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Nexus among Bank Competition, Efficiency and Financial Stability: A Comprehensive Study in Bangladesh*

Syed Mohammad Khaled RAHMAN¹, Mohammad Ashraful Ferdous CHOWDHURY²,
Tasmina Chowdhury TANIA³

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Abstract

This study examines the impact of bank competition and efficiency in the financial stability of the banking sector in Bangladesh. The study used the Lerner index and the Boone indicator to represent the bank competition, while the non-performing loan (NPL) and Z-score are used to represent financial stability. The secondary data were collected from the annual reports of 28 DSE listed commercial banks of Bangladesh over the period from 2011 to 2018. Using a dynamic panel GMM model, the study found the Lerner index is significantly negatively related with Z-score, which means that higher bank competition results in higher bank stability. It is also seen that higher cost efficiency results in higher bank stability. The Lerner index has negative, but insignificant impact on NPL. Similarly, using the Boone indicator, this study found that lower competition increases NPL. In terms of the Z-score, the Boone indicator found that 1 unit of increment results in decrease of the Z-score by 6.15 units. The study suggests that, as more competition results in more financial soundness, the banking industry competition should be ensured by policymakers or regulators. Banks could enhance financial stability by cost control to achieve cost efficiency as well as by improving loan-to-asset ratio.

Keywords: Bank, Competition, Financial, Stability, Efficiency

JEL Classification Code: G2, G21, G28

1. Introduction

The precondition for the economic growth and development of a country depends on smooth and efficient flow of saving-investment process through financial intermediation function. Financial stability ensures economic growth through proper investment in the real asset via government and private sector. Stable financial system allocates resources efficiently, minimizes financial risk, and absorbs the shocks through self-corrective mechanisms (The World Bank, 2020). On the other hand, financial instability such as non-performing loan (NPL) hinders the credit disbursement capability of commercial banks to a significant extent and hampers money circulation in the market. Higher level of NPL damages the system of monetary transmission to the real economy as well as hampers the financial intermediary role of the financial institutions significantly, which would negatively affect trade and investment both in and out of the country. NPLs are regarded as byproducts of the financial crisis (Woo, 2000). Fiordelisi and Mare

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¹First Author and Corresponding Author. Associate Professor, Department of Business Administration, Shahjalal University of Science and Technology, Bangladesh [Postal Address: Kumargaon, Akhaila, Sylhet-3114, Bangladesh] Email: kr15sust@gmail.com

²Associate Professor, Department of Business Administration, Shahjalal University of Science and Technology, Bangladesh. Email: ashraful_ferdous@yahoo.com

³Assistant Professor, Department of Business Administration, Shahjalal University of Science and Technology, Bangladesh. Email: tasmina.tania@gmail.com

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(2014) argued that competition can enhance the quality of the services, efficiency and finally improves the financial stability of the country. However, Beck et al., (2013) stated that the nexus between bank competition and financial stability is one of the most debatable issues in the banking literature. OECD (2010) reports that the competition has been criticized as a major barrier for the soundness of the banking sector of a country. Too much competition in the banking sector can increase the probability of default through non-performing loans and also the financial soundness (measured as Z-score).

A solid, stable and healthy banking sector is undoubtedly important for all the participants of economic life (Roman & Sargu, 2013). According to Holmström and Tirole (1998) competition enhances efficiency of firms. The banks that are more efficient have good credit investigation and supervision procedure, which reduces non-performing loan (NPLs) (Noor, Bakri, Yusof, Noor, & Abdulla, 2020; Berger & DeYoung, 1995). Nevertheless, the significance and importance of soundness is highly important when the economy of the country is highly bank driven. As the economy of Bangladesh is highly bank driven, it is highly important to examine how the bank competition effects on the financial stability. With respect to the supply side of the banking sector of Bangladesh, the numbers of commercial banks are raising immensely. At present, there are 41 private commercial banks operating, 33 are conventional and eight are Islamic banks. On the one hand, the number of banks is increasing; on the other hand, the bank soundness indicators are deteriorating. As new commercial banks are entering into banking industry so it is expected that competition would increase, which ultimately would lead to increased efficiency and reduced NPL. However, the non-performing loan (NPLs) is deteriorating the capital adequacy of the financial industry to a large extent.

NPL is alarming for the banking industry in Bangladesh for last few decades. The international standard of NPL is 2% or below, but in Bangladesh, it is more than 5 to 6 times. Z-score is also showing a very unhealthy situation. The Z-score of the banking industry of Bangladesh was 15.69 in 1996. In 2011, it fell to 9 and further reduced to below 7 in 2018. The performance of NPL has become a major concern for the regulators, investors, and policy-makers. According to latest Bangladesh Bank data, NPL of banking industry stood at Tk110,873 crore out of total disbursed loan of Tk933,727 crore up to March, 2019. The amount of bad and worthless loan stood at approximately Tk37,000 crore in March 2019. In 2018, NPL was Tk93,911 crore and in 2017 it was Tk74,303 crore (Prothom Alo, 2019). In terms of proportion of total loan, NPL ratio was 11.87% in March 2019, but it was 9.31% in December 2017. It is observed that the NPL ratio is growing in Bangladesh with the passage of time. This

erratic behavior of the banking sector of Bangladesh where the number of banks and financial institution are increasing in one side and the nonperforming loan and disability (as Z-score is deteriorating) is raising on the other side motivate us to conduct this study. So, the main objective of the study is to explore the effect of bank competition and efficiency in financial stability of the banking sector of Bangladesh. The specific objectives are as follows:

- a. To know the financial stability of the banking industry in Bangladesh for the period under study
- b. To analyze the descriptive statistics of banking industry competition, financial stability or soundness, and efficiency of sample banks for the period under study
- c. To explore the significance and direction of impact of the level of bank competition and efficiency on sample banks' financial stability for the period under study

Increase of NPL is an attribute of financial catastrophe of a country. From the perspective of Bangladesh, the present study is worthy of investigating the relationship of financial stability with bank competition and efficiency due to severity of classified loans, liquidity crisis, inefficiency, and ongoing debate on number of banks in contemporary periods. The study contributes to the existing body of knowledge by complying with competition-stability theory as opposed to competition-fragility theory through empirical evidences. The study also unveils the managerial and cost efficiency of banks as significant factors of financial soundness.

The rest of the study is structured as follows: Section 2 deals with literature review and theoretical framework, Section 3 explains Data and methodology, Section 4 illustrates empirical results and discussion, and lastly, Section 5 provides policy implications and concluding remarks.

2. Literature Review and Theoretical Framework

There is an ongoing debate on whether bank competition exacerbates or mitigates the financial stability of a bank. There are two conflicting views regarding the issue- 'competition-stability' view and 'competition-fragility' view. The proponents of 'competition-stability' view argued that banks are more cautious to obey the rules and regulations in an increased competition. Banks try to achieve cost, revenue, and operational efficiency to retain their competitive position. Besides it, banks become more interested to maintain relationship with their clients through Customer Relationship Management process. In a perfect competition structure, no bank has significant market power

to increase interest rate on loans and advances which results in reduced adverse selection and moral hazard. Moreover, banks take less risk in choosing investment portfolios and borrowers' credit risk reduced over the long run.

The proponents of 'competition-fragility' view argued that intense competition leads to coordination problem in repackaging deposits to loans. Banks are inclined to take more risk in their financing and investing activities. At times excessive diversification risk leads to insolvency risk and bank's financial innovation brings poor result. Loan sales, credit default swaps, and financial derivatives cause erosion of liquid assets. Besides these, increased competition reduces market power, profit margin, and charter value of a particular bank. It is seen that fierce competition entices banks to go for aggressive lending, which creates bad loans and NPL. Weak financial institutions' solvency is threatened. Moreover, to retain market share banks often formulate riskier policies such as lowering capital level and increasing credit risk. Many research works have been conducted to explore the relationship between NPL and financial stability as well as industrial competition. As stated earlier, the literature on the bank competition and financial stability is mixed.

2.1. Research Supporting 'Competition-Stability' View

Schaeck and Cihak (2008) studied European and US banks during 1995-2005 and found that competition increases profit and cost efficiency. Bank soundness increases through efficiency channel. Amidu and Wolfe (2013) investigated 978 banks in 55 emerging and developing countries over the 2000-2007 period. The authors found that greater bank competition is associated with higher revenue diversification, greater bank solvency and higher profitability. Kasman and Kasman (2015) investigated Turkish banks for the 2002-2012 period. They found that competition has an inverse relationship to NPL, but positive impact on Z-score. Fernández and García (2015) conducted research on the Mexican banking sector for the period 2001-2008 and they found that increased bank competition has resulted in greater financial stability. Park (2016) analyzed 15 major Chinese banks and revealed that less competition negatively influences financial stability of a commercial bank.

Rahim (2016) analyzed Malaysian commercial banks during the 1996-2011 period to assess the impact of competition on efficiency. The author found that Granger causality tests support a positive effect of competition on technical efficiency in Malaysian banking. Shijaku (2017) investigated 16 Albanian banks over the 2008-2015 period and found that greater competition has been crucial for boosting bank stability. Budhathoki, Rai, and Rai (2020) found transformation of financial system from

the monopolistic competition to perfect competition brings efficiency and stability in Nepal.

Noman, Gee, and Isa (2017) examined the commercial banks of ASEAN countries over the 1990-2014 period and found that a decrease in market power stimulates banks to hold more equity capital, which promotes financial stability. Kim (2018) have conducted a research on the basis of panel dataset for commercial banks in OECD countries from 2000 to 2014 and author found that banks with more influence on market take more liquidity risk implying that less competition leads to financial fragility. Clark, Radić, and Sharipova (2018) found that competition has a highly significant positive effect on bank stability in the CIS countries and negative relationship with NPL ratio. Kanas, Al-Tamimi, Albaity, and Mallek (2019) conducted a research on the effect of bank competition on stability. Based on sample of 7,227 U.S., U.K., and Canadian banks for 2009 to 2015, the authors found that stability decreases at low competition levels and has a mixed behavior at medium competition levels. Baum, Grazzini, and Schäfer (2019) analyzed European commercial, cooperative, and savings banks. The study found that more diversification results in more financial stability and small-size banks benefit more than large-size banks. Other researchers who found positive relationship between competition and stability are Miah and Uddin (2017), Řepkova and Stavarek (2013), Ajisafe and Akinlo (2014), Benthem (2017), Jeon and Lim (2013), and Fiordelisi and Mare (2014).

2.2. Research Supporting 'Competition-Fragility' View

Schaeck and Cihak (2012) analyzed European banks and found that competition has a negative and significant association with financial stability Heimdal and Solberg (2015) used accounting data for Norwegian banks from 1991-2014. They found a linear positive relationship between competition and non-performing loan rates, meaning negative relationship to stability. Bashir, Hussain, Wang, and Ali (2017) investigated Chinese banks' annual data from 2000 to 2014 and found that increased competition enhances NPL. De-Ramon, Francis, and Straughan (2018) analyzed data from the UK banking industry over the period 1994 to 2013, and found that competition lowers stability. Albaity (2019) investigated the data from 276 banks across eighteen MENA countries over the period 2006 to 2015 and found that less competition leads to less probability of default and high probability of profitability. Ibrahim, Salim, Abojeib, and Yeap (2019) investigated Malaysian commercial banks after the Asian crisis and found that overall market concentration increases bank risk. Other researchers who found negative relationship between NPL and financial stability as well as

industrial competition are Wang (2018), Karim, Chan, and Hassan (2010).

2.3. Research Supporting Mixed Evidences

The study by Beck, Jonghe, and Schepens (2013) was based on a large sample of 17,055 banks from 79 countries during 1994–2009. The authors found a heterogeneous relationship between competition and bank stability. Kabir and Worthington (2015) used data from 16 countries over the 2000–2012 period and do not find a consistent Granger causality effect between competition and stability. Leroy and Lucotte (2017), in their study on the European banks over years 2004 to 2013, found that more competition stimulates more risk. However, it still has a positive influence on reducing the systematic risk. Moyo (2018) used the bank data from South Africa and found a mixed result. Result differs according to competition indicator. Jayakumar, Pradhan, Chatterjee, Sarangi, and Dash (2019), in their study on banks in 32 European countries between 1996 and 2014, found banking competition plays an important role in driving banking stability both positively and negatively. Other researchers who found mixed or inconclusive evidences regarding relationship between NPL and financial stability as well as industrial competition are Hossain and Ahamed (2015) and Lata (2015).

2.4. Research Gap

With respect to Bangladesh banking sector, a few attempts have been made to explore present state and causes of NPL and possible remedial measures (Hossain & Ahamed, 2015; Lata, 2015; Rifat, 2016). Granting special privileges to large loan defaulters such as rescheduling of loan and lowering of interest rate encourage regular borrowers to become loan defaulters to avail the special privileges (Prothom Alo, 11/06/2019). Some studies focused on consequences of NPL on financial performances. However, no research has been conducted to examine the effect of both bank competition and bank efficiency on financial soundness or stability measured by both Z-score and NPL. The aim of the study is to fill this research gap by considering triangular effect of those three above-mentioned issues in a comprehensive way.

3. Research Methods and Materials

3.1. Data and Sample

This empirical study was conducted with a quantitative research approach. Secondary data was used. This study considered the annual data from 28 DSE-listed commercial banks of Bangladesh over the period from 2011 to 2018. The financial statements of all banks operating in Bangladesh were collected from the annual reports, websites, etc. This study

also employed the industry-specific and macroeconomic variables to examine the impact of bank competition on the financial stability. The industry-specific and macroeconomic data was collected from various secondary databases including the world development indicators, IMF financial statistics (IFS) database, Quandl, Global economy, and Economagic. Population of the study was all scheduled commercial banks of Bangladesh, the number of which is 56. From the population sampling frame is developed. Two criteria were selected for a population item to be included in sampling frame: (i) the banks should be operating continuously during the study period and (ii) the banks should be listed in any stock exchange. Samples were selected from sampling frame. Stratified random sampling method was used to select banks where type of bank is stratification factor. Twenty-eight banks were selected as samples out of which 23 were conventional banks and five were Islamic banks.

3.2. Variables and Models Description

Although the static panel methods are used as the baseline estimators, this proposed study employed the dynamic GMM estimators to examine the impact of bank competition on the financial stability of the banking sector of Bangladesh. We employed the dynamic panel GMM estimator to address the possible endogeneity problem. Another argument for using the dynamic GMM is the sampled numbers of banks (T) are higher than the number of years (N). The base model for the proposed study was as follows:

Financial Stability = f {competition, bank specific variables, industry specific variables, macroeconomic variables}

The above equation financial stability of the banking sector split into two parts:

$$Z_score_{i,j,t} = a_i + \sum_{k=1}^k \beta_k X_{i,t}^k + \sum_{l=1}^l \beta_l X_{j,t}^l + \sum_{m=1}^m \beta_m X_{k,t}^m + \varepsilon_{i,t} \quad (1)$$

$$NPL_{i,j,t} = a_i + \sum_{k=1}^k \beta_k X_{i,t}^k + \sum_{l=1}^l \beta_l X_{j,t}^l + \sum_{m=1}^m \beta_m X_{k,t}^m + \varepsilon_{i,t} \quad (2)$$

Here, i , j and t subscripts represent bank, country and year, respectively. a_i is a constant term. For both equations dependent variables are Z-score and NPL, used as proxy for financial stability, where higher values of Z-score represent the lower probability of bank default and vice versa. $X_{i,j,t}^k$ are the bank-level control variables. $X_{j,t}^l$ is the industry specific variable and $X_{k,t}^m$ are macroeconomic variables. $\varepsilon_{i,j,t}$ is an error term. The details of the variables are explained below:

3.2.1. Dependent Variables

Non-performing loan (NPL): The ratio of non-performing loan to total loan. Higher ratio indicates the financial disability.

Z-score: It refers the soundness of the banks. The formula for Z-Score, $Z = (\mu + K) / \sigma$. Here, μ denotes the bank's average return on assets (ROA), K is the equity capital in percentage of total assets and σ is the standard deviation of the ROA. Higher value reflects higher bank stability and less risk

3.2.2. Independent Variables

Lerner Index: An indicator for measuring the bank competition of a country. Higher value indicates less competition in the banking sector.

Boone indicators: This is a measure of the degree of competition, computed as the elasticity of profits to marginal costs.

A. Bank Specific variables

CIR: Cost to income ratio. It refers the efficiency of the bank

ACR: Asset composition ratio is calculated by fixed asset to total asset. It is a proxy for the bank

LA: Loans to Assets (LA) are the ratio to indicate the portfolio mix. It also refers the bank credit exposure.

LLP: The ratio of loan loss provision to total assets

EQASS: A measure of banks capital strength in year t , calculated as equity/total assets.

NIE/TA: A measurement for representing the efficiency of management relative to asset. It can be calculated as non-interest expense/total assets.

LNTA: The natural logarithm of total assets of the bank in year t .

B. Macro-economic factors:

LNGDP: Gross domestic product in Natural logarithm.

INFL: Inflation rate

3.2.3. Measurement of Competition Indexes

For measuring banking industry competition Lerner index and Boone indicator were used. The derivations of these indexes are described below:

a. Determination of Lerner Index:

The regression equation for determining the index is as follows:

$$\ln TC_{it} = \alpha_0 + \alpha_1 \cdot \ln y + \frac{1}{2} \cdot \alpha_2 \cdot (\ln y)^2 + \sum_{j=1}^3 \beta_j \cdot \ln w_{jit} + \sum_{j=1}^3 \sum_{k=1}^3 \beta_{jk} \cdot \ln w_{jit} \cdot \ln w_{kit} + \sum_{j=1}^3 \lambda_j \cdot \ln y \cdot \ln w_j + \varepsilon_{it} \quad (3)$$

Here, TC indicates total costs, y indicates one output (total assets), w_j indicate three input prices. The ratios used as input prices are as follows:

w_1 = price of labor (ratio of personnel expenses such as salaries & wages to total assets)

w_2 = the price of physical capital (ratio of other non-interest expenses to fixed assets)

w_3 = the price of borrowed funds (ratio of interest expense to total interest bearing deposit and non-deposit borrowings)

The assessed regression coefficients of the above model are applied to determine the marginal cost (MC) as follows:

$$MC_{it} = \frac{TC_{it}}{y_{it}} \left[\alpha_1 + \alpha_2 \cdot \ln y_{it} + \sum_{j=1}^3 \lambda_j \cdot \ln w_{jit} \right] \quad (4)$$

Lerner index for each bank in each year is determined by using the following formula:

$$LernerIndex_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (5)$$

Here, P_{it} = Price of bank production (ratio of total revenues to total assets)

b. Determination of Boone Indicator:

To measure this index the following simple linear regression model was applied:

$$\ln \pi_{it} = \alpha + \beta \cdot \ln MC_{it} + \varepsilon_{it} \quad (6)$$

Here, π_{it} is profit (return on asset) of the bank i in time period t

MC_{it} = Marginal cost of the bank i in time period t

ε_{it} = Random error term, β = Boone indicator

As the relationship between profit and cost is negative so the expected sign of β is negative which shows that rise in industrial rivalry enhances profits of more efficient banks.

4. Results and Discussions

4.1. Financial Stability of Commercial Banks

From Figure 1, it is seen that the score was 11.11 in 1996, but a sharp decline is observed the next year (5.81). The score jumped to 15.95 in 1998, which is a significant increase from the previous year and highest among all the observed years. Again, there is a sharp decrease next year (6.86). Afterwards, there was little fluctuation in stability as the score remained steady within 6-8 in most of the years.

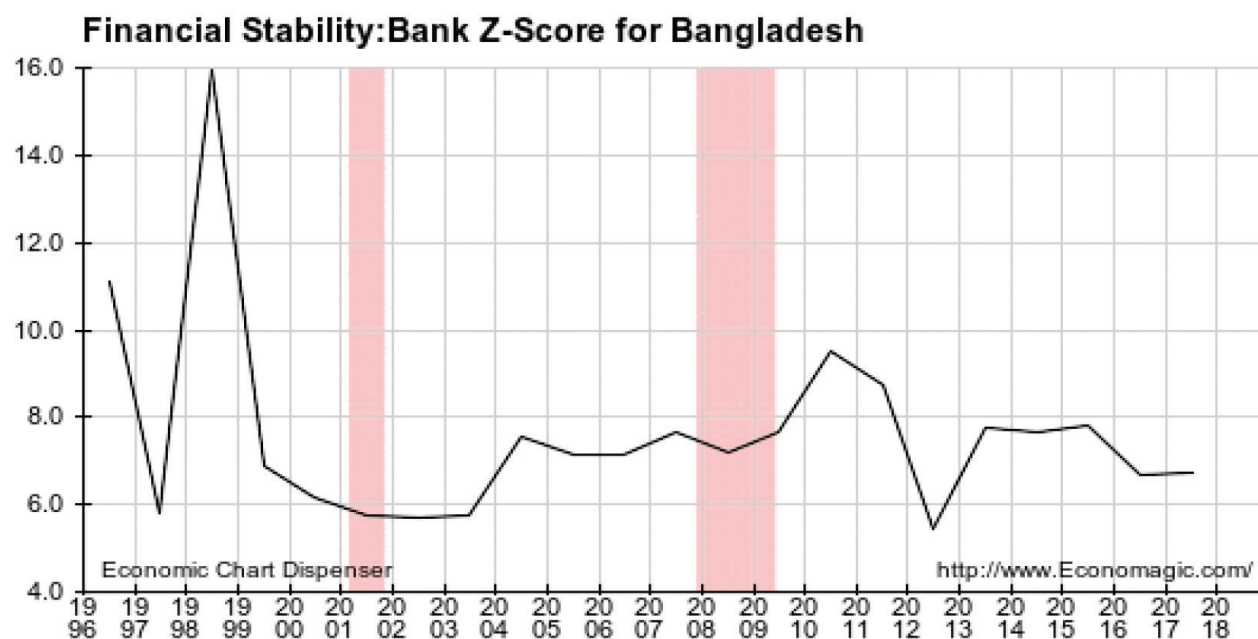


Figure 1: Z score of Bangladeshi banks from 1996 to 2018

Source: Federal Reserve Economic Data: St. Louis Fed

Table 1: Descriptive statistics of year-wise NPL

Year	Mean NPL (%)	Standard deviation	Minimum	Maximum	Mean Z score	Standard deviation	Minimum	Maximum
2011	5.748	10.654	0.790	57.27	11.524	13.622	-3.173	57.366
2012	8.601	12.490	0.872	60.78	9.441	13.248	-2.504	55.631
2013	8.927	13.953	1.429	73.31	9.740	13.074	-1.785	58.133
2014	9.947	14.874	1.528	1.52	9.305	11.105	-0.665	44.091
2015	10.78	16.280	0.900	76.14	8.843	10.622	-0.618	42.118
2016	10.801	15.968	0.964	71.89	8.929	12.955	-0.999	61.638
2017	11.385	17.343	1.542	80.04	8.606	12.260	-1.340	58.714
2018	12.284	18.055	1.918	81.99	8.545	12.878	-1.729	61.659

Source: Data compiled by authors from annual reports

4.2. Year-wise NPL and Z score of Sample Banks

From Table 1, it is seen that NPL has increased gradually from 2011 (5.74%) to 2018 (12.28%). It shows an increasing trend. Standard deviation of NPL among sample banks also has increased in every year and it is more than the mean, which indicates large deviations. Minimum NPL ratio is found in 2011 (.79%) while maximum NPL ratio is found in

2018 (81.99%). Table 1 shows some descriptive statistics of year-wise NPL and Z-score of sample banks:

From the table it is seen that mean Z-score has decreased gradually from 2011 (11.52) to 2018 (8.54), which indicates that financial stability is decreasing. Lowest financial stability is found in 2018. It shows a decreasing trend. Standard deviations of Z-score among sample banks were higher in earlier years and it is more than the mean, which indicates

large deviations. Minimum Z-score is found in 2011 (-3.17) while maximum Z-score is found in 2018 (61.65).

4.3. Year-wise Lerner Index of Sample Banks

From Table 2 it is seen that the mean Lerner Index was negative in 2011, 2012, and 2013. Lowest competition is seen in 2017 and highest competition is seen in 2015. Standard deviations of this index among sample banks were higher. Minimum and maximum values of this index are found in 2012 (-963.97 and 2.941). Table 2 shows some descriptive statistics of year-wise Lerner Index of sample banks:

4.4. Year-Wise Boone Indicator and Three-Bank Concentration Ratio (CR3), Cost to Income Ratio, and Non-Interest Expense to Total Asset Ratio of Sample Banks

The Boone Indicator of any year is determined by taking the data of all 28 sample banks. Three-bank concentration ratio is determined by taking the data of largest three banks' assets. Table 3 shows year-wise Boone Indicator and three-bank concentration ratio of sample banks:

In case of the Boone Indicator the more negative value indicates more competition and vice versa and in case of three-bank concentration ratio large concentration means less competition. From Table 3 it is seen that the degree of competition was highest in 2016 and lowest in 2012 according to the Boone Indicator, but three-bank concentration ratio shows that competition is decreasing as the proportion of three banks' assets was 25.95% in 2011 and increased to 37.93% in 2018. Cost-to-income ratio shows fluctuating pattern as it has increased from 2011 to 2013, then decreased for the next two years and increased again in the next years. The highest mean cost-to-income ratio is seen in 2017 (75.02%), while lowest mean cost-to-income ratio is seen in 2018 (-16.56%). Standard deviation of cost-to-income ratio among sample banks differs significantly from one year to another. From Table 3 it is seen that non-interest expense as a proportion of total asset was low (less than 2%) in earlier years, but has increased in later years (7% - 9%). Highest mean NIE/TA ratio is found in 2018 (8.96%) and lowest one is found in 2011 (1.52%).

4.5. Effect of Competition and Efficiency on Financial Stability

In order to measure the impact of banking industry competition and bank efficiency on financial stability of banks, Generalized Method of Moment (GMM) multiple regression technique has been applied where financial

Table 2: Descriptive statistics of year-wise Lerner Index

Year	Mean Lerner Index	Standard deviation	Minimum	Maximum
2011	-32.364	165.930	-878.987	0.894
2012	-35.810	181.960	-963.971	2.941
2013	-4.626	23.934	-126.603	1.011
2014	0.526	0.648	-1.107	2.306
2015	0.082	0.775	-3.417	0.655
2016	0.562	0.673	-1.014	1.984
2017	0.814	0.971	-1.053	2.817
2018	0.137	1.031	-3.902	1.189

Source: Data compiled by authors from annual reports

Table 3: Year wise Boone Indicator, CR3, and Efficiency ratios

Year	Boone Indicator	Three-bank concentration ratio	Mean Cost to Income ratio	Mean NIE/TA ratio
2011	-.162	25.950	46.429	1.520
2012	.104	26.450	52.044	1.804
2013	.023	28.470	72.015	1.822
2014	-.075	29.020	64.969	8.539
2015	-.033	28.370	59.042	6.474
2016	-.258	29.130	64.263	7.210
2017	-.135	29.170	75.023	7.829
2018	-.059	37.930	-16.564	8.967

Source: Data compiled by authors from annual reports

stability is considered as explained variable and banking industry competition as well as bank efficiency is considered as explanatory variable. This regression technique has been applied because the number of sample banks (28) is more than the number of years (8). Non-performing loan (NPL) and Z-score has been used as proxies of financial stability. Lerner Index and Boone Indicator have been used to measure banking industry competition. The proxies of bank efficiency are cost-to-income ratio and non-interest expense to total asset ratio.

Table 4 shows the outcome of regression model. Lerner Index is calculated as the proportion of excess of the price over marginal costs. The higher value of the index would indicate less competition in the banking industry. Z-score refers the soundness of the banks. Higher value reflects higher bank stability and less risk. Based on our model estimations, it is found that an additional 1 unit of Lerner Index reduces the Z-score by 0.00454 and 0.00524 in models 1 and 2, respectively. In both models, measures of bank

competition Lerner Index is significantly negatively related with Z-score, which means that the higher Lerner Index lowers the bank stability. So, higher bank competition results in higher bank stability or soundness and vice versa. It can also be inferred that bank competition has significant impact on financial soundness.

Regarding measures of efficiency, higher CIR or NIE/TA ratios indicate lower efficiency and vice versa. In model 1, both efficiency ratios are negatively related with Z-score, which means that higher cost efficiency results in higher bank stability or soundness and vice versa. This result is consistent with Rahman, Chowdhury, and Moudud-ul-huq (2020) who found that the less efficient banks have more risk exposure. It is also found that management's capability to reduce non-interest expenses as proportion of total asset has significant impact on financial soundness although impact of CIR is insignificant. 1% increase of NIE/TA ratio would result in reduction of Z-score by 0.215 unit and vice versa. In model 2, CIR is insignificant and positively related, but NIE/TA ratio is significant and negatively related with Z-score, which means that higher cost efficiency results in higher bank stability or soundness and vice versa. One-percent increase of NIE/TA ratio would result in reduction of Z-score by 0.242 unit and vice versa. These findings support the previous empirical research works of Amidu and Wolfe (2013), Řepkova and Stavarek (2013), Rahim (2016), Fernández and García (2015), Kim (2018), Noman et al. (2017), and Fiordelisi and Mare (2014).

Other significant variables that have impact on financial soundness are loan to asset ratio and macro-economic variable GDP. More proportion of loan in total asset results in more financial soundness and vice versa. 1% increase of loan ratio would result an increase of Z-score by 0.00963 unit and vice versa. In both models 3 and 4 the Lerner Index has negative, but insignificant impact on bank stability or soundness measured by NPL. Higher NPL means less financial soundness and vice versa. More bank competition results in more NPL and vice versa. This is due to the fact that the new banks that are entering into the banking industry are extending loans and advances without adequate security and proper credit analysis. As a result outstanding loans became NPL when it past due after certain days. The lenient credit policy of new banks entices some existing old banks to go for aggressive lending which results in more NPL. This is in conformity with the study by Nguyen et al. (2018)

In model 3, CIR is negatively and insignificantly related, but NIE/TA ratio is positively and significantly related with NPL. It means that more proportion of non-interest expenses results in more NPL and vice versa. Loan ratio is negatively and significantly related with financial soundness, which means that more proportion of loan in total asset results in less financial soundness and vice versa. In model 4, both efficiency ratios are positively and significantly related with

NPL, which means that if expenses as proportion of asset or income increase than NPL would also increase. One-percent increase of CIR and NIE/TA ratio would result in increase of NPL by 0.0655% and 0.242%, respectively. In both models 3 and 4 the loan ratio has negative and significant impact on NPL. It means that increased proportion of loan in total assets increases financial soundness and vice versa. One-percent increase of loan ratio would result a decrease of NPL by 0.00237%.

Table 5 shows the effect of bank competition measured by the Boone indicator and bank efficiency on financial stability. Higher Boone indicator value means lower competition. In model 5, the Boone indicator is significantly positively related with NPL, which means that lower competition increases NPL or decreases financial soundness and vice versa. One unit of increase of the Boone indicator causes 5.5% increase of NPL and vice versa. The efficiency ratios are significantly positively related with NPL, which means that less cost efficient bank would likely to suffer from more NPL and vice versa. One-percent increase of CIR and NIE/TA results in 0.00199% and 0.0577% increase of NPL respectively. Other significant factors that have impact on NPL are loan ratio, GDP, and inflation. Loan ratio is negatively related with NPL. One-percent increase of loan ratio results in 0.00214% decrease of NPL and vice versa. GDP and inflation are positively related with NPL, which means that more economic growth leads to more NPL.

In model 6, the Boone Indicator is significantly negatively related with Z-score. It means that less bank competition results in less financial stability and vice versa. One unit of the Boone indicator increment results in decrease of the Z-score (financial stability) by 6.15 units. CIR is insignificant, but NIE/TA is significantly negatively related with Z score. One-percent increase of NIE/TA results in 0.223 unit decrease of Z-score. These findings support the previous empirical research works of Shijaku (2017), Miah and Uddin (2017), Ajisafe and Akinlo (2014), Kanas et al. (2018), Benthem (2017), Jeon and Lim (2013), and Karim et al. (2010). Other significant factors that have impact on Z-score are loan ratio, GDP, and inflation. Loan ratio is positively related with Z-score. 1% increase of loan ratio results in 0.00928 unit increase of Z-score and vice versa. GDP and inflation are negatively related with Z-score.

The diagnostic tests in both Tables 4 and 5 found no problems of instruments validity and autocorrelation in all models. The p-value of the Arellano and Bond (1991) does not reject the null hypothesis meaning there is no chance of second-order correlation problem. Moreover, this study also applied the lags of the concerned variables, which confirm models are free from autocorrelation issues. Furthermore, the insignificant p-value of the Hansen test also assures that the null hypothesis of the over-identification is not rejected.

Table 4: Coefficient table of regression output (using Lerner index as proxy of competition)

Model No.	(1)	(2)	(3)	(4)
Variables	Z_score	Z_score	NPL ratio	NPL ratio
L.Z Score	0.362 (0.268)	0.876*** (0.0480)		
L.NPL ratio			0.532 (0.392)	1.003*** (0.0468)
Lerner	-0.00454** (0.00182)	-0.00524*** (0.000957)	-0.000731 (0.00155)	-0.000549 (0.000745)
CIR	-0.00149 (0.00176)	4.46e-05 (0.000352)	-0.000114 (0.00155)	0.00226*** (0.000356)
ACR	-1.189*** (0.298)	0.419 (0.425)	0.108 (1.922)	-0.336 (0.287)
LA	0.00690*** (0.000987)	0.00963*** (0.000655)	-0.00288*** (0.000767)	-0.00237*** (0.000414)
LLP	-0.498 (0.410)	-0.364 (0.234)	1.145 (1.352)	0.662* (0.396)
EQASS	0.561 (0.481)	0.0122 (0.0188)	-0.0793 (0.466)	-0.0411 (0.0479)
NIETA	-0.215*** (0.0288)	-0.242*** (0.0191)	0.0801*** (0.0189)	0.0655*** (0.0106)
LNTA	-2.181 (3.100)	-0.0544 (0.0471)	-1.348 (4.026)	0.0355* (0.0211)
LNGDP	-0.810 (3.792)	-3.014*** (0.681)	-2.197 (5.033)	-2.0231 (4.093)
_lYear_2013		2.173*** (0.572)		0.358 (0.767)
_lYear_2014	0.0196 (0.269)	1.608*** (0.369)	0.409 (0.259)	1.073 (0.666)
_lYear_2015	-0.378 (0.348)	0.850*** (0.326)	0.114 (0.409)	0.773 (0.683)
_lYear_2016	0.0212 (0.185)	0.503 (0.324)	-0.292 (0.399)	
_lYear_2017		0.0817 (0.356)		0.495 (0.572)
_lYear_2012	-1.131 (0.725)		0.979 (1.217)	2.778*** (0.854)
_lYear_2018	0.0374 (0.336)		0.300 (0.721)	1.108* (0.584)
Constant		21.54*** (4.675)		-1.120* (0.588)
Observations	168	196	168	196
No. of instruments	19	25	19	25
Number of groups	28	28	28	28

Table 4: (Continued)

AR(1)	0.36	0.16	0.46	0.12
AR(2)	0.44	0.23	0.89	0.86
Hansen J test (P-value)	0.12	0.31	0.07	0.16

Source: Authors estimation, Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5: Coefficient table of regression output (using Boone indicator as proxy of competition)

Model No.	(5)	(6)
Variables	NPL ratio	Z_score
L.Z_score		0.836*** (0.0566)
L.NPLratio	0.995*** (0.0587)	
Boone	5.524** (2.782)	-6.146** (2.893)
CIR	0.00199*** (0.000525)	-0.000147 (0.000577)
ACR	-0.302 (0.311)	0.802 (0.729)
LA	-0.00214*** (0.000415)	0.00928*** (0.000978)
LLP	0.659 (0.403)	-0.551 (0.420)
EQASS	-0.0471 (0.0564)	0.0261 (0.0351)
NIETA	0.0577*** (0.0112)	-0.223*** (0.0262)
LNTA	0.0242 (0.0240)	-0.110* (0.0643)
LNGDP	5.989*** (2.252)	-5.036*** (1.671)
INFL	0.463** (0.211)	-0.389** (0.158)
Constant	-44.79*** (17.08)	39.53*** (12.56)
Observations	196	196
No. of instruments	21	21
Number of groups	28	28
AR(1)	0.12	0.17
AR(2)	0.94	0.20
Hansen J statistics (P value)	0.31	0.11

Source: Authors estimation, Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5. Recommendations and Policy Implications

From the study it is found that more competition results in more financial soundness or stability. So, banking industry competition should be ensured. It does not mean increasing the number of banks. NPL would increase if new banks come into the financial market. Ensuring competition means ensuring level playing field among all types of commercial banks in providing financial services, ensuring equal opportunities for investment in public and private sector, as well as ensuring equal scope for financing from financial market at low cost of debt. Commercial banks should try financial innovation through new financial instruments or new schemes, which would improve financial soundness of the banks. From the study it is found that efficiency ratios have significant impact on financial soundness or stability. So, banks should emphasize on cost control to achieve cost efficiency in order to boost up their operating income. Increased operating income would lead to enhanced financial soundness of the banks. They should also try to reduce non-operating expenses as much as possible with a view to enhancing managerial efficiency. Increasing the level of managerial efficiency would reduce NPL and increase financial stability. NPL can be reduced by taking appropriate measures before the sanction of the loan such as applying proper credit investigation technique to judge credit worthiness, keeping adequate security and collateral, evaluating purpose of the borrowed fund, appraising the prospect of the venture to which borrowed fund would be invested, and forecasting future financial strength of borrower. New proliferation of services, geographic diversification, and portfolio investment of commercial banks can contribute to stability of net income, which ultimately would lead to financial soundness. Besides these, the banks can increase the proportion of long term loan in their loan portfolio with a view to earn higher return than working capital loan.

6. Conclusion

The study reveals that increase in bank competition would result in improved financial soundness or stability because competitive pressure would ensure financial discipline, managerial efficiency, streamline of loan appraisal, sanction, and disbursement procedure, and taking optimal rather than sub-optimal decisions. Achieving cost efficiency is a

significant factor, which influences financial soundness. This can be obtained through economies of scale and economies of scope. Bangladesh Bank has to play a vital role through policy formulation to ensure competitive environment to all financial institutions regarding project financing, investment, loan disbursement, and financial services. The present study is conducted on commercial banks. Future studies can be undertaken on non-bank financial institutions to explore the impact of bank competition and efficiency on financial stability. Furthermore, future research works can be conducted on different dimensions such as effect of NPL on bank efficiency or on bank solvency, determinants of NPL to get new insight into the subject matter in a comprehensive way.

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