Financial strength of banking sector in Bangladesh: a CAMEL framework analysis

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Abstract

Purpose – This paper investigates the financial strength of banks in Bangladesh and factors affecting the financial strength over the years 2010–2015 on 35 banks.

Design/methodology/approach – Additive value function with CAMEL rating (capital stength, asset quality, managerial efficiency, earning ability, liquidity) has been employed to calculate banks' financial strength index (FSI). In the second stage, panel regression has been exercised to find out the determinants of banks' financial strength.

Findings – Empirical finding exhibits that the Islamic banks of Bangladesh are financially stronger and outperform conventional and Islamic window banks with higher liquidity. In the ownership category, private banks have more financial strength with higher capital strength, asset quality, managerial efficiency and earning ability than public banks. Bank size, loan recovery, salary and banking sector development positively affect whereas the loan-asset negatively affect the bank's financial strength in Bangladesh.

Research limitations/implications – This study has its limitations despite its importance. CAMELS is a more improved form than using CAMEL. But because of the data deficiency on "S" which represents sensitivity, it would not be possible to use CAMELS framework. Further researchers could incorporate this.

Practical implications – Government and banks should allow Islamic banks to enter the market on easy terms because of their outstanding performance in the existing market. In addition, banks should provide loans with consideration so that they cannot create credit risk. In addition, they should calculate composite financial strength annually to understand which components they need to work on.

Originality/value – This study extends the extant result on the composite FSI. It is hard to examine the financial strength of banks using only ratio value, which misleads most of the time. The study offers evidence on how the FSI provides more rigorous results and what are the factors contribute most to the financial strength of banks.

Keywords Financial strength, FSI, CAMEL framework, Bank, Bangladesh

Paper type Research paper

1. Background of the study

Financial institution widely known as the banking sector performs a momentous role in ameliorating economic growth with development via channelling the needed fund for the economy ([Fayed, 2013](#)). It is considered the lifeblood in the modern trade. Extraordinary

Asian Journal of Economics and Banking
Vol. 6 No. 3, 2022
pp. 353-372
Emerald Publishing Limited
e-ISSN: 2633-7991
p-ISSN: 2615-9821
DOI 10.1108/AJEB-12-2021-0135

changes in this sector have been ascertained worldwide in the former two decades. This change has been accelerated due to the increase of inside banking competition (Srairi, 2010). Huge numbers of new markets have been emerged due to strategic changes of these financial institutions (Ariss, 2010). Therefore, to sustain in the market, banks need to have financial strength which indicates banks' performance explaining how much banks are solvent, how is their profitability, asset quality and managerial efficiency. Within this issue, a rising number of researchers investigate the different kinds of banks' performance as an indicator of financial strength comparing the financial ratios in individual aspects like profitability (Adesina, 2021; Le and Ngo, 2020).

In this issue, a large number of studies have been conducted focusing on the banks' financial ratio, for example, profit (profit-asset ratio), income ratio, credit risk, liquidity risk (Migliardo and Forgione, 2018; Khalil and Siddiqui, 2019), net interest margin, return on equity (ROE) (Gupta and Mahakud, 2020), loan growth (Karim *et al.*, 2014) and capital adequacy. These studies have explored banks' performances in various dimensions. However, these results did not conclude the overall strength of banks and provided some conflicting comparisons. Like, Khalil and Siddiqui (2019) concluded that conventional banks' performance in profitability is higher than the Islamic banks whereas Islamic banks have less liquidity risk and have more financial strength than conventional banks. Karim *et al.* (2014) explored that both conventional and Islamic banks have higher loan growth whereas in equity growth, Islamic banks perform better than the conventional banks. These studies fail to compare the overall performance of those banks as these cannot compare if one group of banks' overall financial strength is better than another or not. Therefore, because of the gap in existing literature, this study attempts to evaluate the composite financial strength of banks in Bangladesh. The size of the banking sector in Bangladesh is relatively larger than many other countries with the almost same level of income per capita and development (Rahman and Islam, 2017). After independence, all banks of Bangladesh were nationalized. However, because of inefficiency in management and low financial strength, the overall system was again privatized after 1980. With this, various reformation measures were taken which lead to the growth of this industry in 1990 (Uddin *et al.*, 2012). The reformation was on supervision of central bank, interest rate, debt recovery, monetary policy and so on. At that time, many investment banks and commercial banks were established (Ahmad and Hassan, 2007). With these conventional banks, there was the introduction of the Islamic Bank in 1983. Foreign and domestic investors had shown their interest to invest in this sector. To sustain the economy with the existing growth, to accelerate the investment and to perpetuate in this rapid increase of competition, banks emphasized financial strength (Islam *et al.*, 2014). Not only in Bangladesh but also worldwide, banks emphasized enhancing financial strength to compete and make proficient employment of existing resources. Though Bangladesh Bank uses the CAMEL framework to measure banks' performance, there is a conflicting result as banks focus on ratio analysis only. Based on this point, this study has evaluated the overall strength of banks in Bangladesh so that they become aware of their overall financial strength. As financial strength represents banks' financial health and performance, it will help banks to compete and sustain themselves in the globalized banking industry. There have hardly been found any studies on the whole banks' financial strength. Therefore, this study will be a new addition in evaluating the overall banks' financial strength in Bangladesh.

The author has contemplated achieving the following research objectives:

(1) To investigate the overall financial strength of different bank groups of Bangladesh.

(2) To examine the determinants of bank's financial strength.

To estimate the financial strength, I have used the additive value function which is a popular multi-criteria approach. To construct the composite index, the CAMEL framework has been used. In addition, I have investigated the factors affecting the financial strength of banks.

2. Literature review

For both developing and developed countries, bank's financial strength plays a significant role in the development and economic growth through proficient employment of existing resources, channelling the needed fund to the economy and with the promotion of trade and industry (Demirguc-Kunt et al., 2011; Saini and Sindhu, 2014; Fulford, 2015). A strong financial sector not only accelerates a smooth circulation of a fund but also allows the overall economic growth of a country. Many authors have studied the differences in the financial strength of different groups of the bank (Doumpos et al., 2017). Studies have used profitability of banks, asset ratio, liquidity ratio, cost/income ratio and many more for the evaluation of performance (Harahap, 2018; Ibrahim, 2020; Hanif et al., 2012). However, most of the studies found CAMEL as an efficient tool for measuring banks' financial performance (Pekkaya and Demir, 2018; Todorović et al., 2018; Mohammed et al., 2015). Therefore, many studies were conducted on measuring the financial condition of conventional and Islamic banks using this CAMEL framework. Nguyen et al. (2020) in their study on the Vietnam Bank's performance found that all banks' performances are significantly affected by CAMEL components except for earning ability. Ping and Kusairi (2020) in their study has measured bank performance by Return on Asset (ROA) and then used CAMEL components as determinants of bank performance. They have explored that capital strength and earning ability affect performance positively whereas the other three CAMEL variables have a negative effect. Among the variables, an increase in liquidity reduces the bank's income as it intends to reduce the return rate. Sun et al. (2017) used "net interest margin" to evaluate the bank performance in organisation of Islamic Countries (OIC) and explored that commercial banks earn more than Islamic banks. Then they explored the determinants of the bank performance and have found that capital adequacy and managerial efficiency significantly affect bank performance.

Some studies have been found on banks' performance and their determinants in Bangladesh. Saha and Bishwas (2021), Robin et al. (2018), Islam et al. (2017) and Mahmud et al. (2016) examined the bank performance using ROA and ROE. Saha and Bishwas (2021) explored that loan loss provision, bank size and leverage ratio are statistically significant factors of ROA but the macroeconomic factors do not have any statistically significant effect. Robin et al. (2018) and Yesmine and Bhuiyah (2015) examined that capital ratio, asset quality and bank size have a significant impact on bank performance. Where capital ratio, asset quality and bank size affect positively whereas ownership category affects negatively. It shows that the private banks of Bangladesh are more competent than the public banks. Mahmud et al. (2016) have found that bank-specific factors like adequacy of capital, gearing ratio, size and ratio of operating expense affect financial performance. The last three factors affect the profitability of banks negatively whereas there has not been found any significant relationship in the case of the ratio of non-performing loans (NPL) and liquidity. Rafiq (2016) analyzed bank performance using the CAMEL framework and has analyzed that Islamic banks perform better in capital ratio and total deposit whereas conventional banks have higher ROE and ROA. In addition, efficiency in maintaining operating costs has a significant positive impact on the bank performance.

Ali and Puah (2019) in their study have examined that an increase in bank size increases a bank's profitability whereas credit risk affects negatively. The larger banks have the advantage of economies of scale which increases the bank's income. Alarussi and Alhaderi (2018) measured bank performance on ROA and explored that bank asset ratio positively

affects bank performance whereas financial leverage affects negatively. Leverage is the policy of a bank that represents the trade of banks between the collection of finance either by debt or by equity. Çekrezi *et al.* (2015) have used bank size, adequacy of capital and bank age as the factors influencing bank performance of Albania and have found that except for the bank size all the factors have felt a negative impact on performance. Nisar *et al.* (2015) explored bank profitability determinants of banks in Pakistan using the pooled ordinary least square (POLS) method and investigated that cost, liquidity and default loan negatively affect bank performance whereas banking sector development and asset quality have a significant positive impact on it. Hasanov *et al.* (2018) examined that bank size, loan–asset ratio and capital ratio positively affect a bank's performance. The loan ratio helps to increase the interest income which ultimately increases banks' profit but if banks take a higher level of risk and provide a larger amount of loan, it can negatively affect bank performance. The alternative explanation of negative relationship between loan growth and bank performance is similar to the finding of Kashif *et al.* (2016) who explored that providing a higher amount of loan without consideration increases the propensity of non-performing loans and decreases banks' solvency.

Staikouras and Wood (2004) explored the profitability determinants of the European banks and have found that equity ratio and fund gap have a significant positive impact on bank performance whereas loan–asset ratio and loan loss provision to asset ratio has a significant negative effect. Though with the increase of loan–asset ratio, the liquidity of banks increases which leads to the increase of bank income but the higher increase of loan amount increases the management expense which further reduces the profitability. Jaffar and Manarvi (2011) compared the Islamic and conventional banks' performance using the CAMEL framework and explained that Islamic banks perform better in liquidity whereas conventional banks are more efficient in managerial performance. In addition, it is illustrated that the lower the loan loss provision the higher the loan recovery and the higher the bank performance. Berhani and Sejdini (2016) examining the determinants of bank profitability found that capital ratio and the salary expense have a significant positive effect on bank profit. In addition, the higher salary expense has both short-term and long-term positive effects on banks' performance which indicates that higher expense increases the effectiveness of the staff to work.

From the above-mentioned literature, it can be found that some researchers have used CAMEL components for banks' performance evaluation whereas most of them have used ROA representing banks' financial strength. Most of the researchers have used traditional tools like single ratio evaluation for the performance evaluation which may not be able to represent the real scenario and with this ultimately proper policy formulation may also not be possible. However, no one explored a composite performance index. In addition, most of the researchers have used POLS method to analyze the determinants without considering the time-invariant variable. Therefore, this study is significantly different from the existing study as first of all it analyzes the financial strength index (FSI) which represents banks' financial health and performance using an additive value function. The second stage evaluates the determinants of the composite banks' financial strength.

3. Formulation of hypothesis

Following the previously presented argument, the author can propose the following hypotheses those address which groups are financially stronger than others:

H1. Islamic banks have more financial strength than conventional banks.

H2. Islamic window banks have more financial strength than conventional banks.

Related to the factors affecting bank performances, the following hypotheses can be formed.

H3. Bank size positively affects banks' financial strength.

H4. Loan recovery positively affects banks' financial strength.

H5. Loan to total asset ratio positively affects banks' financial strength.

H6. Leverage negatively affects banks' financial strength.

H7. Salaries and allowance positively affect banks' financial strength.

H8. Interest income to total asset positively affects banks' financial strength.

H9. Banking sector development positively affects banks' financial strength.

4. Methodological framework
The author intends to calculate the FSI and further tries to find out the determinants of financial strength. Additive value function with CAMEL framework has been used to calculate the FSI of banks. After that, through panel regression, the causal effect relationship has been calculated among financial strength and its determinants.

4.1 Estimating financial strength of banks
To calculate every bank's financial strength, the author has used the additive value function. The additive value function is widely used for multi-criteria evaluation. This multi-criteria evaluation is mainly applied when there is the need for a complete ranking of the alternative. In the case of decision-making like making choice, classifying, making rank or describing an issue, this method provides more robust results (Doumpos and Zopounidis, 2012). Therefore, this model is a perfect fit for this study as it will help to make the rank of different kinds of banks according to their financial strength in the different periods. It has been applied to compare the banks in a common setting. The idea of additive value function which is a part of stochastic multiobject acceptability analysis (SMAA) will be found in the study of Tervonen and Figueira (2008). Keelin (1981) in his study provides a detailed explanation of this model as well as Doumpos and Zopounidis (2012) in their study on European banks again used this model where a precise form of this model will be found.

As a variable for the additive value function, this study has used the CAMEL components. These components are widely considered as the best combination of variables to represent bank performance. Among the CAMEL framework, there are five components by which a multi-criteria approach is used in finding out financial strength. These components are capital strength measured by total shareholders' equity to total asset, asset quality as loan loss provision to gross loan, managerial efficiency as operating cost to operating income, earnings as gross profit to total asset and liquidity as liquid asset to total asset. This CAMEL framework has also been used by Bangladesh Bank and it is successfully used to know about the weaknesses and strengths of banks (Balasundaram, 2008). Therefore, choosing this framework as the variable of additive value function would be the best fit for this study.

The basic additive value function proposed by Barron and Schmidt (1988) is as follows:

$$V(x_i) = \sum_{j=1}^{n} w_j v_j(x_{ij}) \tag{1}$$

where V = Overall value which would be $0 \leq v \leq 1$, w_j = Weight which represents relative

importance and $\sum_{j=1}^{n} w_j = 1$. $v_j(x_{ij}) =$ Single attribute function and here $0 \leq v_j(x_{ij}) \leq 1$ which means that the calculated $v_j(x_{ij})$ would be greater than or equal to zero and less than or equal to one.

Equation (1) has again been represented by the following equation (Doumpos and Zopounidis, 2012; Keelin, 1981). Therefore, Equation (1) can be written as –

EAR = Equity to assets ratio	w_{EAR} = Weight given to equity to assets ratio
LGR = Loan loss provision to gross loan ratio	w_{LGR} = Weight given to loan loss provision to gross loan ratio
CIR = Cost to income ratio	w_{CIR} = Weight given to cost to income ratio
PAR = Profits to total assets ratio	w_{PAR} = Weight given to profits to total assets ratio
LAR = Liquid assets to total assets ratio	w_{LAR} = Weight given to liquid assets to total assets ratio

Here, $\int_{\text{EAR}}, \int_{\text{LGR}}, \int_{\text{CIR}}, \int_{\text{PAR}}, \int_{\text{LAR}}$ are the ratios monotone marginal value functions. Its value is normalized in 0 and 1. So the value would be between 0 and 1 after normalization. And with this, after the calculation of $V(x_i)$, the overall performance index value would also be between 0 and 1. The financial strength values tend to 1 shows higher financial strength and the values towards 0 will show lower financial strength of banks

$$V(x_i) = \left(w_{\text{EAR}} \times \int_{\text{EAR}} \right) + \left(w_{\text{LGR}} \times \int_{\text{LGR}} \right) + \left(w_{\text{CIR}} \times \int_{\text{CIR}} \right) + \left(w_{\text{PAR}} \times \int_{\text{PAR}} \right)$$
$$+ \left(w_{\text{LAR}} \times \int_{\text{LAR}} \right) \tag{2}$$

where

$V(x_i) =$ The financial strength of bank "i".

4.1.1 Normalization of ratios. In the case of the monotone marginal value function, the normalization will be done for each bank's variable in each year. For the normalization of the financial ratios, the author has used the following formula (Barron and Schmidt, 1988):

$$I_{it}^n = \frac{I_{it} - \text{Min}(I_i)}{\text{Max}(I_i) - \text{Min}(I_i)} \tag{3}$$

where

$I_{it} =$ Normalized value in the year t of the variable i.

$\text{Max}(I_i) =$ Maximum value of a variable for each bank from 2010 to 2015.

$\text{Min}(I_i) =$ Minimum value of a variable for each bank from 2010 to 2015.

The value of I_{it}^n for the five financial ratios will be in 0 and 1. From this calculation, the author can convert the variable's value into a normalized form.

4.1.2 Weight calculation. There are various ways to calculate weight like expert examination, scaling, score method, ordinal method, equal weight and so on. In this study, the scoring method has been used based on scaling (Hunjak and Jakovčević, 2001). Therefore, to calculate w_j, the mean score has been calculated with a five-point rating scoring scale of 1–5. The steps to calculate the weights are discussed below.

Step 1: First the ratio values of the indicators need to be converted in percentage. Like,

$$\text{Percentage of ratio} = A \times 100$$

where A = Ratio of an indicator.

For example, consider the conversion of equity to assets ratio in percentage form

$$\frac{\text{Equity}}{\text{Assets}} \times 100$$

Step 2: Calculate all the individual indicators' six years average percentage values for all banks.

Step 3: Then, determine the five-point scoring scale which will range from 1 to 5 for every indicator.

The points will be assigned to the banks according to pointer and positions value. The scale boundaries are bounded by the indicator's maximum and minimum values. The following points are assigned to the banks:

1 if 0 percentile < percentage value of indicator < 15 percentile

2 if 15 percentile < percentage value of indicator < 35 percentile

3 if 35 percentile < percentage value of indicator < 65 percentile

4 if 65 percentile < percentage value of indicator < 85 percentile

5 if 85 percentile < percentage value of indicator to maximum

Step 4: The weight for each indicator will be determined by dividing the summation of individual indicator's points by the summation of the points given to all the indicators. So finally the summation of weights given to each indicator will be equal to 1.

4.2 Determinants of financial strength of banks

To investigate the factors affecting the FSI of banks, "Panel Regression Model" has been used. There are three techniques of panel data evaluation under panel regression. Those are POLS, random effect and fixed effect. In this study, the two most important variables are time-invariant. Those are the ownership category and functional category. The fixed-effect model cannot estimate the effect of time-invariant variables (Doumpos *et al.*, 2017). Therefore, in this study, the author has not used the fixed-effect model. Consequently, author has conducted POLS and random effect model. To choose between these two models, the "Breusch–Pagan Lagrange Multiplier (LM) test" has been conducted. This POLS is the same as the normal OLS regression. It is called POLS when the OLS is used in the case of panel data. The regression model in this case is given as follows:

$$Y_{it} = \alpha_0 + \alpha_i X_{it} + \mu_{it} \tag{4}$$

where i = Bank, t = Time (year), Y_{it} = Dependent variable, X = Explanatory variables, α_0 = Constant term, α = Coefficient of X, ε = Error term, $i = 1, 2, 3, \ldots, 35$ and $t = 1, 2, 3, \ldots, 6$. And it has been assumed that unobserved variables are over time constant.

Whereas the POLS assumption is highly restricted, the random effect model can overcome this restriction. With this, the effect of time-invariant variables can be estimated by the random effect model which overcomes the constraints of the fixed-effect model. In this model, the individual-specific effect is independent of explanatory variables.

$$Y_{it} = \beta_0 + \beta_i X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \tag{5}$$

where Y_{it} = Dependent variable, X = Explanatory variables, β_0 = Constant term, β = Coefficient of X, α = Unknown intercept for each bank, μ = "Random effect in the group which is same like ε = Error term. The only difference is that μ is for every group", i = Banks = 1, 2, 3, …, 35 and t = Year = 1, 2, 3, …, 6. And it has been assumed that unobserved variables are over time constant.

In this study, the dependent variable is the financial strength of banks and the explanatory variables include Bank Size as [ln (Total Asset)], Loan Recovery as [Gross Loan-Loan Loss Provision], Loan to Asset Ratio and Leverage as [Liabilities/Equity Ratio], Salary and Allowances, Interest Income/Total Asset and Banking Sector Development as [log (Total Asset)/GDP growth], Bank Ownership Category as [0 = Public Bank (Base category), 1 = Private Bank] and Bank Functional Category as [1 = Conventional Bank (Base category), 2 = Islamic Bank, 3 = Islamic Window Bank]. Breusch–Pagan LM test is popularly used in case of choosing if the POLS will be more efficient for this study's data set or the random effect will be efficient. The hypotheses of this test are-

H0: POLS would be accepted

HA: Random effect model would be accepted.

4.3 Sample
Currently, the number of scheduled banks under the supervision and control of the central bank of Bangladesh is 61. The banks' data that are not available have been excluded from the study. After excluding the banks those needed data are missing, 35 banks data have been collected from annual reports of banks from 2010 to 2015. Among these, in the category of ownership, there are 29 private banks and 6 public banks. In another category, there are 18 conventional banks, 7 Islamic banks and 10 Islamic window banks.

5. Data analysis
5.1 Bank's financial strength
Table 1 shows the summary statistics of five CAMEL components from the year 2010 to 2015 of all banks and different categories of banks. It represents that the liquidity of all banks is higher than other components of CAMEL. Managerial efficiency is reflected by the cost to income ratio. All banks' capital strength, earning ability and liquidity are not so high. The cost to income ratio is very high, 63.45% which reflects the lower managerial quality of all banks. However, the asset quality of all banks is higher than other CAMEL components. It has been examined that Islamic banks outperform in capital strength (higher equity to asset ratio), managerial efficiency (lower cost to income ratio), earning ability (higher profit to asset ratio) and liquidity (higher liquid to total asset ratio) than the conventional and Islamic window banks.

The conventional banks have higher asset quality (lower loan loss provision to gross loan ratio) than the Islamic banks and Islamic window banks. Therefore, Islamic banks are performing better with a higher quality in most of the CAMEL components than conventional and Islamic window banks. On the other side, public banks have higher liquidity than private banks whereas private banks have higher capital strength, asset quality, managerial efficiency, earning ability with higher equity to asset ratio, lower loan loss provision to gross loan ratio, lower cost to income ratio and higher profit to total asset ratio than the private banks. Consequently, on average, private banks' performance is better than public banks.

Bank groups Descriptive statistics	All banks (n = 35) Mean (P)	SD	Conventional bank (n = 16) Mean	SD	Islamic bank (n = 7) Mean (P)	SD	Islamic window bank (n = 12) Mean (P)	SD	Public bank (n = 6) Mean (P)	SD	Private bank (n = 29) Mean (P)	SD
Capital strength	6.06	11.93	7.22	5.82	−1.27	23.81	8.80	2.31	3.48	7.79	6.60	12.58
Asset quality	1.26	1.97	1.18	1.72	1.49	2.71	1.23	1.78	2.11	3.38	1.08	1.48
Managerial quality	63.45	126.96	81.42	184.39	54.74	40.50	44.57	12.71	135.04	295.57	48.64	22.61
Earnings	1.56	2.16	1.62	2.16	0.98	2.98	1.82	1.47	−0.15	2.91	1.91	1.79
Liquidity	12.72	8.24	12.36	5.82	15.76	3.00	11.43	11.91	13.29	16.80	12.60	4.98

Note(s): N = Number; P = Percentage, SD = Standard Deviation

Table 1.
Summary statistics

Therefore, it is hard to examine the financial strength of banks using only ratio values. The FSI provides a more rigorous result.

Table 2 presents the FSI of different types of banks. The FSI reflects how much the bank is financially strong and it ultimately reflects bank performance which means how well the bank is financially performing. It has been calculated by combining five components of CAMEL with their relative weight. The higher the financial strength value towards 100, the higher the bank performance.

From 2010 to 2012, conventional banks, Islamic banks and Islamic window banks have an increasing trend of financial strength. In 2013, this conventional bank and Islamic bank's financial strength has increased but Islamic window bank's financial strength has decreased. But in 2014, the conventional bank and Islamic bank's financial strength became decreased whereas Islamic window bank's financial strength became increased and this increasing trend remains sustained in 2015. On average, the Islamic banks are financially stronger than the conventional and Islamic window banks with the highest FSI of 54.88%. Whereas the conventional bank has been ranked 2 with FSI 52.45% and Islamic window bank has been ranked 3 with the lowest FSI 51.42%. The variation in FSI among conventional banks, Islamic banks and Islamic window banks is not so high. This indicates that, on average, of all the CAMEL components, Islamic banks are performing better than conventional banks and Islamic window banks. In the ownership category, in 2010, 2013 and 2014, public banks' financial strength was higher than private banks whereas in 2011–2012 and in 2015, the private banks' financial strength was higher than the public banks. However, on average, private banks are financially stronger than public banks. Therefore, there is an opportunity for Bangladesh to form a financially strong banking sector through expanding this sector with the flourish of private Islamic banks.

Figure 1 represents the trend of financial strength from 2010 to 2015 by banks. AB Bank has increasing EAR from 2010 to 2012. In 2014, this AB Bank's financial strength has been decreased but in 2015, it again managed to increase its financial strength. In the case of the City, EXIM, Eastern, Janata, Rupali, Jamuna, Merchantile, United Commercial and Uttara banks, this same type of trend like increasing, decreasing and again increasing trend can be seen. In the case of First Security, Islami, Prime and Southest banks, there has been seen the increasing trend of the FSI. This indicates that, over time, the financial strength of these banks is increasing. So, their performance has been becoming better over years. It can be examined that different banks have enjoyed a different level of financial strength with fluctuating FSI values.

On average, most of the banks of Bangladesh have a lower level of financial strength with an FSI of less than 50% which is reflected in Table 3. On average, IFIC Bank has been ranked 1 with the highest FSI 65.35% and the Agrani Bank has been ranked 2 with the second highest FSI 57.71%.

The Eastern Bank has the lowest amount of FSI with 37.98%. Therefore, it has been ranked 35 with lower financial strength. The result indicates that the IFIC Bank is financially stronger than the other sample banks of Bangladesh whereas the Eastern Bank has the

		Years							
	Bank groups	2010	2011	2012	2013	2014	2015	Average	Rank
Functional category	CB	34.29	42.05	45.19	53.50	51.25	59.85	52.45	2
	IB	40.01	40.19	42.81	60.03	58.18	58.49	54.88	1
	IWB	35.59	45.15	48.86	48.16	55.20	53.48	51.42	3
Ownership category	PB	39.40	39.56	31.34	55.64	55.28	48.01	44.87	2
	PrB	35.16	43.40	49.00	52.42	53.72	53.72	47.90	1

Note(s): Code of Bank Group: CB = Conventional Bank; IB = Islamic Bank; IWB: Islamic Window Bank; PB: Public Bank; PrB: Private Bank

Table 2.
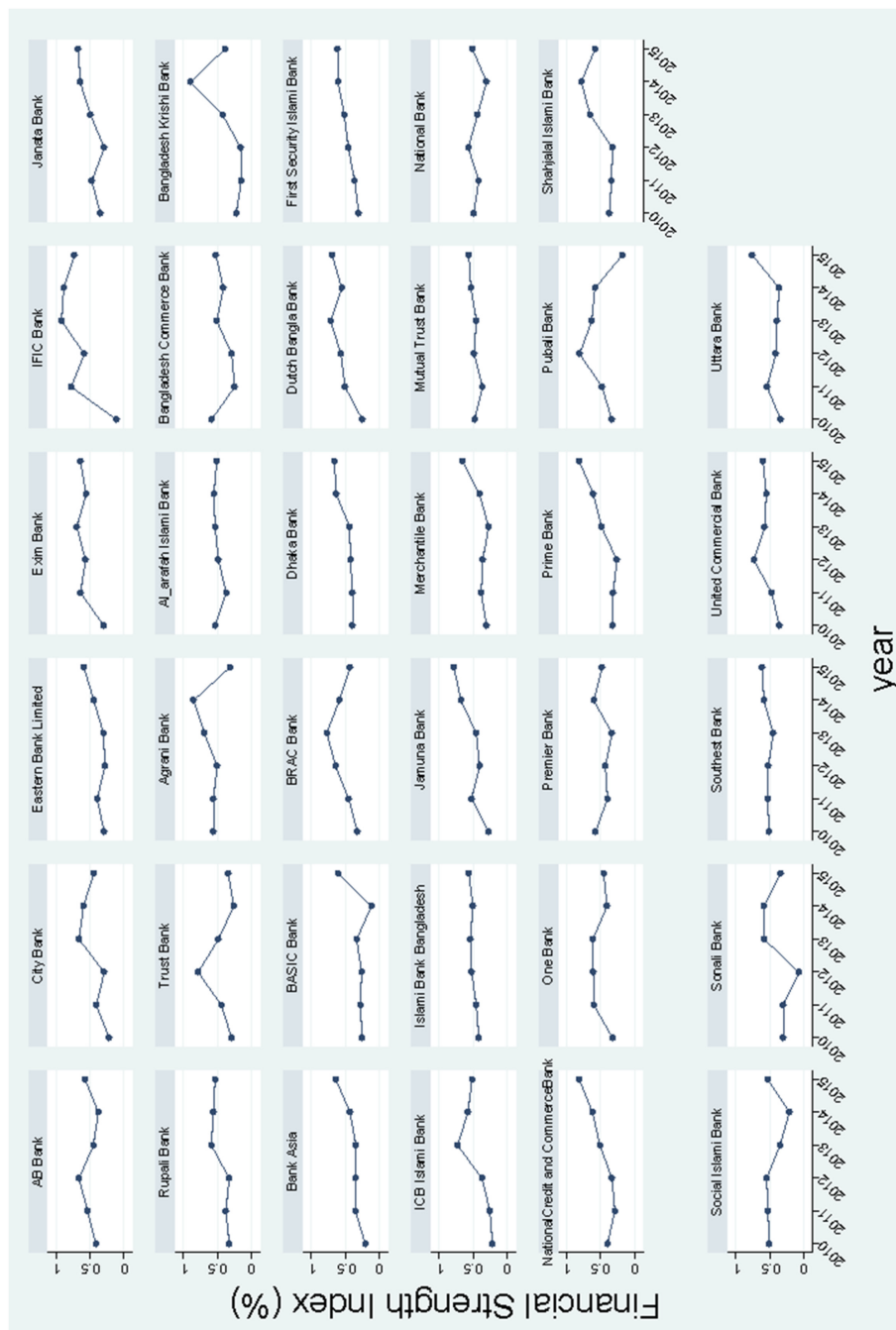Financial strength index of different bank groups

Figure 1.
Financial strength
index by
individual banks

Bank name	Six years average financial strength (%)	Standard deviation	Rank
AB Bank	50.13	10.59	12
City Bank	41.88	15.38	32
Eastern Bank	37.98	12.78	35
EXIM Bank	56.25	14.86	3
IFIC Bank	65.35	28.10	1
Janata Bank	47.80	15.50	21
Rupali Bank	45.69	12.55	27
Trust Bank	43.62	19.72	28
Agrani Bank	57.71	18.33	2
Al-Arafah Islami Bank	49.91	7.37	14
Bangladesh Commerce Bank	42.83	13.31	30
Bangladesh Krishi Bank	48.02	12.77	19
Bank Asia	41.28	19.14	33
BASIC Bank	30.35	16.08	36
BRAC Bank	52.89	17.48	7
Dhaka Bank	48.95	12.88	17
Dutch Bank	54.94	17.22	4
First Security Islami Bank	49.54	18.38	15
ICB Islami Bank	46.17	17.33	25
Islami Bank Bangladesh	49.40	5.73	16
Jamuna Bank	52.00	18.83	8
Merchantile Bank	43.45	18.89	29
Mutual Trust Bank	47.98	6.77	20
National Bank	42.54	9.93	31
National Credit and Commerce Bank	51.87	20.32	9
One Bank	50.01	12.50	13
Premier Bank	51.27	12.81	10
Prime Bank	45.77	22.07	26
Pubali Bank	47.26	18.07	23
Shahjalal Islami Bank	50.76	19.26	11
Social Islami Bank	47.63	9.63	22
Sonali Bank	39.67	16.00	34
Southest Bank	53.34	7.46	6
United Commercial Bank	54.47	12.62	5
Uttara Bank	46.88	16.39	22
ANOVA: Prob > chi^2 = (0.493)	48.16	15.72	

Table 3.
Financial strength
index of the individual
banks in Bangladesh

Note(s): Prob = Probability, chi = Chi-square, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

lowest amount of financial strength with lower FSI values than the other banks. Among the 35 banks, only 11 banks, AB, IFIC, EXIM, Agrani, BRAC, Dutch-Bangla, National Credit and Commerce, One Bank, Shahjalal Islami, Southest and United Commercial banks, have the higher amount of financial strength with higher FSI that was more than 50% whereas the remaining 24 banks have the lowest amount of FSI that was less than 50%. It indicates that most of the banks of Bangladesh have a low level of financial strength with a lower FSI value.

Table 4 shows the relationship of different financial ratios to bank's composite FSI. With FSI to equity to asset ratio, profit to asset ratio and liquid asset to total asset ratio, there have found positive relationship and with FSI to loan loss provision to gross loan ratio and cost to income ratio have found negative relationship for all banks and all other bank groups. The magnitude of the relationship of loss provision to gross loan ratio to FSI for all bank groups is very high compared to other financial ratios. For all banks, the equity to asset ratio, cost to income ratio, profit to asset ratio and liquid asset to total asset ratio highly affect FSI. With loan loss provision to gross loan ratio to FSI, there is a lower magnitude of a negative relationship.

		EAR	LGR	CIR	PAR	LAR
Financial strength (index)	*All banks*	0.79	−0.4529	−0.957	0.841	0.844*
	CB	0.319	−0.727	−0.1130	0.429	0.663*
	IB	0.407	−0.3118*	−0.865	0.231	0.844
	IWB	0.516	−0.666	−0.781*	0.574	0.533
	PB	0.547	−0.697	−0.2155	0.107	0.122
	PrB	0.821	−0.317	−0.2182*	0.672	0.979*

Note(s): Code of Bank Group: CB = Conventional Bank, IB = Islamic Bank, IWB = Islamic Window Bank, PB = Public Bank, PrB = Private Bank. Variables Name: EAR = Equity to asset ratio; LGR = Loan loss provision to gross loan ratio; CIR = cost to income ratio; PAR = profit to asset ratio; LAR = Liquid asset to total asset ratio; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 4.
Correlation of financial
ratios to FSI

In the case of conventional banks, the loan loss provision to gross loan ratio and liquid asset to total asset ratio have a higher magnitude of relationship with FSI whereas the other three have a lower magnitude of the relationship. The Islamic bank's FSI with cost to income ratio and liquid to total asset ratio has a strong relationship. Therefore, these two variables are contributing more to becoming financially strong. For Islamic window banks, liquid to total asset ratio and cost to income ratio have higher contribution in forming financial strength as these variables have strong relationship whereas the others have had low to moderate magnitude of relationship. In the case of ownership category, public bank's equity ratio and loan loss provision to gross loan ratio have a higher magnitude of relationship and these have more contribution in the formation of financial strength. In case of private banks, the equity ratio, profit ratio and liquid to total asset ratio have higher magnitude of relationship with the gross FSI.

5.2 Determinants of bank's financial strength

To find out the efficient model for this study from the random effect and POLS model, the LM test has been conducted. The p-value of the LM test is 0.0498. By considering the p-value, it has been examined that the null hypothesis that is the adoption of POLS is rejected and the alternative hypothesis that is random effect model will be adopted is accepted. Therefore, for this study, random effect model is efficient and will provide a valid result.

In regression Table 5, the dependent variable is the FSI of banks. Here, the regression has been conducted for the different variables affecting the FSI. The different independent

Dependent variable: FSI Variables	FSI
Bank size	7.025** (3.259)
Loan recovery (billion tk)	0.0124** (0.00556)
Gross loan to total asset (ratio)	−83.97*** (20.99)
Leverage	−0.191 (0.189)
Salary and allowances (billion tk)	0.317* (0.186)
Interest income to total asset (ratio)	−66.61 (52.14)
Banking sector development	0.00000627*** (0.00000162)
Islamic bank	7.530* (3.858)
Islamic window bank	−0.407 (2.774)
Private bank	9.153** (4.131)
Constant	−77.63 (83.87)
Observations	210
Number of banks	35

Note(s): FSI = Financial Strength Index, tk = taka, Robust standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 5.
Determinants of
Bank's financial
strength of Bangladesh
through random
effect model

variables are bank size, loan recovery, gross loan to total asset, leverage, salary and allowances and interest income to total asset, banking sector development and time-invariant variables conventional bank, Islamic bank, Islamic window bank, public bank and private bank group. Among the three bank groups, conventional, Islamic and Islamic window banks, the conventional bank has been considered as the base category. Among public and private banks, the public banks have been considered as the base category. The regression model is estimated with a robust option so that if the heteroscedasticity presents, it becomes corrected automatically.

Bank size has a positive impact on the bank's FSI. With the increase of bank size, the FSI of banks in Bangladesh increases. Bank size is indicated with the log of bank's total assets. With the 1% increase of bank's assets, the FSI increases by 7.025%. The result is consistent with other's study results like Ali and Puah (2019) and Çekrezi *et al.* (2015). It is considered that large-sized banks have an additional advantage of access to external financing and those banks may enjoy lower costs due to economics of scale which ultimately helps in increasing the FSI of banks. The result is significant at 5% level. Therefore, there is a chance of the banks in Bangladesh to become financially stronger by increasing the number of big-sized banks rather than establishing small-sized banks.

With the increase of the number of loans recovered, the FSI of banks increases and this result is significant at 5%. Loan recovery represents how much loan has been recovered from the given total loan by subtracting the loan loss amount. With the increase of the amount recovered, the loan loss amount will be decreased. Therefore, banks need to keep a lower amount of provision from their profit which will ultimately help to increase FSI (Jaffar and Manarvi, 2011).

The FSI of banks in Bangladesh and gross loan to total asset has a negative relationship which is consistent with the study of Kashif *et al.* (2016) and Staikouras and Wood (2004). It indicates that banks of Bangladesh have to bear the higher cost to provide a larger amount of loan which causes the decrease of financial strength. Providing a larger amount of loan without proper supervision increases the intensity of converting loan amounts in non-performing loans. Therefore, a higher amount of given loan may negatively affect the FSI with higher credit risk. Strong supervision is needed at the time of loan disbursement to reduce loan default. Salary and allowances positively affect the FSI at 10% significant level which is similar to the study result of Berhani and Sejdini (2016) explained in the literature review. With 1 billion taka increase in salary and allowances given to employees contributes to increasing the financial strength of banks in Bangladesh by 0.31 billion taka. The increase of salary and allowances given to employees inspire the employees to do more hard work for increasing the financial strength of banks. Banking sector development leads to an increase in the bank's FSI increase with 1% significant level and it fulfils our expectation (Nisar *et al.*, 2015). However, the result of leverage and interest income to total assets is not significant.

Among the conventional vs. Islamic vs. Islamic window banks, the Islamic bank's FSI is 7.53% higher than the conventional bank and this result is significant at 10% level. Whereas among Islamic window and conventional banks, there has been found insignificant relationship. However, Islamic window bank's FSI is 0.0165% higher than the conventional bank's FSI. It can be concluded that among functional categories, the Islamic bank has higher financial strength than the conventional and Islamic window banks. Among the ownership category, the private banks have 9.153% higher financial strength than the public banks which is consistent with Lee and Kim (2013).

6. Conclusions
This study focuses on the financial strength of the banking sector of Bangladesh. Under the CAMEL framework, managerial efficiency, capital strength, earning ability, asset quality and

liquidity aggregated have been used to examine banks' financial strength. From this study, it has been explored that Islamic bank is financially stronger than the conventional and Islamic window banks with higher liquidity and also in a financially strong position in the CAMEL components. According to the ownership category, private banks are financially stronger than public banks with higher capital strength, asset quality, managerial efficiency and earning ability. This indicates that private banks give more attention to improving techniques for cost minimization with a greater amount of earnings. IFIC Bank is financially stronger and the Eastern Bank has the lowest financial strength than the other banks of Bangladesh. The regression result also confirms that Islamic banks' financial strength is higher than the conventional and Islamic window banks and it is significant. The result also shows that the private banks are financially stronger than the public banks with higher asset quality, capital strength, earning ability and managerial efficiency. The determinants like, bank size, loan recovery, loan to total asset ratio, salary and allowances, banking sector development, ownership category and Islamic bank significantly affect the financial strength of banks. Among these detements, bank size, loan recovery, salary and allowances positively affect banks' FSI whereas loan to total asset ratio affects negatively. Therefore, banks should not provide a larger amount of loans without consideration and they should provide the loan or invest more carefully to avoid credit risk. As Islamic banks are performing better day by day, government and banks should allow a larger amount of Islamic banks to enter into and make the rules and regulations easier to covert from conventional banks to Islamic banks to improve their financial strength. In addition, banks should focus on the performance of banks in all CAMEL components so that they can improve their overall strength. Government should also reduce their support to public banks so that these banks can compete in the financial market like private banks and they become encouraged to improve their financial strength. Banks can calculate the composite financial strength annually with the method used in this study rather than using the only financial ratios to get more accurate results so that they can explore in which sector they need to focus more to improve their overall performance.

This study has its limitations despite its importance. CAMELS is a more improved form than using CAMEL. But because of the data deficiency on "S" which represents sensitivity, it would not be possible to use the CAMELS framework. The further researcher could incorporate this.

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Appendix 1

Variables name	Variables description	Measured by	Units of measurement
Bank-specific variables			
Bank size	Bank size shows the size of banks in terms of total assets. With the increase of size, the banks may enjoy economics of scale and may provide a variety of services	= ln(Total Asset)	Percentage
Loan recovery	It means how much money has been recovered from the given loan by bank	= Gross loan-loan loss provision	Billion taka
Loan to asset ratio	How much loan is given in terms of total asset	= Total loan/Total asset	Ratio
Leverage	It is an investment technique of using the borrowed capital for future return	= Total liabilities/Equity	Ratio
Salary and allowances	It is the total amount of salary and allowances provided by the banks	= Summation of all salary and allowances given	Billion taka
Interest income/ Total asset	It is the ratio of the interest income from the given loans to total asset	= Interest income of a bank/Total asset of a bank	Ratio
Banking sector development	It represents how much the bank's asset changes with the change of the country's GDP. The increase of banks' assets with GDP will cause the development of the banking sector	= log(Total Asset)/GDP growth	Ratio
Bank ownership category	Public banks are owned and operated by the government and another is private banks that are privately owned but they are scheduled banks	0 = Public bank (base category) 1 = Private bank	Binary
Bank functional category	Among this category, there are commercial banks that deal with interest, Islamic banks that are interest-free and the last one is Islamic window banks which have both the facility of interest-based and interest-free services	1 = Conventional bank (base category) 2 = Islamic bank 3 = Islamic window bank	Categorical

Table A1.
Variables used as determinants of financial strength of banks

Appendix 2

Bank name	Web link
AB Bank Limited	http://www.abbl.com
Agrani Bank Limited	http://www.agranibank.org
Al-Arafah Islami Bank Limited	http://www.al-arafahbank.com/
Bangladesh Commerce Bank Limited	http://bcblbd.com/
Bangladesh Krishi Bank	http://www.krishibank.org.bd
Bank Asia Limited	http://www.bankasia-bd.com
BASIC Bank Limited	http://www.basicbanklimited.com
BRAC Bank Limited	http://www.bracbank.com
Dhaka Bank Limited	http://dhakabankltd.com
Dutch-Bangla Bank Limited	http://www.dutchbanglabank.com
Eastern Bank Limited	http://www.ebl.com.bd
EXIM Bank	http://www.eximbankbd.com
First Security Islami Bank Limited	http://www.fsiblbd.com
ICB Islamic Bank Limited	http://www.icbislamic-bd.com/
IFIC Bank Limited	http://www.ificbank.com.bd/
Islami Bank Bangladesh Limited	http://www.islamibankbd.com
Jamuna Bank Limited	http://www.jamunabankbd.com
Janata Bank Limited	http://www.janatabank-bd.com
Mercantile Bank Limited	http://www.mblbd.com
Mutual Trust Bank Limited	http://www.mutualtrustbank.com
National Bank Limited	http://www.nblbd.com
National Credit and Commerce Bank Limited	http://www.nccbank.com.bd
One Bank Limited	http://www.onebankbd.com
Premier Bank Limited	http://www.premierbankltd.com
Prime Bank Limited	https://www.primebank.com.bd/
Pubali Bank Limited	http://www.pubalibangla.com
Rupali Bank Limited	https://rupalibank.org/en/
Shahjalal Islami Bank Limited	http://www.sjiblbd.com/
Social Islami Bank Limited	http://www.siblbd.com
Sonali Bank Limited	http://www.sonalibank.com.bd
Southeast Bank Limited	https://www.southeastbank.com.bd
The City Bank Limited	http://www.thecitybank.com
Trust Bank Limited	http://www.trustbank.com.bd
United Commercial Bank	http://www.ucb.com.bd/
Uttara Bank Limited	http://www.uttarabank-bd.com

Table A2.
Data source

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