

SHORT-TERM DETERMINANTS OF BANKING PROFITABILITY AND FINANCIAL SUSTAINABILITY OF BANKS IN BANGLADESH: AN EMPIRICAL STUDY OF COVID-19 EFFECTS

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Abstract

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The purpose of this study is to examine the profitability and financial sustainability of banks in Bangladesh before and during COVID-19. The study compares the profitability and financial sustainability of 23 listed private commercial banks. The data for short-term periods before the COVID-19 and during the COVID-19 crisis we used. Financial ratios, descriptive statistics, correlation matrix and linear regression model estimations are used for the analysis of data. The mean values of *ROA*, *ROE* and *NIM* are found before the COVID-19 crisis as 0.0019, 0.0270 and 0.0054, and during the COVID-19 as 0.00128, 0.01856 and 0.00321 respectively. On the other hand, the mean values of *NFLR*, *CCR*, *ICR*, and *OSR* are found before COVID-19 as 2.0936, 6.852, 0.9314 and 0.4751, and during COVID-19 as -2.5961, 5.879, 0.7673 and 0.3587 respectively. The findings construe a significant impact of the unprecedented pandemic. Within a short period of time, sample banks' profitability and financial sustainability deteriorated significantly. A key implication of our study is that the private-sector commercial banks in Bangladesh experienced severe financial difficulties during COVID-19 which impacted their profitability and financial sustainability. The findings of the study suggest that adverse economic events have substantial effects on the financial realities of financial institutions. The findings of the study are expected to be useful to both academics and policymakers.

Keywords: Financial Sustainability, Banks, Bangladesh, Effect, Profitability

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1. INTRODUCTION

Coronavirus (COVID-19 hereafter) appeared first in Wuhan, China in December 2019. COVID-19 is then spread in many countries and causing an unprecedented economic crisis all over the world. Bangladesh and neighboring South Asian countries including India and Pakistan suffered from severe consequences of the COVID-19 pandemic. The World Bank forecasted that the gross domestic product (GDP) of Bangladesh would decline from 2% to 3% during COVID-19 (World Bank, 2020). The International Monetary Fund (IMF) also projected the growth rate of Bangladesh to drop to 2% during COVID-19 (IMF, 2020).

The banking sector represents an important sector of the economy. A stable or volatile economy impacts the performance of the banking sector. As COVID-19, which continues even in 2021 contributed to instability in the economy, the banking sector is susceptible to be affected by the COVID-19 trauma. Interest income is the main source of revenue of a bank. As the loan repayment power of the loanees has been affected by the traumatic business environment during COVID-19, the Central Bank of Bangladesh instructed banks and financial organizations in Bangladesh not to classify loanees as loan defaulter due to non-payment of interest by loanees for the time being. The prevalent circumstances impacted banks' ability to recover loan and interest. Consequently, the profitability of banks has presumably shrunk in 2020. Moreover, the major decline in fee income from export, import and remittance increased worries about operational losses of banks during COVID-19 (Amin, 2020).

The banking sector of Bangladesh is also experiencing disparity in deposit mobilization due to unattractive interest rates offered by banks and reduced public savings capacity. The lending activities of banks are also getting worse. In some cases, 40% of loans have been classified due to non-recovery (Zahid, 2020). The banking industry cannot afford to endure the pressure arising from unprecedented economic instability for various reasons as stated above.

Several studies were undertaken to assess the profitability and financial sustainability of banks at the country, cross-country and regional levels (Duan & Niu, 2020; Cruz-García et al., 2020; Adelopo et al., 2018). Cruz-García et al. (2020) shade light on 15-EU countries, examining banks' profitability and financial sustainability in the wake of the global financial crisis (GFC) during 2007-2008. Their study overwhelmingly emphasizes net interest margin (NIM) as an important profitability measurement tool and examines the determinants that lead to the disparity in NIM. Adelopo et al. (2018) investigate banks' profitability before, during and after the financial crisis in Europe and argue that the financial crisis doesn't impact the relationship between bank-specific determinants and profitability.

Duan and Niu (2020) investigated the impact of liquidity on profitability before, during and after the financial crisis. Raza et al. (2019) also emphasized NIM and examined profitability by using the spread ratio, rather than using the two common measures

of profitability, such as return on assets (ROA) and return on equity (ROE). Iskandar et al. (2019) and Islam and Rana (2019) examined the profitability determinants of commercial banks in Malaysia and Bangladesh respectively. However, the scope of the present study is different from those studies in view of the nature of determinants of profitability considered in the present study. Batten and Vo (2019) measured profitability using ROA, ROE, and NIM in Vietnamese banks. They considered the size of the company, capital adequacy, credit risk, operation cost, and productivity as the indicators of profitability. Bansal et al. (2018) used the profit margin to explain the profitability of Indian banks. They selected the determinants that are sensitive to the profit margin ratio. Noman et al. (2015) measured the influence of banking type on the profitability of banks in Bangladesh. They suggest providing emphasis on considering the macroeconomic determinants of profitability.

A bank is meant to be financially sustainable if it consistently can produce enough revenue inflow to cover relevant expenses and generate a surplus. The steady growth of revenue is one of the determinants of a firm's financial sustainability. The capability of a firm to protect itself from external negative influences, especially during a crisis period is also critical to its sustainability. Financial sustainability received heightened importance in the wake of failures of large banks and financial institutions during the global financial crisis of this century (Yip & Bocken, 2018). The financial sustainability of banks and many other firms has again become the talk of the day during the COVID-19 crisis.

The review of prior studies reveals that many studies have been conducted on the profitability of banks in Asia and Europe, but there is a dearth of research measuring and comparing the profitability and financial sustainability of banks during and before the COVID-19 crisis. Because of this research gap, this study aims at measuring and comparing the profitability and financial sustainability of banks in Bangladesh before and during COVID-19. Relevantly, the investigation, analysis and findings of the study are guided by two research questions:

RQ1: Did COVID-19 have any effects on banks' profitability and financial sustainability?

RQ2: What factors contributed to changing profitability and financial sustainability during COVID-19?

This paper contributes to the existing literature by measuring whether a pandemic affects the performance of the banking sector in Bangladesh. Selected dependent and independent variables are considered to describe the profitability and financial sustainability of banks. The study avoids considering the macroeconomic variables because this study does not make a time series analysis and assumes that the impact of the macroeconomic variables would not be so vigilant for the selected two periods (quarters) considered in the study.

The paper is structured into six sections. The remaining sections comprise a literature review (Section 2), research methods (Section 3), empirical results (Section 4), discussion of findings (Section 5) and conclusion (Section 6).

2. LITERATURE REVIEW

Prior studies reveal that credit risk, capital adequacy ratio, net interest income, firm size, ownership structure, risk appetite, management efficiency and product diversification are important factors of profitability (Kanga et al., 2020; Adelopo et al., 2018; Rahman et al., 2023; Ghosh, 2014; Sufian, 2012).

Duan and Niu (2020) used three factors, such as liability-side liquidity creation, off-balance sheet liquidity creation and asset-side liquidity creation of profitability of banks. They found that liquidity creation and bank profitability are positively associated during the financial crisis and normal period. They asserted that liquidity acts as counterproductive during the financial crisis.

Le and Ngo (2020) focused on other three factors of bank profitability, such as the number of bank cards issued, the number of automated teller machines (ATMs) and the number of points of sale terminals which are highly important for bank profitability. They explain that competition and capital market improvement enhance the profitability of firms while overhead cost and large capital decrease profitability. Their study implies that crisis event usually impacts profitability.

Kanga et al. (2020) investigated banks' profitability in West African Economic and Monetary Union (WAEMU) countries by applying the Z-score ratio. Their result shows a positive and significant impact of capital on ROA and a sensitivity of the bank's profitability with changes in capital ratio. Their study also indicates an increase in capital ratio due to a rapid increase in equity rather than that of assets might result in a decrease in return on equity, where firm size also shows a positive result.

Paltrinieri et al. (2021) found that income diversification positively impacts profitability more in Islamic banks than in conventional banks. Their results provide more robust evidence in using accounting measures, i.e., ROA or ROE, their standard deviation and the Z-score.

Al-Harbi (2019) investigated banks' profitability in emerging and Organisation of Islamic Cooperation (OIC) countries focusing on internal and external factors and found that crisis event doesn't have a negative effect on profitability. Their study considered capital adequacy and found a positive impact on ROA and NIM thus forming a positive relationship with profitability. The study also found other operating income has a highly positive and significant influence on ROA and NIM. Similarly, off-balance sheet activities contribute positively to profitability. On the other hand, his study claims overhead costs reduce banks' profitability, but a positive relation may be formed if the bank's authority reduces cost and transfers part of the operating cost to their customers.

Dietrich and Wanzenried (2011) confirm that bank size plays a critical role in a time of financial crisis on profitability. They find large-sized banks are comparatively less profitable than medium and small-sized banks because of large operational costs and liquidity. Adelopo et al. (2018) examined the banking profitability factors of West African States banks during, before and after the period of the financial crisis. They found both internal and external factors have significant relationship with bank profitability. However, the financial crisis does

not have any notable relationship with bank profitability in the West African States banks. A similar study conducted by Bouzgarrou et al. (2018) found different results. Their findings suggest that in the crisis period, foreign banks perform better than domestic banks. However, both the banks' profit growth is affected by the financial crisis.

Korytowski (2018) inspected the determinants of banks' profitability in the post-financial crisis era in the European Union (EU). Based on their examination of internal and macro-level factors, this study found that bank size is adversely associated with bank profitability where risk appetite has a profitability-fostering effect during the post-crisis period. The study considered ROA and ROE as the proxies of profitability. It is claimed that the use of NIM to measure profitability rather than loan asset class would distort the actual result.

A good number of studies are found to have explored the determinants of the profitability of banks in Bangladesh. Islam and Rana (2017) conducted their study using panel data of 15 selected private commercial banks in Bangladesh. They found banks' dependence on capital strength and liquidity to improve profitability because these determinants result in with significant positive impact on NIM. They also found that high operating expense reduces banks' profitability and particularly small-sized banks face hardship to maintain profitability because of this fixed expense. They recommend that banks should focus on the efficiency ratio to maintain an acceptable operating expense margin.

Majumder and Li (2018) found that a higher capital ratio is significantly related to banks' performance and reduces the risk in the banking sector, but performance and risk are inversely related. Results of this study also show a positive impact of cost inefficiency, an opposite impact of off-balance sheet activities and no significant impact of annual GDP growth rate on banks' profitability. They also speculate that a higher volume of the loan may cause to deteriorate the bank's performance.

Rahman et al. (2015) explored banks' profitability in Bangladesh using three different measures, ROA, NIM and ROE. Their empirical results indicate that capital adequacy and loan intensity positively impact profitability. Their study also found that capital adequacy is significant and positively related to NIM and ROE, but in case of ROA, it is true only when the equity to total asset ratio is used as a proxy for capital. On the contrary, cost efficiency and off-balance sheet activities have significant negative impacts on profitability. In addition, non-interest income and credit risk impact NIM, while bank size impacts ROA significantly and positively.

Sufian and Habibullah (2009) investigated the profitability and performance of conventional banks in Bangladesh from 1997 to 2004. They found some specific factors including credit risk, loans intensity, and cost which stimulate bank profitability, whereas non-interest income has a detrimental effect instead. Besides, these findings, their study reveals that firm size is inversely associated with ROE while ROA as well as NIM are positively associated. Reportedly, their study confirms that macroeconomic variables have

an insignificant link to banks' profitability in Bangladesh.

While we found several studies, as evidenced above, there is a lack of studies on banks' profitability and financial sustainability, considering the COVID-19 effects. This study presents a comparison of selected banks' financial performance in the first quarter and the second

quarter of 2020 to highlight the impact of COVID-19. The scope of our study is large because we considered profitability and financial sustainability together. Although the datasets and time frame for the study are short, it is nevertheless possible to gauge the short-term implications of the pandemics on both profitability and sustainability of banks.

Table 1. Summary of prior research on profitability/financial sustainability determinants and research gap (Part 1)

<i>Studies (year), author's name</i>	<i>Sector, nature of crisis and country</i>	<i>Proposed determinants</i>	<i>Research gap</i>
<i>Earliest</i>			
Majumder and Li (2018)	<i>Sector:</i> 34 state-owned commercial banks, conventional private commercial banks, Islamic private banks. <i>Crisis type:</i> little focus on the 2007 to 2009 financial crisis. <i>Country:</i> Bangladesh.	Liquidity, cost inefficiency, labor productivity, non-traditional activity, income diversification, deposit ratio, leverage, market power, economic growth, bank lending interest rate and inflation. Risk determinants: default risk, credit risk and overall risk. Bank capital: actual capital and regulatory capital.	The study focuses on the bank profitability of Bangladesh and ignores the bank sustainability facts and sheds light on any financial crisis and COVID-19 issue logically absent because of study period fact.
Adelopo et al. (2018)	<i>Sector:</i> 123 commercial banks. <i>Crisis type:</i> financial crisis of 2007-2009. <i>Country:</i> West African countries.	Size, cost management, liquidity, capital strength, credit risk, market power, GDP and inflation.	The study investigates bank profitability before, during and after the financial crisis of 2007-2009. Where bank's sustainability issue is absent in the study.
Korzeb and Samaniego-Medina (2019)	<i>Sector:</i> 14 commercial Banks. <i>Crisis type:</i> does not focus on financial crisis. <i>Country:</i> Poland.	Cost to income, cost to assets, donation to bank assets, donation to net profit, energy consumption and saving disclosure, energy saving policies, environmental financing, social sustainability disclosure, financial assistance, development incentives, sponsorships, product responsibility disclosure, responsibility for banking products and services.	This paper investigates the banking sectors involvement with sustainable development through multi-dimensional evaluation and focuses on various shortcomings in the sustainable performance of commercial banking activities.
Al-Harbi (2019)	<i>Sector:</i> 686 conventional banks. <i>Crisis type:</i> period considered 1989 to 2008 and consciously avoids the financial crisis of 2007-2009 or any other crisis. <i>Country:</i> 52 OIC countries.	Capital adequacy, loans, deposits, cost management, off-balance sheet activities, foreign ownership, real GDP growth, economic development, real interest rate, tax, deposit insurance, oil shocks, stock market capitalization, banking sector development (industry size), size and concentration.	The study does not touch on any financial crisis. Despite the fact, the study also does not focus on the bank's sustainability issue.
Rosman et al. (2014)	<i>Sector:</i> 79 Islamic banks. <i>Crisis type:</i> during 2007-2010 that includes the period of the 2007-2008 financial crisis. <i>Country:</i> Middle Eastern and Asian countries.	Three different types of efficiency measures including overall technical, purely technical, and scale efficiency. In addition, this method enables us to distinguish between three types of return to scale (RTS), namely: the constant return to scale (CRS), decreasing return to scale (DRS) and increasing return to scale (IRS).	The study investigates bank profitability during the financial crisis of 2007-2009. Where bank's sustainability issue is absent in the study.
<i>Latest</i>			
Le and Ngo (2020)	<i>Sector:</i> 23 banks. <i>Crisis type:</i> financial crisis of 2007-2009 has been considered in the study but was not in the core focused issue. <i>Country:</i> Australia, Belgium, Brazil, Canada, China, France, Germany, Hong Kong, India, Italy, Japan, Korea, Mexico, Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Sweden, Switzerland, Turkey, the United Kingdom, and the United States (in this literature, the financial crisis of 2007-2008 is considered as dummy variable and the target of this paper is to examine the profitability determinants).	Electronic banking products, bank efficiency, capital adequacy, credit risk, effects of financial market development, effects of market, power, economic growth, inflation, effects of the financial contagion.	The study investigates the bank's profitability factors where the 2007-2009 financial crisis has been considered. However, the study does not touch on the bank's sustainability issues and COVID-19 fact.

Table 1. Summary of prior research on profitability/financial sustainability determinants and research gap (Part 2)

Studies (year), author's name	Sector, nature of crisis and country	Proposed determinants	Research gap
<i>Latest</i>			
Kanga et al. (2020)	Sector: 113 banks (commercial, investment, private and public). Crisis type: does not focus on any financial crisis. Country: all WAEMU countries.	Bank riskiness, bank size, industrial concentration and competition, business cycle, level of financial sector development, borrowing cost, political stability and capital requirement.	The paper investigates the bank's profitability while does not focus on any financial crisis and the study also denies the bank's sustainable issues.
Paltrinieri et al. (2021)	Sector: 47 Islamic and 154 conventional banks. Crisis type: Financial crisis of 2007-2009. Country: the United Arab Emirates, Saudi Arabia, Qatar, Bahrain, Oman, Kuwait, Malaysia, Indonesia, Pakistan, Bangladesh and Turkey.	Size, asset growth, leverage effects, lending strategy, bank efficiency, GDP, level of inflation, the level of regulatory restrictions, financial crisis in 2008 and 2009.	This paper examines the impact of income diversification on the profitability and firm-risk of banks. Where the bank's sustainability is ignored and the COVID-19 crisis is also absent.
Duan and Niu (2020)	Sector: 9,074 banks. Crisis type: financial crisis of 2007-2009. Country: the United States.	Bank size, capital, business model characteristics, operational efficiency, credit risk, bank concentration, the annualized growth rate of real GDP, inflation, and federal funds rate, 'cat fat' liquidity creation measure, liquidity creation on the asset side, liquidity creation on the liability side and liquidity creation off the balance sheet.	This paper examines the effect of liquidity creation on profitability. The study considers both the financial crisis period of 2007-2009 and normal time but the COVID-19 crisis period is absent and the bank's sustainability facts are also untouched here.
Cruz-García et al. (2020)	Sector: 3,316 banks. Crisis type: financial crisis of 2007-2009, Great Recession years. Country: the EU-15 countries.	Market power, Risk aversion, Size, Interest rate risk, Credit risk, Risk interaction, Average operating costs, Reserves, Implicit payments and Efficiency.	The study examines bank profitability during the Great Recession years of the EU and ignores the sustainable factors in the study

3. RESEARCH METHODOLOGY

3.1. Data

This study is conducted on secondary data collected from Bangladesh Bank website and the published quarterly financial reports of selected commercial banks. We used the data for two short-term periods covering the first quarterly period (January to March 2020) before the COVID-19 crisis in Bangladesh and the second quarterly period (April to June 2020) during the COVID-19 crisis. Descriptive statistics, correlation matrix and linear regression model estimations are used for the analysis of data.

3.2. Sample design

Currently, there are 60 scheduled banks in Bangladesh. These consist of 6 state-owned commercial banks, 42 private-owned commercial banks, 9 foreign banks and 3 specialized banks. Foreign banks, specialized banks and state-owned commercial banks are excluded from this study. Of the 42 private-owned commercial banks, only 29 are listed on Dhaka Stock Exchange. However, data for 6 of these listed banks are not available. Finally, the sample of this study consists of 23 listed private-sector commercial banks in Bangladesh which represent 72.10% of the total assets of all listed banks (Dhaka Stock Exchange, 2020).

3.3. Econometric specification

The specific determinants of banks' profitability in Bangladesh are estimated using the regression model as under:

$$Y_{1i} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon \quad (1)$$

If we put $i = 1, 2$ in Eq. (1) then we get Y_{11} and Y_{12} which indicate the *ROA* and *ROE* respectively; where, β_0 is the constant parameter/intercept term, β_1 - β_9 represent the regression coefficient, ε is the random disturbance term or error term, X_1 represents *capital adequacy*, X_2 is the *firm size*, X_3 denotes the *liquidity*, X_4 represents the *deposits*, X_5 is the *non-interest income*, X_6 is the *cost to income*, X_7 denotes the *loan loss provisions*, X_8 is the *off-balance sheet* and X_9 denotes *tax*.

The specific determinants of banks' sustainability in Bangladesh are estimated as under:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon \quad (2)$$

If we put, $i = 1, 2, 3, 4$ respectively in Eq. (2), we get Y_1, Y_2, Y_3, Y_4 ; where, Y_1 = net financial liabilities ratio, Y_2 = cash coverage ratio, Y_3 = interest coverage ratio and Y_4 = operating surplus ratio.

3.4. Variable definitions

Various dependent and independent variables have been identified in Table 1. The depended variables relating to profitability include return on assets (*ROA*), return on equity (*ROE*) and net interest margin (*NIM*). The depended variables relating to financial stability are net financial liabilities ratio (*NFLR*), operating surplus ratio (*OSR*), cash coverage ratio (*CCR*) and interest coverage ratio (*ICR*). Independent variables comprise *capital adequacy*, *firm size*, *liquidity (LIQD)*, *deposits*, *non-interest income (NIITP)*, *cost to income*, *loan loss provisions*, *off-balance sheet (OBS)* and *tax*.

Table 2. Identification and definition of dependent and independent variables

Type	Variable	Definition and measure
Dependent variables: Profitability	Return on assets (ROA)	Net income to total assets
	Return on equity (ROE)	Net income as a fraction of total equity capital
	Net interest margin (NIM)	Net interest income divided by total assets
Dependent variables: Financial sustainability	Net financial liabilities ratio (NFLR)	Total liabilities less current assets divided by operating income
	Operating surplus ratio (OSR)	Profit before provision as a fraction of operating income
	Cash coverage ratio (CCR)	Total cash divided by interest expenses
	Interest coverage ratio (ICR)	Operating income divided by interest expense
Independent variables	Capital adequacy	Total equity capital to total assets
	Firm size	Natural logarithm of total assets
	Liquidity (LIQD)	Total loans to total assets
	Deposits	Total deposits as a fraction of total assets
	Non-interest income (NIITP)	Non-interest income to total profit
	Cost to income	Operating expense as a fraction of total assets
	Loan loss provisions	Loan loss provisions divided by total loans
	Off-balance sheet (OBS)	Off-balance sheet as a fraction of total assets
	Tax	Tax to total profit

4. EMPIRICAL RESULTS

4.1. Descriptive statistics

The current section presents the results of the study based upon descriptive statistics, correlation matrix

and regression. Table 3 below presents the mean, median, minimum and maximum values for all dependent variables before and during the COVID-19 crisis.

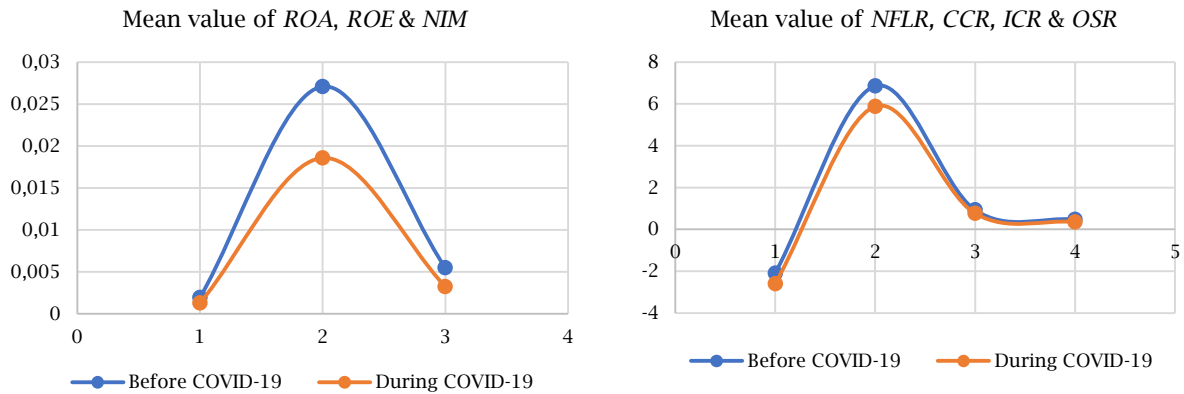
Table 3. Descriptive statistics before and during the COVID-19 crisis

Dependent variable	Mean		Median		Minimum		Maximum		Std. dev.	
	Before	During	Before	During	Before	During	Before	During	Before	During
ROA	0.002	0.001	0.002	0.001	0.000	0.000	0.004	0.004	0.001	0.001
ROE	0.027	0.019	0.027	0.013	0.002	0.001	0.052	0.048	0.013	0.015
NIM	0.005	0.003	0.005	0.003	0.0001	0.000	0.011	0.006	0.003	0.002
NFLR	-2.094	-2.596	-1.936	-1.534	-10.971	-20.174	4.237	5.952	3.479	5.651
CCR	6.852	5.879	5.215	4.982	2.960	2.521	39.077	18.431	7.123	3.434
ICR	0.931	0.767	0.848	0.714	0.251	0.273	3.4352	2.337	0.662	0.440
OSR	0.475	0.359	0.504	0.359	0.117	0.084	0.691	0.607	0.139	0.136
Capital adequacy	0.072	0.070	0.071	0.068	0.035	0.035	0.109	0.108	0.018	0.017
Firm size	26.557	26.596	26.563	26.590	25.117	25.121	27.782	27.818	0.451	0.454
LIQD	0.719	0.710	0.716	0.712	0.593	0.570	0.850	0.862	0.062	0.075
Deposits	0.768	0.764	0.768	0.761	0.666	0.675	0.847	0.842	0.047	0.048
NIITP	2.514	4.191	1.198	2.292	0.378	0.306	22.184	21.602	4.481	5.135
Cost to income	2.863	4.133	1.348	2.870	0.673	0.281	19.994	20.053	4.477	4.559
Loan loss provisions	0.002	0.001	0.002	0.001	0.000	0.000	0.004	0.005	0.001	0.001
OBS	0.275	0.237	0.258	0.234	0.116	0.110	0.476	0.416	0.112	0.091
Tax	0.446	0.451	0.435	0.458	0.264	0.084	0.745	0.746	0.103	0.184

Table 3 also shows that the mean (standard deviation) values of three *profitability* measures are 0.001 (0.001), 0.019 (0.015) and 0.003 (0.002) for ROA, ROE and NIM respectively. The maximum values for ROA, ROE and NIM are 0.004, 0.048 and 0.006 respectively whereas the minimum values are 0.000, 0.001 and 0.000 respectively during the crisis of COVID-19. The mean (standard deviation) values of four *financial sustainability* measures are -2.596 (5.651), 5.879 (3.434) and 0.767 (0.440) and 0.359 (0.136) for NFLR, CCR, ICR and OSR respectively. The maximum values for NFLR, CCR, ICR and OSR are 5.952, 18.431, 2.337 and 0.607 respectively whereas the minimum values are -20.174, 2.521, 0.273 and 0.084 respectively during the crisis of COVID-19. Mean (standard deviation) value of *capital adequacy* is 0.070 (0.017), ranging from a maximum 0.108 to a minimum is 0.035. The mean value (standard deviation) of *firm size* is 26.596 (0.454) respectively whereas the minimum and maximum

values of *firm size* are 25.121 and 27.818 respectively. *Liquidity* mean (standard deviation) value is 0.710 (0.075) whereas the maximum and minimum values are 0.862 and 0.570 respectively. *Deposits* mean (standard deviation) is 0.764 (0.048) and minimum and maximum values are 0.675 and 0.842 respectively. *Non-interest income* mean (standard deviation) is 4.191 (5.135) and minimum and maximum values are 0.306 and 21.602 respectively. *Cost to income* mean (standard deviation) is 4.133 (4.559) and minimum and maximum values are 0.281 and 20.053 respectively. *Loan loss provisions* mean (standard deviation) is 0.001 (0.001) and whereas the maximum and minimum values are 0.005 and 0.000 respectively. It is also seen from the table that the OBS and tax are 0.237 and 0.451 respectively. The maximum value of OBS is 0.416 with a minimum value of 0.110. Tax ranges from a maximum 0.746 to a minimum 0.084 during the crisis of COVID-19.

Figure 1. Mean value comparison



As per Figure 1, the mean values of ROA, ROE, and NIM before and during COVID-19 are 0.00193, 0.02708, 0.00545, and 0.00128, 0.01856, 0.00321 respectively. The mean values of NFLR, CCR, ICR, and OSR before and during COVID-19 are

-2.0936, 6.852, 0.9314, 0.4751 and -2.5961, 5.879, 0.7673 and 0.35870. It appears that banks were more profitable and financially sustainable in the pre-COVID period.

Table 4. Correlation matrix among variables before the crisis of COVID-19 for bank profitability

	ROA	ROE	NIM	Capital adequacy	Firm size	LIQD	Deposits	NIITP	Cost to income	Loan loss provisions	OBS	Tax
ROA	1											
ROE	0.849**	1										
NIM	0.464*	0.359	1									
Capital adequacy	0.454*	-0.058	0.241	1								
Firm size	-0.500	-0.327	-0.153	-0.436*	1							
LIQD	-0.544**	-0.395	-0.280	-0.290	0.286	1						
Deposits	-0.195	-0.078	-0.044	-0.244	-0.023	0.469*	1					
NIITP	-0.549**	-0.604**	-0.535**	-0.069	0.065	0.208	-0.055	1				
Cost to income	0.184	-0.012	0.744**	0.330	-0.108	-0.389	-0.258	-0.099	1			
Loan loss provisions	0.089	0.043	0.211	0.099	0.111	-0.227	-0.329	-0.296	-0.339	1		
OBS	0.209	0.216	0.059	0.017	-0.123	-0.380	-0.742**	-0.164	-0.201	0.550**	1	
Tax	-0.273	-0.161	0.278	-0.314	0.266	-0.176	0.067	-0.135	-0.142	0.192	-0.008	1

Note: ** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

Table 5. Correlation matrix among variables during the crisis of COVID-19 for banks' profitability

	ROA	ROE	NIM	Capital adequacy	Firm size	LIQD	Deposits	NIITP	Cost to income	Loan loss provisions	OBS	Tax
ROA	1											
ROE	0.922**	1										
NIM	0.160	0.284	1									
Capital adequacy	0.200	-0.104	-0.322	1								
Firm size	-0.236	0.046	0.276	-0.441*	1							
LIQD	-0.136	-0.100	0.078	-0.228	0.229	1						
Deposits	0.192	0.267	0.193	-0.257	0.035	0.301	1					
NIITP	-0.524**	-0.549**	-0.346	0.096	0.006	0.211	-0.108	1				
Cost to income	-0.058	-0.016	0.607**	0.030	0.238	-0.409*	-0.209	-0.151	1			
Loan loss provisions	-0.315	-0.364	0.022	-0.004	-0.157	-0.157	-0.204	0.397	-0.023	1		
OBS	-0.024	-0.035	-0.190	0.011	-0.165	-0.310	-0.704**	-0.270	-0.364	0.047	1	
Tax	-0.236	-0.219	0.142	-0.279	-0.164	-0.233	0.110	-0.306	0.079	-0.033	0.096	1

Note: ** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

Tables 4 and 5 provide information about the degree of correlation between profitability variables and explanatory variables for the dataset. Pearson's correlation coefficients are used to show the degree of relationship. Multi-collinearity is a problem when the correlation exceeds 0.80. From

the correlation matrix, it is observed that most of the correlation values are relatively small, so the correlation matrix output ensures that there is no significant concern of multi-collinearity between the explanatory variables. The matrix shows that capital adequacy is positively and significantly

associated with *ROA* before the crisis of COVID-19 but during the crisis of COVID-19, there are no variables that are positively and significantly associated with *ROA*. On the opposite of this, *LIQD* and *NIITP* are negatively and significantly associated with *ROA* before the crisis of COVID-19. In COVID-19, *ROA* is negatively and significantly associated with *NIITP*. The matrix also shows that

NIITP is negatively and significantly related to *NIM* before the crisis of COVID-19 but there are no variables that are negatively and significantly associated with *NIM* during the crisis of COVID-19. On the other hand, *cost to income* is positively and significantly associated with *NIM* both the before and during the crisis COVID-19.

Table 6. Correlation matrix among variables before the crisis of COVID-19 for banks' financial sustainability

	<i>NFLR</i>	<i>CCR</i>	<i>ICR</i>	<i>OSR</i>	<i>Capital adequacy</i>	<i>Firm size</i>	<i>LIQD</i>	<i>Deposits</i>	<i>NIITP</i>	<i>Cost to income</i>	<i>Loan loss provisions</i>	<i>OBS</i>	<i>Tax</i>
<i>NFLR</i>	1												
<i>CCR</i>	0.242	1											
<i>ICR</i>	0.327	0.913**	1										
<i>OSR</i>	0.089	-0.233	-0.141	1									
<i>Capital adequacy</i>	-0.399	-0.014	0.192	0.057	1								
<i>Firm size</i>	-0.008	0.082	-0.025	-0.154	-0.436*	1							
<i>LIQD</i>	-0.510*	-0.357	-0.555**	-0.252	-0.290	0.286	1						
<i>Deposits</i>	-0.327	-0.059	-0.199	-0.021	-0.244	-0.023	0.469*	1					
<i>NIITP</i>	-0.219	-0.097	-0.241	-0.669**	-0.069	0.065	0.208	-0.055	1				
<i>Cost to income</i>	0.262	0.684**	0.835**	-0.443*	0.330	-0.108	-0.389	-0.258	-0.099	1			
<i>Loan loss provisions</i>	0.150	0.053	0.155	0.461*	0.099	0.111	-0.227	-0.329	-0.296	0.056	1		
<i>OBS</i>	0.409*	-0.064	0.052	0.302	0.017	-0.123	-0.380	-0.742**	-0.164	0.072	0.550**	1	
<i>Tax</i>	0.383	0.258	0.232	0.040	-0.314	0.266	-0.176	0.067	-0.135	0.120	0.192	-0.008	1

Note: ** Correlation is significant at the 0.01 level, * Correlation is significant at the 0.05 level.

Table 7. Correlation matrix among variables during the crisis of COVID-19 for bank financial sustainability

	<i>NFLR</i>	<i>CCR</i>	<i>ICR</i>	<i>OSR</i>	<i>Capital adequacy</i>	<i>Firm size</i>	<i>LIQD</i>	<i>Deposits</i>	<i>NIITP</i>	<i>Cost to income</i>	<i>Loan loss provisions</i>	<i>OBS</i>	<i>Tax</i>
<i>NFLR</i>	1												
<i>CCR</i>	-0.034	1											
<i>ICR</i>	0.218	0.867**	1										
<i>OSR</i>	0.196	-0.061	0.058	1									
<i>Capital adequacy</i>	-0.655**	0.149	0.097	-0.329	1								
<i>Firm size</i>	0.330	-0.120	0.052	-0.003	-0.441*	1							
<i>LIQD</i>	-0.356	-0.444*	-0.615**	-0.128	-0.228	0.229	1						
<i>Deposits</i>	-0.243	0.121	-0.051	0.044	-0.257	0.035	0.301	1					
<i>NIITP</i>	-0.073	-0.289	-0.360	-0.319	0.096	0.006	0.211	-0.108	1				
<i>Cost to income</i>	0.372	0.575**	0.804**	-0.341	0.030	0.238	-0.409*	-0.209	-0.151	1			
<i>Loan loss provisions</i>	0.125	-0.163	-0.026	0.311	-0.004	-0.157	-0.157	-0.204	0.397	-0.023	1		
<i>OBS</i>	0.336	-0.171	-0.065	0.204	0.011	-0.165	-0.310	-0.704**	-0.270	-0.038	0.047	1	
<i>Tax</i>	0.378	0.098	0.087	-0.027	-0.279	-0.164	-0.233	0.110	-0.306	0.079	-0.033	0.096	1

Note: ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at 0.05 at the level (2-tailed).

Tables 6 and 7 reveal information about the degree of correlation between financially sustainable variables and explanatory variables for the dataset. Pearson's correlation coefficients are used to show the degree of relationship. Multicollinearity is a problem when the correlation exceeds 0.80. From the correlation matrix, it is observed that most of the correlation values are relatively small, so the correlation matrix output

ensures that there is no significant concern of multicollinearity between the explanatory variables.

4.2. Regression analysis

The model for the bank's profitability is selected on the basis of strong diagnostics and high value for the R-squared. The results are represented in Tables 8, 9, 10, 11, 12, 13 and 14 with different *profitability* and *financial sustainability* indicators.

Table 8. Comparisons of internal factors on banks' profitability (*ROA*) before and during the crisis of COVID-19

Dependent variable	Explanatory variable	Before the crisis of COVID-19 (January–March 2020)			During the crisis o COVID-19 (April–June 2020)		
		Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
ROA	Intercept	0.024	1.715	0.108	0.030	1.749	0.102
	Capital adequacy	0.005	0.511	0.617	-0.006	1.657	0.673
	Firm size	-0.001	-1.261	0.228	-0.001	-0.401	0.132
	LIQD	-0.007	-2.292	0.038	-0.003	-1.536	0.299
	Deposits	-0.002	-0.401	0.695	-0.001	-1.010	0.854
	NIITP	-0.000	-3.462	0.004	-0.000	-0.146	0.008
	Cost to income	-0.031	-0.469	0.646	-0.092	-3.183	0.476
	Loan loss provisions	-0.056	-0.296	0.771	-0.102	-0.695	0.435
	OBS	-0.001	-0.408	0.689	-0.004	-0.520	0.326
	Tax	-0.003	-1.833	0.088	-0.003	-0.977	0.014
	R-squared	0.7454			0.634		
	F-statistic	4.553			2.695		

Note: Adjusted R-squared: 0.5817, p-value: 0.005865. Adjusted R-squared: 0.3987, p-value: 0.04697.

According to the regression results as specified in Table 8, the model shows R-squared value of 0.7454 which explains that 74.54% (before the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*ROA*). Only 25.46% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 4.553 and is significant endorsing the validity and stability of the model relevant to the study. *Liquidity* has a negative and significant impact on *ROA* before the crisis of COVID-19, which indicates more loans to customers and more profit. *NIITP* has a negative and significant impact on *ROA* which reveals that banks with a high-level non-interest income tend to have a low level of *ROA*.

On the other hand, Table 8 reports that the model shows R-squared value of 0.634 which explains that 63.4% (during the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*ROA*). Only 36.6% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 2.695 and is significant endorsing the validity and stability of the model relevant to the study. It is seen from the results that *NIITP* and *tax* are negatively and significantly related to *ROA*. The results imply that banks that derived a higher proportion of their income from non-interest sources such as fee-based services tend to report a lower level of profitability (*ROA*).

Table 9. Comparisons of internal factors on banks' profitability (*NIM*) before and during the crisis of COVID-19

Dependent variable	Explanatory variable	Before the crisis of COVID-19 (January–March 2020)			During the crisis o COVID-19 (April–June 2020)		
		Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
NIM	Intercept	0.020	0.664	0.517	-0.006	-0.228	0.823
	Capital adequacy	-0.001	-0.035	0.972	-0.022	-0.989	0.339
	Firm size	-0.001	-1.054	0.310	-0.000	-0.329	0.747
	LIQD	0.007	1.090	0.294	0.012	2.474	0.027
	Deposits	-0.000	-0.023	0.982	0.007	0.644	0.530
	NIITP	-0.000	-3.503	0.004	-0.000	-2.267	0.040
	Cost to income	0.814	5.572	0.000	0.910	4.466	0.001
	Loan loss provisions	0.277	0.664	0.518	0.508	1.897	0.079
	OBS	-0.002	-0.341	0.738	-0.001	-0.137	0.893
	Tax	0.005	1.360	0.195	-0.000	-0.086	0.933
	R-squared	0.8233			0.7459		
	F-statistic	7.247			4.566		

Note: Adjusted R-squared: 0.7097, p-value: 0.0006084. Adjusted R-squared: 0.5825, p-value: 0.005795.

According to the regression results as specified in Table 9, the model shows R-squared value 0.8233 which explain that 82.33% of the variation in the dependent variable is explained by the explanatory variables of the model (*NIM*). Only 17.67% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 7.247 and is significant endorsing the validity and stability of the model relevant to the study. It is seen from the table that *NIITP* is negatively and significantly related to *NIM* which implies that banks with a high level of non-interest income show low *NIM*. The table also points out that *cost to income* has a positive and

significant impact on *NIM* which suggests that the higher the *cost to income* (high level of cost to total assets (TA) ratio), the higher the *profitability*.

On the other hand, R-squared value is 0.7459 which explains that 74.59% of the variation in the dependent variable is explained by the explanatory variables of the model (*NIM*). Only 25.41% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 4.566 and is significant endorsing the validity and stability of the model relevant to the study. *Liquidity* (*LIQD*) has a positive and significant impact on *NIM* during COVID-19, which indicates low loans to customers'

low profit. *NIITP* is negatively and significantly related to *NIM*, this result implies that banks that derived a higher proportion of their income from non-interest sources such as fee-based services tend to report a lower level of profitability. It also points

out that *cost to income* has a positive and significant impact on *NIM* which suggests that the higher the *cost to income* (high level of cost to TA ratio), the higher the *profitability*.

Table 10. Comparisons of internal factors on financial sustainability (*NFLR*) before and during the crisis of COVID-19

Dependent variable	Explanatory variable	Before the crisis of COVID-19 (January–March 2020)			During the crisis of COVID-19 (April–June 2020)		
		Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
<i>NFLR</i>	Intercept	80.220	1.521	0.150	-1.061	-0.018	0.986
	<i>Capital adequacy</i>	-138.787	-3.438	0.004	-230.677	-4.820	0.000
	<i>Firm size</i>	-1.641	-1.058	0.308	1.341	0.773	0.453
	<i>LIQD</i>	-21.415	-1.972	0.069	-26.982	-2.645	0.019
	<i>Deposits</i>	-21.581	-0.974	0.347	-14.787	-0.611	0.551
	<i>NIITP</i>	-0.123	-0.981	0.343	0.224	1.441	0.171
	<i>Cost to income</i>	338.360	1.349	0.199	727.283	1.631	0.125
	<i>Loan loss provisions</i>	-84.365	-0.118	0.908	-127.124	-0.190	0.852
	<i>OBS</i>	0.193	0.020	0.984	13.184	1.038	0.317
	<i>Tax</i>	4.189	0.723	0.482	4.650	1.228	0.240
	R-squared	0.7166			0.8509		
	F-statistic	3.934			8.878		

Note:

Adjusted R-squared: 0.5345, p-value: 0.01107.

Adjusted R-squared: 0.7551, p-value: 0.0002041.

According to the regression results as specified in Table 10, the model shows R-squared value of 0.7166 which explains that 71.66% (before the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*NFLR*). Only 28.34% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 3.934 and is significant endorsing the validity and stability of the model relevant to the study.

On the other hand, the model shows R-squared value of 0.8509 which explains that 85.09% (during

the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*NFLR*). Only 14.91% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 8.878 and is significant endorsing the validity and stability of the model relevant to the study. It is seen from the results that *capital adequacy* is strongly and negatively significant to *NFLR*, *LIQD* is negatively and significantly related to *NFLR* during the crisis of COVID-19.

Table 11. Comparisons of internal factors on financial sustainability (*CCR*) before and during the crisis of COVID-19

Dependent variable	Explanatory variable	Before the crisis of COVID-19 (January–March 2020)			During the crisis of COVID-19 (April–June 2020)		
		Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
<i>CCR</i>	Intercept	-3.738	-0.029	0.977	63.986	1.054	0.310
	<i>Capital adequacy</i>	-1.188	-1.220	0.242	-7.904	-0.160	0.875
	<i>Firm size</i>	1.068	0.285	0.780	-2.066	-1.156	0.267
	<i>LIQD</i>	-3.153	-1.203	0.249	-13.792	-1.313	0.210
	<i>Deposits</i>	6.416	0.120	0.906	8.479	0.340	0.739
	<i>NIITP</i>	3.475	0.012	0.991	-0.115	-0.721	0.483
	<i>Cost to income</i>	2.200	3.634	0.003	1028.932	2.242	0.042
	<i>Loan loss provisions</i>	9.170	0.530	0.605	-476.079	-0.691	0.501
	<i>OBS</i>	-1.552	-0.665	0.517	-8.908	-0.681	0.507
	<i>Tax</i>	-1.052	-0.075	0.941	-2.184	-0.560	0.584
	R-squared	0.6063			0.5719		
	F-statistic	2.396			2.078		

Note:

Adjusted R-squared: 0.3532, p-value: 0.06921.

Adjusted R-squared: 0.2967, p-value: 0.1062.

According to the regression results as specified in Table 11, the model shows R-squared value of 0.6063 which explains that 60.63% (before the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*CCR*). The value for the F-statistic is 2.396 and is significant endorsing the validity and stability of the model relevant to the study. It is observed from Table 11 that *cost to income* has a positive and significant on *CCR* before the crisis of COVID-19 which suggests that the higher the *cost to income*

(high level of cost to TA ratio), the lower the *sustainability* (*CCR*).

R-squared value 0.5719 which explains that 57.19% (during the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model *CCR*. It is seen from the results that *cost to income* has been positively and significantly related to *CCR* during the crisis of COVID-19 which suggests that the higher the *cost to income* (high level of cost to TA ratio), the lower the *sustainability* (*CCR*).

Table 12. Comparisons of internal factors on financial sustainability (*ICR*) before and during the crisis of COVID-19

Dependent variable	Explanatory variable	Before the crisis of COVID-19 (January–March 2020)			During the crisis of COVID-19 (April–June 2020)		
		Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
ICR	Intercept	0.474	0.061	0.952	4.529	0.970	0.349
	Capital adequacy	-5.797	-0.970	0.349	-1.544	-0.407	0.690
	Firm size	0.100	0.435	0.670	-0.088	-0.643	0.530
	LIQD	-3.912	-2.433	0.029	-2.304	-2.851	0.013
	Deposits	0.248	0.075	0.941	0.114	0.060	0.953
	NIITP	-0.015	-0.821	0.425	-0.026	-2.105	0.054
	Cost to income	219.157	5.898	3.88	161.274	4.568	0.000
	Loan loss provisions	91.609	0.862	0.403	17.238	0.325	0.750
	OBS	-1.241	-0.867	0.401	-1.150	-1.143	0.272
	Tax	-0.215	-0.251	0.806	-0.373	-1.244	0.234
	R-squared	0.8281			0.8456		
	F-statistic	7.496			8.519		

Note: Adjusted R-squared: 0.7177, p-value: 0.0005092. Adjusted R-squared: 0.7463, p-value: 0.000256.

R-squared value is 0.8281 which explains that 82.81% (before the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*ICR*). The value for the F-statistic is 7.496 and is significant endorsing the validity and stability of the model relevant to the study. *Cost to income* has a positive and strong significant and *LIQD* has a negative significant effect on *ICR* before the crisis of COVID-19. According to the regression results as specified in Table 12, the model shows R-squared

value of 0.8456 which explains that 84.56% (during the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*ICR*). Only 15.44% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 8.519 and is significant endorsing the validity and stability of the model relevant to the study. It is seen from the results that *LIQD* is negative and *cost to income* has a positive and strong significantly effect on *ICR*.

Table 13. Comparative analysis of internal factors on financial sustainability (*OSR*) before and during the crisis of COVID-19

Dependent variable	Explanatory variable	Before the crisis of COVID-19 (January–March 2020)			During the crisis of COVID-19 (April–June 2020)		
		Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
OSR	Intercept	1.880	1.496	0.157	1.805	0.902	0.382
	Capital adequacy	0.608	0.632	0.538	-3.612	-2.225	0.043
	Firm size	-0.031	-0.833	0.419	0.001	0.020	0.984
	LIQD	-0.632	-2.441	0.029	-0.630	-1.821	0.090
	Deposits	0.023	0.044	0.966	-0.501	-0.610	0.552
	NIITP	-0.018	-6.075	2.86	-0.017	-3.249	0.006
	Cost to income	-39.989	-6.687	1.03	-45.692	-3.021	0.009
	Loan loss provisions	39.707	2.322	0.036	60.883	2.683	0.018
	OBS	-0.019	-0.083	0.935	-0.311	-0.723	0.482
	Tax	-0.016	-0.119	0.907	-0.247	-1.920	0.075
	R-squared	0.8985			0.7021		
	F-statistic	13.77			3.666		

Note: Adjusted R-squared: 0.8332, p-value: 1.631. Adjusted R-squared: 0.5106, p-value: 0.01482.

R-squared value 0.8985 which explain that 89.85% (before the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*OSR*). Only a 10.15% variation in the dependent variable remains unexplained by the explanatory variables of the study. The value for the F-statistic is 13.77 and is significant endorsing the validity and stability of the model relevant to the study. It is seen from the results that *LIQD* is negative and *loan loss provisions* are positive and significant, on the other hand, *cost to income* and *NIITP* have a negative and strong significant effect on *OSR*. This result shows that banks that disburse a higher proportion of their loans from total assets, the higher the *cost to income* and a higher proportion of income from non-interest

sources such as fee-based services tend to report a lower level of *OSR*.

According to the regression results as specified in Table 13, the model shows R-squared value of 0.7021 which explains that 70.21% (during the crisis) of the variation in the dependent variable is explained by the explanatory variables of the model (*OSR*). The value for the F-statistic is 3.666 and is significant endorsing the validity and stability of the model relevant to the study. It is seen from the results that *capital adequacy*, *NIITP*, *cost to income* are negative and *loan loss provisions* are positive and significant on *OSR* which implies that banks with a high level of equity capital, non-interest income and tend to have a low level of *OSR*.

5. DISCUSSION OF FINDINGS

Various measures have been used in this study to analyze the selected banks' profitability and financial sustainability before and during COVID-19. While there are popularly used profitability ratios (e.g., *ROE* and *ROA*), liquidity because of its inverse relationship with profitability is used as a good indicator of profitability. Usually, the amount of total loans is compared to total assets to measure the liquidity of banks (Goddard et al., 2013). More loans to clients reduce liquidity but increase profit. A larger amount of loans granted to banks' customers results in higher interest revenue and lower liquidity. However, loan default culture which is a common problem in Bangladesh impacts banks' profitability and financial sustainability. Adelopo et al. (2018), Majumder and Li (2018), Tan (2016), and Hoque et al. (2022) report similar findings. Our study finds that *liquidity* is positively and significantly related to banks' profitability during COVID-19. During COVID-19, banks' loans to customers declined as compared to the loans in the pre-COVID period. Loan recovery also declined during COVID-19. As a consequence, banks' profitability declined during COVID-19. The studies of Duan and Niu (2020), Keister (2019), Rahman et al. (2015), and Bourke (1989) also report a positive relationship between loans and profitability.

We measured the relationship between non-interest income and profitability by using the ratio *NIITP*. The relevant results indicate that *NIITP* has a negative and significant impact on profitability irrespective of the periods before and during COVID-19. Lepetit and Strobel (2013) find a similar result. This implies that the tendency of banks to earn from non-interest sources rather than from traditional interest-earning sources lowers profitability because non-interest sources and income are more unsteady in nature than interest income. This finding contradicts the findings of Duan and Niu (2020) and Al-Harbi (2019). Non-interest income impacts profitability negatively during the financial crisis (Maudos, 2017). Banks' excessive tendency to switch to generating income from non-interest sources rather than traditional interest-based income reduces the profitability of banks (Majumder & Li, 2018).

This study measures *cost to income* to decide about the impact of management efficiency on banks' profitability in normal and COVID-19 crisis periods. This variable has been found significantly positive to *NIM* for both the periods before and during the crisis. A number of studies (Majumder & Li, 2018; Sufian & Habibullah, 2009) also find that cost efficiency has a significant and positive impact on bank performance. Our result implies that more expenses incurred for salary, fees, rent, insurance, new branch set up and maintenance, and other operating expenses would not hamper the profitability of the banks in Bangladesh. As to the commercial banking sector, it is perceived that incurring costs for service enhancement and the tendency to stay close to the clients would increase profitability and banks would have the opportunity to recover the costs. On the other hand, these results conflict with the findings of Athanasoglou et al. (2008) and Bourke (1989) who report a negative relationship between the cost of

operation and bank profitability. This indicates that banks that are able to control their operating costs are likely to be more profitable.

Tax has an association with *ROA*. It is found significantly and negatively associated with *ROA* during the crisis of COVID-19. That is, *tax* impacts lowering profitability, reflecting the negative effects of regulations during the crisis of COVID-19. This finding has support by Tan (2016) who reports that *tax* is significantly and negatively associated with profitability.

Our findings show that *capital adequacy* has a negative and significant impact on *NFLR* before the crisis of COVID-19. This implies that banks with a high level of equity capital tend to have a low level of net financial liabilities. On the other hand, while *capital adequacy* is strongly and negatively significant, *liquidity* becomes negatively and significantly associated with *NFLR* during the crisis of COVID-19. This further implies that banks that derived a higher proportion of their equity capital and loans tend to report a lower level of *NFLR*. The regression coefficient between *LIQD* and *NFLR* is -26.982 which indicates that banks with more loans may have less *NFLR*.

The regression coefficient between *cost to income* and *CCR* during COVID-19 is more than that before the crisis of COVID-19. This implies that banks' sustainability (*CCR*) reduces more during COVID-19 due to higher the *cost to income*. *Cost to income* has a positive and significant effect while *liquidity* has a negative significant effect on *ICR* before the crisis. This further indicates that the higher the *cost of income*, the lower the *ICR*. Banks that derive a higher proportion of their loans as compared to total assets tend to report a lower level of *ICR*. The regression coefficient between *LIQD* and *ICR* is -3.912 which implies that banks with more loans have the chances of low *ICR*. Our findings show that *liquidity* has a negative and *cost to income* has a positive effect on *ICR* during the crisis of COVID-19. For this reason, the higher the *cost to income*, the lower the sustainability (*ICR*), and banks which derived a higher proportion of their loans as compared to total assets tend to report a lower level of *ICR*.

6. CONCLUSION

An overview of the results is that banks before the crisis were more profitable and financially sustainable than during the crisis of COVID-19. The mean values of *ROA*, *ROE* and *NIM* are found before the COVID-19 crisis as 0.0019, 0.0270 and 0.0054 and during the COVID-19 as 0.00128, 0.01856 and 0.00321 respectively. On the other hand, the mean values of *NFLR*, *CCR*, *ICR*, and *OSR* are found before COVID-19 as 2.0936, 6.852, 0.9314 and 0.4751, and during COVID-19 as -2.5961, 5.879, 0.7673 and 0.3587 respectively. The findings construe a significant impact of the unprecedented pandemic. Within a short period of time, sample banks' profitability and financial sustainability deteriorated significantly. Although the datasets for the study only covered two short quarters of 2020 the findings construe a significant impact of the unprecedented pandemic. Within a short period of time, both banks' profitability and financial sustainability eroded significantly. While banks may

be willing to grant loans or participate in the government's initiative of giving moratoriums to their existing clients, they are also faced with the risk of declining profit. If the pandemic prolongs, the banks' financial sustainability may also be negatively impacted as it is expected that the non-performing loans (NPL) may increase over time.

This study is a quick response to the effect of COVID-19 on the banking sector in Bangladesh since the pandemic spread out. For this reason, the authors have considered 23 listed sample banks on the basis of short-term determinants. Future researchers may further enquire about post-

pandemic effects in recent years on all scheduled listed or non-listed banks including Public limited and Islamic banks and the more reflective variables combining various macro-level variables. This study gives an idea about the economic circumstances and financial conditions of the banking sector in Bangladesh before and during the crisis of COVID-19. The researchers believe that, regardless of limitations, the empirical findings of this study will be beneficial for banking policymakers and for future researchers to predict situational reactions on bank profitability and sustainability in both the short term and the long term.

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