       LnCIR |   -1.306301    -2.358585        1.052284               .
        LnBS |    .0187855    -.1548973        .1736828               .
         HHI |    .0151274     .0117343        .0033932               .
   Inflation |   -.4348139    -.3903956       -.0444183               .
   GDPGrowth |   -.3190366    -.2390686        -.079968               .
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =   -13.32    chi2<0 ==> model fitted on these
                                        data fails to meet the asymptotic
                                        assumptions of the Hausman test;
                                        see suest for a generalized test
```

According to Table - 2, the test statistics have a chi statistic of -13.32 with nine degrees of freedom. Therefore, the model fitted to these data does not satisfy the Hausman test's asymptotic assumption. So, here Random Effect GLS model has been selected over Fixed Effects Regression model for interpretation of the long run specification while Bank specific control variable "Bank Size", banking industry concentration control variable Herfindahl-Hirschman Index (HHI) and Inflation Rate & GDP Growth Rate has been used as macroeconomic control variables are considered as control variables into the model. The output of random effect GLS model shows in Table – 1 above are as follows:

Table – 1 above shows that the coefficient of log of nonperforming loan ratio (LnNPLR) used as proxy of credit risk is -0.111 in the long run which is significant at 5% level. Therefore, at the 5% level of significance, the hypothesis that LnNPLR having a negative influence on the profitability of commercial banks operating in Bangladesh is not rejected. However, the negative coefficient indicates that when NPLR of banks increases, ROA decreases.

As shown in Table - 1 above, the coefficient of log net interest margin (LnNIM) which is used as a proxy for interest rate risk and is also a component of market risk is 0.136 with a p value more than 10%. Therefore, at a 10% level of significance, the hypothesis that LnNIM having a positive influence on the profitability of commercial banks operating in Bangladesh is rejected. However, the positive coefficient indicates that when net interest margin (NIM) or interest rate risk increases, the financial performance of commercial banks in Bangladesh or ROA also increases. The log value of foreign exchange gain/loss (LnFexGL) a proxy for the other market risk factor known as foreign exchange risk having a coefficient of -0.027 and a p value greater than 10%. So, the hypothesis of LnFexGL has negative impact on ROA is rejected at 10% level of significance. And also, the negative coefficient indicates that when Foreign Exchange Risk increases ROA decreases.

The coefficient of loan to deposit ratio (LDR) used as proxy of liquidity risk showed in Table-1 above is 0.006 having p value of more than 10%. Therefore, at a 10% level of significance, the hypothesis that LDR having a positive influence on the profitability of commercial banks operating in Bangladesh is rejected. However, the positive coefficient indicates that when LDR of banks increases, ROA also increases.

The coefficient of log of cost income ratio (LnCIR) used as proxy of operational risk showed in Table-1 above is -1.306 in the long run which is significant at 1% level. Therefore, at the 1% level of significance, the hypothesis that LnCIR having a negative influence on the profitability of commercial banks operating in Bangladesh is not rejected. However, the negative coefficient indicates that when cost income ratio (CIR) increases, ROA decreases.

The coefficient of dummy variable "IslamiConv" used as proxy of different types of banking operations in Bangladesh (both Islamic Banking and Conventional Banking system) showed in Table-1 above is 0.422 in the long run which is significant at 5% level. Therefore, at the 5% level of significance, the hypothesis that the dummy variable "IslamiConv" or banks type having a positive influence on the profitability of commercial banks operating in Bangladesh is not rejected. The coefficient of control variable log of Bank Size (total asset), i.e. LnBS is 0.019 having p value more than 10%. Therefore, at a 10% level of significance, the hypothesis that the control variable "LnBS," or bank size, has a positive effect on the profitability of commercial banks operating in Bangladesh is rejected. The coefficient of within banking industry concentration control variable Herfindahl-Hirschman Index (HHI) is 0.015 having p value of more than 10%. Therefore, at a 10% level of significance, the hypothesis that the

control variable "HHI" has a positive influence on the profitability of Bangladeshi commercial banks is rejected.

Coefficient of macro-economic control variables “Inflation Rate” is -0.435 with p value of more than 10%. So, at 10% level of significance, the hypothesis that control variable “Inflation Rate” has negative impact on the profitability of commercial banks operating in Bangladesh is rejected. The coefficient of other macro-economic control variables “GDP Growth Rate” is -0.319 in the long run which is significant at 5% level. Therefore, at the 5% level of significance, the hypothesis that the control variable "GDP Growth Rate" has a negative influence on the profitability of commercial banks operating in Bangladesh is not rejected.

To test the short run effect on first econometric model, the short run version of model 1.1b has been estimated. Here, 1st lag value of the dependent variable i.e. 1st lag value of ROA has been used as independent variable to make the model dynamic among others including log of non-performing loan ratio (LnNPLR), log of net interest margin (LnNIM), log of foreign exchange gain/ loss (LnFexGL), loan to deposit ratio (LDR) and log of cost income ratio (LnCIR) and dummy variable “IslamiConv” represent two types of banking system Islamic Banking and Conventional Banking system operating in Bangladesh and control variable Bank Size is represented by log of Total Asset (LnBS), within banking industry concentration control variable proxy by Herfindahl-Hirschman Index (HHI) and Inflation Rate & GDP Growth Rate has been used as macroeconomic control variables.

The short run specification of model 1.1b has been examined initially through the pooled OLS regression model and then fixed effect regression model whose findings are shown in Table – 1. Here, the coefficient of lagged return on asset (L.ROA) of pooled OLS regression analysis is 0.440. So, the higher boundary of the coefficient of lagged value of return on asset (L.ROA) for the GMM model would be 0.440. The coefficient of lagged return on asset (L.ROA) of the fixed effect estimates is 0.033. As a result, the lagged return on asset (L.ROA) in the GMM specification would have a lower bound of 0.033. Specifically, if the estimate is λ, it should be laid in the interval of $0.033 \leq \lambda \leq 0.440$. Here, the two step system GMM estimates for the short run specification of model shows that the coefficient of the lagged return on assets (ROA) is 0.384. So, the coefficient is within the acceptable range of $0.033 \leq \lambda \leq 0.440$ established by the pooled OLS regression effect and fixed effects estimates of the short run model 1.1b. This is the points to consistency of estimates.

The output of two step system GMM estimates shows that, the P-value of Wild Chi Squire is less than 0.01, so the model is significant at 1% level and all the independent variables have negative or positive effects on the dependent variable ROA. The number of instruments used in this study is less than the number of groups, and at a 1% level of significance, the log value of the dependent variable ROA's first lagged value, or LnL.ROA, differs considerably from zero. According to the analysis, the Hansen test statistic is 7.50, and the related p-value is higher than 0.10. As a result, at the ten percent level of significance, the null hypothesis of the validity of the over identifying restrictions for the instruments is not rejected. As a result, the model's instruments are suitable and produce accurate, consistent estimations. Table - 1 also displays the autocorrelation test in the error terms. With a matching p-value of less than 10%, the test statistic for first order autocorrelation, or AR(1), is -1.84. Therefore, at a ten percent level of significance, the null hypothesis that the disturbance term (error term) has no first order serial correlation is rejected. The test statistic for second order serial correlation AR(2) in the error term has a p-value that is more than 0.10 and equals -1.55. As a consequence, the null hypothesis that there is no second order serial correlation in the error terms is accepted and the use of instruments from the

second lag and differences is permitted at a ten percent level of significance. This strengthens the case for adopting the two step system GMM estimates to specify model 1.1b correctly, in the short term.

Table – 1 above also shows that the coefficient of log of nonperforming loan ratio (LnNPLR) used as proxy of credit risk is -0.202 in the short run which is significant at 10% level. The hypothesis that credit risk has a negative effect on the profitability of commercial banks operating in Bangladesh is not rejected at a 10% level of significance. Additionally, the negative coefficient shows that as bank NPLR increases, Bangladeshi commercial banks' short-term financial performance or ROA decreases.

As shown in Table-1 above, the coefficient of log net interest margin (LnNIM), which is used as a proxy for interest rate risk and is also a component of market risk is 0.167 with a p value more than 10%. Therefore, at a 10% level of significance, the hypothesis that interest rate risk has a positive short-term impact on the profitability of commercial banks operating in Bangladesh is rejected. However, the positive coefficient indicates that when net interest margin (NIM) or interest rate risk increases, ROA also increases in the short run. The other component of market risk, i.e. foreign exchange risk which is proxy by log value of foreign exchange gain/ loss (LnFexGL) has coefficient of 0.145 with p value of more than 10%. So, the hypothesis of foreign exchange risk has positive impact in the short run on ROA is rejected at 10% level of significance. And also, the positive coefficient indicates that when Foreign Exchange Risk increases the financial performance of commercial banks in Bangladesh or ROA also increases in the short run.

The coefficient of log of loan to deposit ratio (LnLDR) used as proxy of liquidity risk showed in Table-1 above is 0.892 having p value of more than 10%. Therefore, at a 10% level of significance, the hypothesis that LDR having a positive influence on the profitability of commercial banks operating in Bangladesh is rejected. The positive correlation suggests that as LDR of banks increases, Bangladeshi commercial banks' short-term financial performance or ROA also increases.

The coefficient of log of cost income ratio (LnCIR) used as proxy of operational risk showed in Table-1 above is -0.300 in the short run which is not significant at 10% level. The assumption that operational risk has a negative effect on the profitability of commercial banks operating in Bangladesh is therefore rejected at 10% level of significance. However, the negative coefficient indicates that when cost income ratio (CIR) increases, the financial performance of commercial banks in Bangladesh or ROA decreases in the short run. The coefficient of control variable log of Bank Size (total asset), i.e. LnBS is -0.331 having p value more than 10%. Therefore, at a 10% level of significance, the hypothesis that the control variable "LnBS," or bank size, has a short-term negative influence on the profitability of commercial banks operating in Bangladesh is rejected. The coefficient of within banking industry concentration control variable log of Herfindahl-Hirschman Index (LnHHI) is 14.427 in the long run which are not significant at 10% level. Therefore, at a 10% level of significance, the hypothesis that the control variable "LnHHI" has a positive influence on the profitability of commercial banks operating in Bangladesh is rejected.

Coefficient of macro-economic control variables “Inflation Rate” is -1.921 with p value of more than 10%. The hypothesis that the control variable "Inflation Rate" has a negative impact on the profitability of commercial banks operating in Bangladesh is therefore rejected at a 10% level of significance. The coefficient of other macro-economic control variables log of GDP Growth Rate, i.e. “LnGDPG” is 0.600 in the short run which is not significant at 10% level. Therefore, at a 10% level of significance, the hypothesis that the control variable "GDP Growth Rate" has a positive influence on the profitability of commercial banks operating in Bangladesh is rejected.

The summery output of econometric model 1.1 both in the long run and short run where bank specific control variable Bank Size, i.e. log of Total Asset (LnBS), within banking industry concentration control variable Herfindahl-Hirschman Index (HHI) and macroeconomic control variables "Inflation Rate" & "GDP Growth Rate" has been considered into the model is that credit risk of the bank is negatively correlated with financial performance both in the long run and short run while interest rate risk is considered as part of market risk is positively correlated with financial performance both in the short run and long run. The other component of market risk, i.e. Foreign Exchange Risk is positively correlated with financial performance in the short run but have negative correlation with the profitability of the commercial banks operating in Bangladesh in the long run. The liquidity risk of the bank is also positively correlated with financial performance in the long run and short run which is in line with the statistical assumption of this study. The operational risk of the banks is also having negative correlation with financial performance both in the long run and short run. Though, some of these study variables' coefficients are statistically significant and some are not significant at 1%, 5% or 10% confidence level.

Table – 3: Output of Econometric Model 1.2a and 1.2b, where dependent variable is ROE:

Independent Variables	Long Run		Short Run		
	Random Effect	Fixed Effect	OLS Regression	Fixed Effect	Two Step GMM Model
	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)
L_ROE	--	--	0.310*** (0.069)	-0.076 (0.079)	LnL_ROE: 0.191* (0.099)
LnNPLR	- 1.196*** (0.391)	- 0.899* (0.499)	-1.322*** (0.380)	-1.021* (0.561)	-0.255** (0.093)
LnNIM	1.857*** (0.571)	0.633 (0.708)	2.042*** (0.592)	1.099 (0.830)	0.154 (0.255)
LnFexGL	0.505 (0.661)	-0.118 (0.974)	0.457 (0.583)	-0.364 (1.168)	0.336** (0.151)
LDR	0.028 (0.036)	0.050 (0.047)	0.004 (0.039)	0.049 (0.075)	LnLDR: 0.438 (1.118)
CIR	-0.154*** (0.033)	-0.272*** (0.062)	-0.079** (0.033)	-0.310*** (0.073)	LnCIR: -1.364*** (0.411)
IslamiConv (Dummy)	1.210 (1.101)	Omitted	0.627 (0.820)	Omitted	Omitted
LnBS	1.057 (0.926)	2.431 (2.756)	0.766 (0.769)	6.547* (3.684)	-0.089 (0.187)
HHI	-0.096 (0.159)	-0.131 (0.165)	-0.096 (0.185)	-0.139 (0.186)	LnHHI: 7.535 (7.709)
Inflation	0.728 (1.978)	0.728 (2.061)	0.718 (2.542)	-0.056 (2.410)	LnInfa: -2.050 (1.310)

GDP Growth	-1.800 (1.126)	-2.484* (1.323)	-1.506 (1.352)	-3.923** (1.558)	LnGDPG : -0.595 (1.325)
Constant	43.554 (57.503)	54.663 (68.141)	40.551 (68.327)	25.392 (81.895)	-35.395 (48.888)
	R-Sq:- Within: 0.1749 Between:0.6552 Overall:0.4235 Wald Chi2 (10): 96.88*** rho: 0.2731 Obser: 204 Group: 39	R-Sq:- Within: 0.2096 Between:0.4899 Overall:0.3252 F(9,156): 4.60*** rho: 0.5263 Obser: 204 Group: 39	R-Sq: 0.4915 Adj R-Sq: 0.4565 F(11,160): 14.06*** Root MSE: 3.876 Obser: 172	R-Sq:- Within: 0.2308 Between:0.3120 Overall:0.1777 F(10,125): 3.75*** rho: 0.7154 Obser: 172 Group: 37	Wild Chi2(9): 210.97*** Sargar test, Chi2(5)= 25.17*** Hansen test, Chi2(5)= 4.40 AR(1), z= -1.39 AR(2), z= -1.02 Obser: 127, Group: 29 Instruments: 16
	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *	p-value<.01 *** p-value<.05 ** p-value<.10 *
Hausman Test Result	**Random Effect**		**-0.076 ≤ λ ≤ 0.310, here λ = 0.191**		

Initially, the output of random effect GLS model has been analyzed to examine long run effect of model 1.2a. The analysis showed that, the P-value of Wald Chi Squire is less than 0.01, so the model is significant at 1% level and all the independent variables have negative or positive effects on the dependent variable ROE. The interclass correlation (rho) is 27.31%, which suggests that variance among the banks explains for 27.31% of the variations in return on equity (ROE). The within R-square means 17.49% difference in ROE are because of variation within individual banks and between R-square means 65.52% of the difference are because of variation between the banks. The total R-square shows that the factors taken into account in the model account for 42.35% of changes in ROE, whereas about 57.65% of variations in ROE may be due to additional variables that have not been taken into account in this model.

The fixed effects regression model is the alternate specification of econometric model 1.2a. As per findings of fixed effects regression model showed in Table – 3 above, the P-value of F is less than 0.01, so the model is significant at 1% level and all the independent variables have negative or positive effects on the dependent variable ROE. The interclass correlation (rho) is 52.63%, suggesting that variances between banks explain for 52.63% of variations in return on equity (ROE). The within R-square means 20.96% difference in ROE are because of variation within individual banks and between R-square means 48.99% of the difference are because of variation between the banks. The total R-square reveals that the factors taken into account in the model account for 32.52% of changes in ROE, while up to 67.48% of variations in ROE may be attributable to other variables that have not been taken into account in this model.

The Hausman Test, commonly referred to as the Hausman specification test, is used to identify endogenous regressor (predictor variables) in this case. The values of endogenous variables are influenced by other variables in the system. The Hausman test will do this. The specification tests are performed by constructing a test of the hypothesis Ho: a = 0. In contrast to fixed effects, random effects may be estimated via partial pooling. When using partial pooling, the effect estimates for a group will be partially dependent on the more abundant data from other groups if the group has few data points.

Table – 4: Output of Hausman specification test for Econometric Model 1.2a, where dependent variable is ROE

```
                 ---- Coefficients ----
             |      (b)           (B)             (b-B)     sqrt(diag(V_b-V_B))
             |   random         fixed        Difference          S.E.
-------------+------------------------------------------------------------
      LnNPLR |  -1.195593    -.8986437       -.2969488                .
       LnNIM |   1.856732     .6328367        1.223895                .
    LnFexGL |      .50503    -.1179756        .6230056                .
         LDR |   .0277924     .0503146       -.0225222                .
         CIR |  -.1540442     -.272031        .1179868                .
          LnBS |   1.056901     2.431248       -1.374347                .
         HHI |  -.0959754    -.1307943        .0348189                .
   Inflation |   .7278754     .7276603        .0002151                .
   GDPGrowth |  -1.799718    -2.484444         .684726                .
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =    -13.93     chi2<0 ==> model fitted on these
                                          data fails to meet the asymptotic
                                          assumptions of the Hausman test;
                                          see suest for a generalized test
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According to Table - 4, the test statistics have a chi statistic of -13.93 with nine degrees of freedom. Therefore, the model fitted to these data does not satisfy the Hausman test's asymptotic assumption. So, here Random Effect GLS model has been selected over Fixed Effects Regression Model for interpretation of the long run specification while Bank specific control variable “Bank Size”, within banking industry concentration control variable “Herfindahl-Hirschman Index (HHI)” and Inflation Rate & GDP Growth Rate has been used as macroeconomic control variables are considered as control variables into the model. The output of random effect GLS model shows in Table – 3 above are as follows:

Table – 3 above shows that the coefficient of log of nonperforming loan ratio (LnNPLR) used as proxy of credit risk is -1.196 in the long run which is significant at 1% level. Therefore, at the 1% level of significance, the hypothesis that LnNPLR having a negative influence on the profitability of commercial banks operating in Bangladesh is not rejected. However, the negative coefficient indicates that when NPLR or credit risk of banks increases the financial performance of commercial banks in Bangladesh or ROE decreases in the long run.

In Table -3 above, the coefficient of log net interest margin (LnNIM), which is used as a proxy for interest rate risk and is also a component of market risk, is 1.857 in the long run, which is significant at the 1% level. Therefore, at the 1% level of significance, the hypothesis that LnNIM has a positive influence on the profitability of commercial banks operating in Bangladesh is not rejected. However, the positive coefficient indicates that when net interest margin (NIM) or interest rate risk increases, ROE also increases. The log value of foreign exchange gain/loss (LnFexGL) a proxy for the other market risk factor known as foreign exchange risk having coefficient of 0.505 and a p value greater than 10%. So,

the hypothesis of LnFexGL has positive impact on ROE is rejected at 10% level of significance. And also, the positive coefficient indicates that when Foreign Exchange Risk increases the financial performance of commercial banks in Bangladesh or ROE also increases.

The coefficient of loan to deposit ratio (LDR) used as proxy of liquidity risk showed in Table-3 above is 0.028 having p value of more than 10%. Therefore, at a 10% level of significance, the hypothesis that LDR having a positive influence on the profitability of commercial banks operating in Bangladesh is rejected. However, the positive correlation shows that when bank LDR increases, Bangladeshi commercial banks' financial performance or ROE, increases as well.

The coefficient of cost income ratio (CIR) used as proxy of operational risk showed in Table-3 above is -0.154 in the long run which is significant at 1% level. Therefore, at the 1% level of significance, the hypothesis that CIR has a detrimental impact on the profitability of commercial banks operating in Bangladesh is not rejected. However, the negative coefficient indicates that when cost income ratio (CIR) increases, ROE decreases. The coefficient's value of -0.154 indicates that, over the long term, keeping other variables constant, a 1% increase in CIR decreases ROE by 15.40 percentage points.

The coefficient of dummy variable “IslamiConv” used as proxy of different types of banking operations in Bangladesh (both Islamic Banking and Conventional Banking system) showed in Table- 3 above is 1.210 having p value of more than 10%. Therefore, the 10% level of significance rejects the hypothesis that the dummy variable "IslamiConv" or banks type has a positive influence on the profitability of commercial banks operating in Bangladesh. The coefficient of control variable log of Bank Size (total asset), i.e. LnBS is 1.057 having p value more than 10%. Therefore, at a 10% level of significance, the hypothesis that the control variable "LnBS," or bank size, has a positive effect on the profitability of commercial banks operating in Bangladesh is rejected. The coefficient of within banking industry concentration control variable Herfindahl-Hirschman Index (HHI) is -0.096 in the long run which is rejected at 10% level of significance. The hypothesis that the control variable "HHI" has a negative effect on the profitability of commercial banks operating in Bangladesh is therefore rejected at a 10% level of significance.

Coefficient of macro-economic control variables “Inflation Rate” is 0.782 with p value of more than 10%. Therefore, at a 10% level of significance, the hypothesis that the control variable "Inflation Rate" has a positive influence on the profitability of commercial banks operating in Bangladesh is rejected. The coefficient of other macro-economic control variables “GDP Growth Rate” is -1.80 with p value of more than 10%. So, The hypothesis that the control variable "GDP Growth Rate" has a negative effect on the profitability of commercial banks operating in Bangladesh is therefore rejected at a 10% level of significance.

To test the short run effect on first econometric model, the short run version of model 1.2b has been estimated. Here, 1st lag value of the dependent variable i.e. 1st lag value of ROE has been used as independent variable to make the model dynamic among others including log of non-performing loan ratio (LnNPLR), log of net interest margin (LnNIM), log of foreign exchange gain/ loss (LnFexGL), loan to deposit ratio (LDR) and cost income ratio (CIR) and dummy variable “IslamiConv” represent two types of banking system Islamic Banking and Conventional Banking system operating in Bangladesh and control variable Bank Size is represented by log of Total Asset (LnBS), within banking industry concentration control variable “Herfindahl-Hirschman Index (HHI)” and Inflation Rate & GDP Growth Rate has been used as macroeconomic control variables.

The short run specification of model 1.2b has been examined initially through the pooled OLS regression model and then fixed effect regression model whose findings are shown in Table – 3. Here, the coefficient of lagged return on equity (L.ROE) of pooled OLS regression analysis is 0.310. So, the higher boundary of the coefficient of lagged value of return on equity (L.ROE) for the GMM model would be 0.310. The fixed effect estimates' coefficient of lagged return on equity (L.ROE) is -0.076. As a result, the GMM specification's lower bound for lagged return on equity (L.ROE) would be -0.076. Specifically, if the estimate is λ, it should be laid in the interval of $-0.076 \leq \lambda \leq 0.310$. The coefficient of the lag return on equity (ROE) in this case is 0.191, which is also significant at the 10% level according to the two step system GMM estimates for the short run specification of the model. In light of this, the coefficient falls within the permissible range of $-0.076 \leq \lambda \leq 0.310$ set by the fixed effects estimates and pooled OLS regression impact of the short run model 1.2b. This is the points to consistency of estimates.
The output of two step system GMM estimates shows that, the P-value of Wild Chi Squire is less than 0.01, so the model is significant at 1% level and all the independent variables have negative or positive effects on the dependent variable ROE. The number of instruments used in this study is less than the number of groups, and at a 1% level of significance, the log value of the dependent variable ROE's first lagged value, or LnL.ROE, differs considerably from zero. According to the analysis, the Hansen test statistic is 4.40, and the related p-value is higher than 0.10. As a result, at the ten percent level of significance, the null hypothesis of the validity of the over identifying restrictions for the instruments is not rejected. As a result, the model's instruments are suitable and produce accurate, consistent estimations. Table - 16 also displays the autocorrelation test in the error terms. With a matching p-value of more than 10%, the test statistic for first order autocorrelation, or AR(1), is -1.39. Therefore, at a ten percent level of significance, the null hypothesis that the disturbance term (error term) has no first order serial correlation is not rejected. The test statistic AR(2) for second order serial correlation in the error term equal to -1.02 with p-value that is more than 0.10. As a consequence, the null hypothesis that there is no second order serial correlation in the error terms is accepted and the use of instruments from the second lag and differences is permitted at a ten percent level of significance. This strengthens the case for adopting the two step system GMM estimates to specify model 1.2b correctly, in the short term.
Table – 3 above also shows that the coefficient of log of nonperforming loan ratio (LnNPLR) used as proxy of credit risk is -0.255 in the short run which is significant at 1% level. The hypothesis that credit risk has a negative effect on the profitability of commercial banks operating in Bangladesh is not rejected at 1% level of significance. In addition, the negative coefficient indicates that when NPLR or credit risk of banks increases, ROE decreases in the short run.
As shown in Table-3 above, the coefficient of log net interest margin (LnNIM), which is used as a proxy for interest rate risk and is also a component of market risk is 0.154 with a p value more than 10%. The assumption that interest rate risk has a positive short-term impact on the profitability of commercial banks operating in Bangladesh is rejected at a 10% level of significance. However, the positive coefficient indicates that when net interest margin (NIM) or interest rate risk increases, ROE also increases in the short run. The other component of market risk, i.e. foreign exchange risk which is proxy by log value of foreign exchange gain/ loss (LnFexGL) has coefficient of 0.336 in the short run which is significant at 1% level. So, the hypothesis of foreign exchange risk has positive impact in the short run on ROE is not rejected at 1% level of significance. And also, the positive coefficient indicates that when Foreign Exchange Risk increases the financial performance of commercial banks in Bangladesh or ROE also increases in the short run.

The coefficient of log of loan to deposit ratio (LnLDR) used as proxy of liquidity risk showed in Table-3 above is 0.438 having p value of more than 10%. Therefore, at 10% level of significance the hypothesis that LDR having a favorable influence on the profitability of commercial banks operating in Bangladesh is rejected. However, the positive correlation shows that as LDR of banks increases, Bangladeshi commercial banks' short-term financial performance or ROE also increases.

The coefficient of log of cost income ratio (LnCIR) used as proxy of operational risk showed in Table-3 above is -1.364 in the short run which is also significant at 1% level. The hypothesis that operational risk has a negative effect on the profitability of commercial banks operating in Bangladesh is not rejected at 1% level of significance. However, the negative coefficient indicates that when cost income ratio (CIR) increases, ROE decreases in the short run. The control variable log of Bank Size (total asset) or LnBS has a coefficient of -0.089 and a p value greater than 10%. So, the hypothesis of control variable "LnBS" or bank size has negative impact in the short run on the profitability of commercial banks operating in Bangladesh is rejected at 10% level of significance. The coefficient of within banking industry concentration control variable log of Herfindahl-Hirschman Index (LnHHI) is 7.535 in the long run which is significant at 10% level. Therefore, at the 10% level of significance, the hypothesis that the control variable "LnHHI" having a positive influence on the profitability of commercial banks operating in Bangladesh is not rejected.

Coefficient of macro-economic control variables log of Inflation Rate, i.e. "LnInfa" is -2.050 with p value of more than 10%. So, the hypothesis of control variable "Inflation Rate" has negative impact on the profitability of commercial banks operating in Bangladesh in the short run is rejected at 10% level of significance. The coefficient of other macro-economic control variables log of GDP Growth Rate, i.e. "LnGDPG" is -0.595 with p value of more than 10%. Therefore, at a 10% level of significance, the hypothesis that the control variable "GDP Growth Rate" has a negative influence on the profitability of commercial banks operating in Bangladesh is rejected.

The summery output of econometric model 1.2 both in the long run and short run where bank specific control variable Bank Size, i.e. log of Total Asset (LnBS), within banking industry concentration control variable Herfindahl-Hirschman Index (HHI) and macroeconomic control variables "Inflation Rate" & "GDP Growth Rate" has been considered into the model is that credit risk of the bank is negatively correlated with financial performance both in the long run and short run while interest rate risk and foreign exchange risk both are considered as part of market risk is positively correlated with financial performance both in the long run and short run. The liquidity risk of the bank is also positively correlated with financial performance in the long run and short run which is in line with the statistical assumption of this study. The operational risk of the banks is also having negative correlation with financial performance both in the long run and short run. Though, some of these study variables' coefficients are statistically significant and some are not significant at 1%, 5% or 10% confidence level.

5.1 Conclusion

Risk-taking is an essential element of banking and financial intermediation. Failure to effectively evaluate and manage risks may lead to losses that threaten the health of each financial institution and the stability of the entire financial system. The relation between effective risk management system and sound risk management practices is strong and has an impact on overall performance of banks, which is also significant. The different roles of a banking institution cannot operate together without proper risk management to achieve the bank's goals to optimize its capital. There is no other choice but to ensure

acceptable risk management practices for competitive survival. The banks should therefore give more emphasis to quality improvement in risk management and set their performance targets following strategic planning/goals. The extent of the risk management function and the structure maintained depend on the size and complexity of the banks. Risk management is most effective when the financial institution or banks applies basic principles and components of risk management consistently.

The main objective of this study is to evaluate the financial performance of commercial banking operating in Bangladesh as a result of risk management considering both internal and external determinants. The conceptual focus of this research is on how risk variables affect the financial performance of commercial banks. All local commercial banks in Bangladesh that were registered and in operation from the beginning of 2014 to the end of 2019 made up the research population.

The empirical output of the econometric models shows that, the credit risk has a negative impact on both the dependent variables, i.e., the financial performance of commercial banks operating in Bangladesh during the study periods both in the long run and short run, according to the summary of empirical output of the econometric model 1.1 and 1.2, which is also consistent with the statistical assumption of this study. So, when the credit risk of a commercial bank operating in Bangladesh increases the financial performance of the banks decreases. Both the long-term and short-term financial performance of commercial banks operating in Bangladesh during the research periods were positively impacted by the interest rate risk, which is also consistent with the study's statistical assumption. The other factor of market risk, i.e. foreign exchange risk showed negative correlation with ROA but positive correlation with ROE in the long run while positive correlation with both the dependent variables, i.e. financial performance of commercial banks operating in Bangladesh during the study periods in the short run means inconsistency with the statistical assumption of this study. So, we can summarized that, foreign exchange risk has negative correlation with ROA but have positive correlation with ROE in the long run while has positive correlation with both ROA & ROE, i.e. the financial performance of commercial banks operating in Bangladesh in the short run considering all the bank specific control factors, banking industry concentration control factors and macro-economic control factors in to the model. The foreign exchange risk behaves differently in the long run with two dependent variables, i.e. ROA and ROE due to different types of dividend payout policies and capital management policies of the commercial banks operating in Bangladesh, which may have influence on the ROE ratio calculation techniques for the Banks. The liquidity risk has positive impact of both the dependent variables, i.e. financial performance of commercial banks operating in Bangladesh during the study periods both in the long run and short run which is also in line with the statistical assumption of this study considering all the bank specific control factors, banking industry concentration control factors and macro-economic control factors in to the model. So, when the liquidity risk of a commercial bank operating in Bangladesh increases the financial performance of the banks also increases. Last but not least, operational risk has a negative effect on both the dependent variables, i.e., the financial performance of commercial banks operating in Bangladesh during the study periods, both in the long run and short run, which is also consistent with the statistical hypothesis of this study considering all the bank specific control factors, banking industry concentration control factors and macro-economic control factors in to the model. So, when the operational risk of a commercial bank operating in Bangladesh increases the financial performance of the banks decreases.

After reviewing all the outputs of the econometric models, it has been observed that, Banks' can manage their credit risk and operational risk efficiently through implementation of prudent policies, guidelines and ensure proper monitoring, compliances to minimize losses as well as improve their financial

performance. But there may have influence of some external factors on the liquidity risk and market risk of the banks. Which has been analyzed and empirically tested through examined econometric models of this study, i.e. bank should analyzed other external factors like banking industry concentration and macro-economic variables like GDP Growth and Inflation carefully while managing the liquidity risk and market risk in addition to the bank specific risk factors.

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