



Identify the Factors Which Affect to Risk Management Efficiency of the Banks: Evidence from Licensed Commercial Banks in Sri Lanka

Balasooriya Mudiyansele Wasanthi Shyamika Balasooriya

Department of Economics, University of Colombo, Colombo, Sri Lanka

Email address:

bmwsb25@gmail.com, shyamika@cbsl.lk

To cite this article:

Balasooriya Mudiyansele Wasanthi Shyamika Balasooriya. Identify the Factors Which Affect to Risk Management Efficiency of the Banks: Evidence from Licensed Commercial Banks in Sri Lanka. *International Journal of Economic Behavior and Organization*.

Vol. 11, No. 2, 2023, pp. 35-48. doi: 10.11648/j.ijebo.20231102.12

Received: March 30, 2023; **Accepted:** May 4, 2023; **Published:** May 18, 2023

Abstract: Key financial indicator in banking system is capital adequacy ratio is considered. This ratio was approved by the Basel Committee on Banking Supervision. The main objective of this study was examining and identifying the factors affecting to risk management efficiency in domestic licensed commercial banks in Sri Lanka. As well as to find out what is the relationship between capital adequacy ratio and each risk factors. To achieve my research objectives, various type of analytical methods uses to analysis the data: Descriptive Analysis, Unit Root Test, Correlation and Coefficient Regression Analysis, The Hausman's test and Hypothesis Testing. The sample of this study is 12 licensed commercial banks in Sri Lanka. There are 13 domestic licensed commercial banks and one bank has removed due to deviations of the data. A nature of this study is quantitative and annual data got period from 2013 to 2018. The Capital adequacy ratio use as the dependent variable and Credit risk, market risk, liquidity risk, profitability, operational efficiency, and bank size were used as independent variables. The results of the study revealed that credit risk, liquidity risk, profitability and operational efficiency has a significant impact on capital adequacy ratio and credit risk, liquidity risk and profitability share a positive significant relationship with the capital adequacy ratio. Further, operational efficiency has a negative significant relationship with the capital adequacy ratio and market risk and bank size did not show an impact on the on the risk management efficiency. The study concluded that the independents variables have a high impact on the dependent variable and explanatory power of the model is approximately 66%.

Keywords: Capital Adequacy Ratio, Operational Efficiency, Risk Management Efficiency, Domestic Licensed Commercial Banks

1. Introduction

The banking system in Sri Lanka comprises the Central Bank, Licensed Commercial Banks (LCB) and Licensed Specialized banks (LSB). Banking sector plays dynamic and vital role to active the financial obligations in the financial system. As well banking sector has held the highest share of the total assets in the financial system. The LCB are the most important category in the financial system, which dominate highest market share of the entire financial system's assets. Because of that reason, the persistence of Sri Lankan financial system is based on the Licensed Commercial Banks. There are 26 Licensed Commercial banks in Sri Lanka, including 13 domestic commercial banks and 13 Foreign commercial banks.

The banking sector gives enormous liquidity support to the financial system stability. Risk is the degree of uncertainty or potential financial loss inherent in an investment decision. There are various kinds of risks affecting to the banking sector, Mainly, Credit risk, Market risk, Operation risk, Liquidity risk. The objective of this study is to identify the factors which are affecting to risk management efficiency in the banks and identify the is the relationship between bank specific risk factors with risk management efficiency in domestic licensed commercial banks in Sri Lanka.

All Financial institutions and banks faced various type of risks like credit risk, market risk, operational risk, liquidity risk, reputational risk, legal risk and systematic risk. These risk factors are affected to the efficiency of the financial

sector not only banks but also all other financial institutions. The risk management is the best way to maintain the strength and efficiency of the banking system. The risk management process can be help to

- 1) Identifying and assessing the potential risks.
- 2) Developing and executing an action plan to deal with and manage these activities.
- 3) Continuously reviewing and reporting risk management practices after they have put into operation.

The capital adequacy is the most important factor as well as it is the key financial indicator in the banks. The capital adequacy ratio (CAR) is measured the bank's capital to its risk weighted assets. This ratio helps to maintain financial efficiency and financial confidence in the financial system. Moreover, the capital adequacy ratio illustrates the soundness and stability of the bank.

1.1. Basel Committee

The Basel Committee on Banking Supervision originated in the financial market turmoil, which followed the breakdown of the Bretton Woods system of managed exchange rates in 1973. Due to this reason, many banks faced various type of losses. However, banks response to overcome the above-mentioned losses and other disruption in the international financial markets. So that, the central bank governors of the G10 countries established a Committee on Banking Regulation and Supervisory Practices at the end of 1974. It originally named as the Committee on Banking Regulation and supervisory practice. Now it is renamed as the Basel Committee on Banking Supervision (BCBS). The objective of the committee is identifying key supervisory issues and improving quality of banking system. The capital adequacy approved by the Basel Committee. Earlier it was maintained under Basel II regulation. Now capital adequacy is maintaining under Basel III regulations.

1.2. Basel I – The Basel Capital Accord

Basel-I is the foundation of Basel Committee. Capital adequacy becomes the focus of the Committee's activities. The 1988 Accord called for a minimum capital to risk weighted assets 8% to be implemented by the end of 1992. Here main aspects of the Market Risk Amendment were used as the first time and that can use internal models (Value at risk models). This measured the market risk capital requirements. As well as the credit risk also considered in Basel -I framework.

1.3. Basel II – The New Capital Framework

Basel II revised framework in June 2004. It comprises three pillars.

- 1) Minimum capital requirements.
- 2) Supervisory review process.
- 3) Enhanced disclosure (Discipline of market)

1.4. Minimum Capital Requirement

Minimum capital requirement maintains as the percentage

of risk weighted assets (RWA). Risk weighted assets are calculated based on the following approach.

- 1) The standardized approach for credit risk.
- 2) The standardized measurement method for market risk.
- 3) The basic indicator approach for operational risk.

1.5. Supervisory Review Process

This is assessed the bank's capital adequacy and determining whether bank is maintaining additional capital to cover its risks.

1.6. Market Discipline

Market discipline pillar aims to provide consistent and comprehensive disclosure framework and it enhance the comparability between banks.

1.7. Basel III - Responding to Financial Crisis

Capital requirement is based on Basel III regulation. According to the Central Bank Direction 01 in 2016 on capital requirement under Basel III for the licensed commercial banks and licensed specialized banks, Basel III introduced new capital buffers and all banks must preserved it. Furthermore, three pillars which emphasized in the Basel II category is continued applied in Basal III regulation.

2. Research Problem

Several studies have been conducted in the area of risk management fields in the banks. Some empirical studies highly relating with my research problem. The study on Bank specific determinants of risk management efficiency: Evidence from Listed Commercial Banks in Sri Lanka [19]. The study has used the annual data period from 2008 to 2014. Results disclosed that independent variables such as Credit risk, Liquidity risk, Profitability, Market risk, Operational risk and Size of the bank are highly impact on Capital adequacy ratio. Further, there is a negative significant relationship between credit risk and capital adequacy ratio. The liquidity risk, the profitability, the operational efficiency, and the bank size have a positive significant relationship with risk management efficiency, but market risk hasn't any impact on the capital adequacy ratio. This study highly encourages me to identify the

- 1) What are the factors affecting to risk management efficiency of domestic licensed commercial banks in Sri Lanka?
- 2) What is the relationship between bank specific risk factors and risk management efficiency of domestic licensed commercial banks in Sri Lanka?

using updated annual data from the period of 2013 to 2018 getting from Licensed commercial banks in Sri Lanka.

3. Research Objectives

There are several risk factors that affect the risk management efficiency of the banks. It is useful to examine

empirically, to identify actual relationship among these variables and facilitate the necessary policy measures to overcome it. Accordingly, this study aims to achieve the following objectives:

- 1) To identify banks specific risk factors how to affect risk management efficiency of domestic licensed commercial banks in Sri Lanka.
- 2) To identify the relationship between bank specific risk factors and the capital adequacy ratio.

4. Literature Review

Numerous empirical studies have done not only Sri Lanka but also all over the countries on relationship between risk management efficiency and bank specific risk factors. In here, existing literature on the subject area to gain an understanding on the current condition which relating to the topic and begins with the theoretical explanations.

4.1. Theoretical Review

Basel Committee on Bank Supervision is approved the capital adequacy ratio. Now it is continuing under Basel III regulation. Basel I, II and III categories are mention in introduction chapter. BCBS, 2010 shows Basel III proposal reviews national regulators for organization and supervisory organization to evaluate its suitability and control financial system. According to the BCBS, 2010 the existence of credit bubble, constant innovation in financial products and techniques and further it is also cause for financial crisis. Further, one of the main reasons for financial crisis is inadequate bank regulations.

Basel III is the third part of the Basel Accord. The BCBS was introduced a global regulatory standard on capital adequacy market liquidity risk and stress testing focusing on the financial stability. The Basel III, framework provides a foundation for banking system and it helps to maintain financial stability.

The capital buffer theory reveled that banks would maintain a level of capital the required minimum is relating to violation of regulations. The banking approach regulatory minimum capital may increase capital and reduce risk. Accordingly, in Netherlands, current banks capital ratio has an average of a little more than 12%. But this percentage is lying above the minimum capital requirement is 8%. Then these banks hold a capital buffer above of the minimum capital requirement. According to them there are several reasons behind excess capital buffer in banks. First one is buffer as insurance. "Buffer can be used as insurance against cost of unexpected loan losses". "Second one is buffer capital is connected with the bank's assets risk profile in excess of buffer capital in

minimum capital requirement". "Last one is buffer capital helps to maintain financial health in the banking sector". Because of that reason buffer capital is consider as the mechanism of securing banks from failure [16].

According to study Moral Hazard theory also relating to the capital requirement. "The regulations of bank's capital are one of the important instruments in modern banking regulation". This theory helps to maintain good financial health from failure in the economy. This theory explains theoretical explanation between the capital and the risk. As well as it existed the emergence of agency problem [11].

4.1.1. Calculating Capital Adequacy Ratio

According to the Banking Act Directions No 01 of 2016, capital requirements under Basel III for licensed commercial banks and licensed specialized banks in Sri Lanka. Under Schedule-1 Pillar, showed minimum capital requirements and buffers under Basel III was issued by the monetary board of the Central Bank of Sri Lanka. Capital ratios of licensed banks based on above mentioned document commencing on 01st July 2017.

$$\text{Capital adequacy ratio} = \frac{\text{Regulatory Capital (Tier I + Tier II)}}{\text{Total Risk Weighted Assets}}$$

The Supranational institutions, academics and market analysts have increasingly questioned the reliability of bank risk weighted assets (RWAs)". The minimum capital ratios designed by the Basel Committee on Banking Supervision. This research used 50 large European banks over the period from 2008 to 2012. They showed following results in briefly. First point is "the risk weighted assets are affected by the bank's size, the business model and the asset mix". Second one is the adoption of internal ratings based (IRB) approaches is a powerful driver of bank's risk weighted assets". The third results are the lower risk weights are positively linked to the bank's capital cushions. Fourth one is IRB adoption is more widespread in countries. Last one is "regulatory risk weights are not disconnected from market-based measures of the bank risk" [6].

4.1.2. Minimum Capital Requirement

Basel III accord was issued in December 2010 and revised in June 2011. It had come into force and effect in Sri Lanka on July 1, 2017 based on the Central bank direction 01 of 2016 on the capital requirement under the Basel III for licensed commercial banks in Sri Lanka.

From 01st July 2017, every LCB and LSB must comply with three tiers of the capital ratios and banks has to comply these requirements and it can be described as follows.

Table 1. Capital requirement ratios.

	01.07.2017	01.01.2018	01.01.2019
Common Equity Tier 1 Capital Ratio (CET I)	6.25%	7.375%	8.5%
Total Tier 1 Capital Ratio (CET I + AT I)	7.75%	8.875%	10.0%
Total Capital Ratio	11.75%	12.875%	14.0%

Source – Central Bank Sri Lanka

The credit theory of money reviewed that a sale and purchase is the exchange of a commodity for credit. There sub theories also including it. The importance of credit risk for monetary policy as well as after 2008 global financial crisis [18]. The credit creation theory also affects to the credit risk. Credit creation theory means one of the most important function of commercial banks. Banks take deposits from the customers and provides loan to customers. After keeping necessary reserves, the bank provides loans to customers [5].

The study focused the impact of credit risk management on the performance of deposit money banks in Nigeria. They selected five banks for this research. Further, banks were selected based on highest asset. Data was gathered from 2000 to 2014 annual reports data. Further Return on Assets (ROA) and Return on Equity (ROE) are used as bank performance indicators. The results revealed that credit risk management had a positive significant impact on total loans and advances, the ROA and ROE of the deposit money banks [17].

The portfolio theory is relating to the market risk. This approach reviews to maximize the returns for any level of given risk. It is also known as the modern investment theory and modern portfolio theory.

Liquidity Premium theory is relating to the liquidity risk. Liquidity premium theory is a key concept in bond investing. This theory is one of the methods seeks to explain the shape of yield curve. Furthermore, it is usually used to measure and to determine the market rate of securities.

The existence of a liquidity premium in the Brazilian market and investigated whether it's priced and explains part of the variation in asset return. Mainly profitability has five theories. First one is the frictional theory of profits. Here normal rate of profit is return on capital. It is paid to the customer. Second theory is the monopoly theory of profits. Monopoly power limit output and charge higher price than under perfect competition. Another theory is the innovation theory of profits. Economic profits arise because of successful innovation introduced by the entrepreneurs. Fourth one is risk and uncertainty bearing theory of profits. Profits arise because of uncertainty. Last one is managerial efficiency theory of profits. This theory explains some firms are more efficient than other firms [13].

Theory of economic efficiency is relating to the operational efficiency it gives light to our present study on bank efficiency. In addition, this theory is the requirement which, banks must describe banking services at the lowest possible cost. The bank size is based on the assets of the bank. They consider a theory of optimal bank size determination which has implication for the size distribution of banks [12].

4.2. Empirical Literature Review

The capital adequacy ratio is main issue in banking sector. It gives huge impact to the financial sector. The capital adequacy described as an indicator of bank's risk factors which is comprising various kind of risk. These are credit risk, market risk, exchange rate risk likewise [2].

The study examined the relationship between capital

adequacy and banking risks. The Risk weighted asset ratio, the deposit ratio and the inflation rate were used as independent variables. The sample of the study is twelve banks over the period from 2007 to 2011. "The value at risk theory was adopted to estimate capital adequacy ratio of banks". The results revealed "there is a significant negative relationship between risk and capital adequacy ratio of banks [18].

The study focuses to identify the relations between firm's financial structures and their risk investment strategy in Taiwan banking industry. The capital adequacy is affecting to risky investment strategy as market share and leverage have positive relation. The firm performance has positive relation with firm size, Leverage and financial cost. Further, the regression results revealed that banking firms have positive relationship with the states of business cycle [9].

The study focuses to investigate determinants of Turkish bank's capital adequacy ratio and its impact on financial position. Selected 24 banks were used as sample. There are nine independent variables in this study. These are bank size (SIZE), deposit (DEP), loans (LOA), loan loss reserve (LLR), Liquidity (LIQ), Return on assets (ROA), Return on equity (ROE), Net interest margin (NIM), Leverage (LEV). Dependent variable is capital adequacy ratio. The model is multivariate panel regression model. The results show that Bank size, Net interest margin and deposit, haven't any significant impact on capital adequacy and LOA, ROE, LEV have a negative effect on CAR. Finally, they state that LLR and ROA have a positive effect on CAR [7].

The study focuses to investigate the determinants of the capital adequacy ratio in Islamic banking industry. Multiple linear regression analysis used for the research. Independents variables are profitability (ROA), assets earning quality (NPF), deposit structure (DEP), liquidity (FDR) and operational efficiency (OEIOI). The study showed the profitability and the liquidity are positively related to the capital adequacy ratio and Non-performing financing is significant but negatively related to the capital adequacy ratio. Further, depositor's funds and operational efficiency have no significant effect on capital adequacy ratio [1].

The study investigated the most important factors that determine the capital adequacy in commercial banks of Jordan in Amman Stock exchange over the period from 2000 to 2008. They used Multiple Linear Regression Analysis as analytical tools and the correlation Coefficient. The results show that there was existed a statistically significant relationship between the liquidity risk, interest rate risk, return on equity, return on assets and the capital adequacy. Further, liquidity risk and return on asset positively related to capital adequacy. Return on equity and interest rate is negatively correlated to capital adequacy [3].

The study investigates that influencing factors to the capital adequacy of Iranian Private Banks, over the period of 2006 to 2012. Seven explanatory variables were used for this research. The results revealed that there is a negative relationship between bank size and capital adequacy. Further, the positive relationship between Loan asset ratio (LAR),

Return on equity (ROE), Return on assets (ROA), Equity ratio (EQR) and capital adequacy ratio". Risk asset ratio (RAR), Deposit asset ratio (DAR) haven't any impact on capital adequacy ratio [4].

This study investigates determinants of capital adequacy of Ethiopia commercial banks. Eight banks were used and data over the period 2004-2013. They used panel data regression to identify the relationship between bank specific variable and the capital adequacy. The finding of this study is "Return on asset ratio (ROA), Deposit ratio (DEP) and Bank size (SIZE) have positive effect to capital adequacy. Return on equity (ROE) and Net interest margin (NIM) have a negative effect to capital adequacy". Further, Liquidity (LIQ), Loan to asset ratio (LNTA) and Leverage (LEV) haven't a significant effect on capital adequacy [14].

The main objective of this study is identifying the significant bank specific determinants of risk management efficiency of the listed commercial banks in Sri Lanka over the period of 2008 to 2014. Panel regression analysis used as analytical tool. Dependent variable is the capital adequacy ratio (CAR) and independent variables are the credit risk, Market risk, liquidity risk, Return on assets (ROA), bank size and operational efficiency. These are important factors determine the capital adequacy ratio of listed commercial banks in Sri Lanka. Further, "independent variables have huge impact on dependent variable. The results of this study show there is a negative significant relationship between credit risk and capital adequacy ratio. The liquidity risk, profitability, operational efficiency, and bank size have a positive significant relationship with risk management efficiency. Finally, the market risk hasn't impact on the capital adequacy ratio [20].

The purpose of this study is the credit risk management and capital adequacy how to effect on financial performance of bank business. They used data from 2009 to 2014. The sample volume is 25 private banks based on available information. The dependent variable is return on assets (ROA) and independent variables are loan amount, past due credit, loss reserve on loan, liquidity ratio and capital adequacy ratio. They use regression model to run the data.

$$ROA_{i,t} = \beta_1 + \beta_2 NLP_{i,t} + \beta_3 LLP_{i,t} + \beta_4 LA_{i,t} + \beta_5 LR_{i,t} + \beta_6 CAR_{i,t} + e_{i,t}$$

Where

i= individual banking institute

t= time period

ROA_{i,t} = Return on Asset (dependent variable)

β₁ = Intercept

β₂ β₃ β₄ β₅ β₆ = Slope coefficient of variables

NLP_{i,t}, LLP_{i,t}, LA_{i,t}, LR_{i,t}, CAR_{i,t} = All independent variable

e_{i,t} = Random error term.

The results show that multivariate linear regression at 95% confidence level. It shows there is a negative relationship between loss reserve on loans, previous maturity of credits and bank's performance. Further, there is a positive relationship between liquidity ratio, capital adequacy ratio with bank's performance [8].

The study examines the credit risk and capital adequacy of

the 567 rural banks in the Philippines to investigate how both variables effect on bank profitability. Credit risk and capital adequacy ratio are the Independent variables. Dependent variable is profitability. It is measured by return on asset and return on equity. The outcome of this study is capital adequacy gives ambiguous effect on profitability [15].

5. Data and Methodology

Ensuing the review of the literature, this section shows overview of the data, methodology and employed models. Further, this section describes the factors which are affecting to risk management efficiency of domestic licensed commercial banks in Sri Lanka. The deductive approach was used in this research. The dependent variable is the capital adequacy ratio and independent variables are the credit risk, the market risk, the liquidity risk, the profitability, the operational efficiency, and the bank size. This study investigates the factors affecting to risk management efficiency of domestic licensed commercial banks in Sri Lanka and identify the relationship between bank specific risk factors and the capital adequacy ratio. Selected 12 banks were used as sample. One domestic licensed commercial bank data removed due to deviation of data. Further, foreign commercial banks are removed from sample due to unavailability of data. Annual data collected over the period 2013 to 2018.

Further, the credit risk was measured by non-performing loan ratio. Natural logarithm of risk weighted assets for market risk was used to measure the market risk variable. The Liquidity ratio was used to measure the liquidity risk. Profitability was measured by Return on Assets and operational efficiency was measured by operating income divided by operating expenses. Finally, Natural logarithmic of total assets was used to measure the total assets.

5.1. Description on Dependent and Independent Variables

5.1.1. Capital Adequacy Ratio

The capital adequacy ratio is one of the most significant factors which helps to maintain financial stability and efficiency in banking sector. The Basel III is an international standard for the calculation of capital adequacy ratio. The Capital adequacy is a measure of the bank's capital in relation to its risk-weighted detection, which includes loans and advances, deposits, investment in securities like wise. Furthermore, the capital adequacy ratio is a measurement used to determine whether the bank has sufficient capital to withstand unexpected losses arising from various risks that course of business. Those are credit risk, market risk, operation risk like wise. The capital adequacy ratio of the licensed commercial banks in Sri Lanka is computed based on Banking Act Direction No 1 of 2016 issued by Central Bank of Sri Lanka.

5.1.2. Credit Risk

Lending is the most important activity which conducted by banks. The credit risk is arising from lending. According to BCBS, Finalizing Basel III in brief, 2017, credit risk is the risk of loss due to a borrower's being unable to repay a debt

in full or in part. The credit risk is the risk of financial losses to the bank if borrower or counterparty to financial instruments fails to meet its contractual obligations.

According to present study credit risk is measured by non-performing loan ratio. It is calculated by non-performing loan amount divided by total loan amount.

5.1.3. Market Risk

Market risk is arising from adverse fluctuation from market variables. Banks are usually engaged in market activities. Market risk is relating to price changes in financial market. As well as investment is also relating to this risk because interest rate is changed due to market factors. And it is determined based on demand and supply condition. Interest rate changes also relating to the market risk. Market risk is the potential loss of earnings that could arise from the possible fall in value of a portfolio. According to the present research market risk is measured by interest sensitivity ratio. Natural logarithm risk weighted assets for market risk uses to calculate market risk.

5.1.4. Liquidity Risk

Liquidity risk is the potential risk arising from the inability to meet the bank's obligation in a timely manner. Banks are focused on the problems of having insufficient assets set off the cash needs or withdrawal from depositors and loan demands. Facing with liquidity problems, the banks need to borrow funds immediately with extra cost to meet their cash needs. Maintaining the liquidity positions of the banks is one of the main tasks and it is measured by liquidity ratio.

5.1.5. Profitability

Profitability helps to maintain financial stability. Return on Assets (ROA) is proxy of profitability. This is the basis of intra – industry performance of comparison. It is considered as efficiency ratio. Profit before tax expressed as a percentage of average total assets. According my thesis return on assets is one of independent variable in the model. It is calculated net income divided by total assets.

5.1.6. Operational Efficiency

Operational efficiency is considered as management quality of the organization. The operational efficiency simply means controlling operational risk. This means the risk arising from system failure, internal process failure, and external events. Such as natural disasters, political events. Operational risk includes legal risk but excluded reputational risk. If organization can't manage operational risk effectively, then organization should face financial losses as well as damage reputation of the banks. The banks also committed to maintain quality of operation risk management. According to present thesis operational efficiency is measured as operating income divided by operating expenses.

5.1.7. Size of the Bank

Size of the bank is considered as independent variable of present research. The natural logarithm of total assets uses as

proxy of bank's size. The relationship between bank size and capital adequacy it may be positive or negative.

The Credit risk was measured by non-performing loan ratio. Natural logarithm of risk weighted assets for market risk was used to measure the market risk variable. The Liquidity ratio was used to measure the liquidity risk. Profitability was measured by Return on Assets and operational efficiency was measured by operating income divided by operating expenses. Finally, Natural logarithmic of total assets was used to measure the total assets.

5.2. Model Specification

Various type of analysis methods and models was used. Panel data and E views software package were used for achieving the research objective. Further unit root test, multiple regression analysis, fixed effect model test, random effect model test, the Hausman's test, correlation matrix and Durbin Watson test were used for analyzing the data to achieve the research objectives.

Dependent variable is capital adequacy ratio and independent variables are the credit risk, the market risk, the liquidity risk, the profitability, the operational efficiency, and the bank size. for the purpose data got from Central Bank publications

That model can be described econometrically as following.

$$CAR_{it} = \beta_0 + \beta_1 CR_{it} + \beta_2 ISR_{it} + \beta_3 LR_{it} + \beta_4 ROA_{it} + \beta_5 OE_{it} + \beta_6 BS_{it} + \pi_{it}$$

CAR_{it} = Capital Adequacy Ratio (dependent variable)

i = individual banking institute

t = time period

β_0 = Intercept

$\beta_1 \beta_2 \beta_3 \beta_4 \beta_5 \beta_6$ = Slope coefficient of variables

$NLP_{it}, LLP_{it}, LA_{it}, LR_{it}, CAR_{it}$ = All independent variable

π_{it} = Random error term.

6. Analysis and Findings

Analysis based on descriptive statistic. This section presents analysis and findings derived from applying different methods and models from the selected period annual data. Analysis try to identify the factors affecting to the capital adequacy ratio and find the relationship between bank specific risk factors and capital adequacy ratio. To achieving the research objective Panel data and E views software package were used. Further unit root test, multiple regression analysis, fixed effect model test, random effect model test, the Hausman's test, correlation matrix and Durbin Watson test results use for analysis to evaluate the analysis results.

6.1. Descriptive Statistic

As per the methodology, the research study consisted with a sample selection of 12 banks with six years' annual data from 2013 to 2018.

Table 2. Summary of descriptive statistics.

	CAR	CR	ISR	LR	ROA	OE	BS
Mean	0.155215	0.036469	21.8863	0.254853	0.011364	2.067562	26.45462
Median	0.14705	0.03065	22.06557	0.2367	0.01136	2.070922	26.56713
Maximum	0.409	0.1244	25.89842	0.7746	0.03837	3.481557	28.44999
Minimum	0.1083	0.0089	17.61019	0.2087	-0.0023	0.765003	21.64974
Std. Dev.	0.040464	0.020277	1.407766	0.075475	0.006022	0.507189	1.270866
Skewness	3.707348	1.789815	-0.634459	5.186049	1.293025	0.219925	-0.878358
Kurtosis	22.80575	7.242237	4.37263	34.08629	8.561564	3.787794	4.289504
Jarque-Bera	1341.736	92.43097	10.48281	3221.813	112.8559	2.442263	14.24662
Probability	0.000000	0.000000	0.005293	0.000000	0.000000	0.294896	0.000806

Table 2 shows the summary of the statistic on the variables used in the study. The data ranged from the year 2013 to the year 2018. The descriptive statistics is summarized the data to take the useful information and represent the entire population or sample of the population. The Mean, median and mode were used to measure the central tendency and the standard deviation whereas the minimum and maximum variables were used to measure the variability. Further, Kurtosis and Skewness were used to identify behavior of the entire research study.

The mean value of the Capital adequacy ratio is 0.155215 while the maximum and minimum values are 0.409 and 0.1083 respectively. When considering the Jarque Bera test indicated that the capital adequacy ratio probability is 0.000000 which emphasizes that it is not normally distributed as it is less than five percent level.

The credit risk was taken as first independent variable. The mean value is 0.036469 and the maximum and minimum values are 0.1244 and 0.0089 respectively. According to the Jarque Bera test, the probability of credit risk is 0.000000 which represents that it is also not normally distributed as it is less than 5%.

The mean value of the interest sensitivity ratio 21.8863. That was measured by the market risk. The maximum and minimum values of the variable are 25.89842 and 17.61019 respectively. Further, in the Jarque Bera test, the probability of market risk is 0.005293 which represents that variable is a normally distributing and is higher than 5%.

The mean value of the liquidity risk is recorded as 0.254853 while the maximum and minimum values are 0.7746 and 0.2087 respectively. According to the Jarque –

Bera test, the probability of liquidity risk is 0.000000 which indicates that is not normally distributed as it is less than the five percent level.

As shown in the table mean value of the return on assets ratio is 0.011364. That was measured by the profitability of the bank. The maximum and minimum values of the return on assets is 0.03837 and -0.0023 respectively. According to the Jarque – Bera test, the probability of return on assets is 0.000000 which emphasizes that was not a normal distribution as it is less than 5%.

The mean value of the operational efficiency is 2.067562 while the maximum and minimum values are recorded as 3.481557 and 0.765003 respectively. According to the Jarque Bera test, the probability of operational efficiency is 0.294896 which represents a normal distribution and it is higher than five percent level.

The mean value of the bank size is 26.45462. The maximum and minimum values of these variable are 28.44999 and 21.64974 respectively. According to the Jarque Bera test, the probability of the bank size is 0.000806 which emphasizes that is normally distributed as it is less than 5%.

Skewness is a term in statistics that is used to describe asymmetry from the normal distribution in statistical data. Skewness has a zero skewness in normal distribution, but data may not be perfectly symmetric. According to the result the capital adequacy ratio and the liquidity risk values have a high skewness. Because both values are more than one. At last, the high standard deviation is recorded in the variables of interest sensitivity ratio. On the other hand, the lowest standard deviation value is recorded in the variables of profitability which is measured by return on assets.

Table 3. Summary of unit root test.

Variable	Test Name	Statistical Values		Significance Value		Conclusion
		Level	1st Difference	Level	1st Difference	
CAR	Levin, Lin & Chu t*	-7.16819		0.0000		I(0)
	ADF - Fisher Chi-square	36.5398		0.0486		I(0)
CR	Levin, Lin & Chu t*	-9.14648		0.0000		I(0)
	ADF - Fisher Chi-square	48.9249		0.0019		I(0)
ISR	Levin, Lin & Chu t*	-25.2166		0.0000		I(0)
	ADF - Fisher Chi-square	44.4125		0.0068		I(0)
LR	Levin, Lin & Chu t*	-8.86054		0.0000		I(0)
	ADF - Fisher Chi-square	40.4943		0.0189		I(0)
ROA	Levin, Lin & Chu t*	-24.1021		0.0000		I(0)
	ADF - Fisher Chi-square	64.0775		0.0000		I(0)
OE	Levin, Lin & Chu t*	-3.73879		0.0000		I(0)
	ADF - Fisher Chi-square	39.9861		0.0215		I(0)

Variable	Test Name	Statistical Values		Significance Value		Conclusion
		Level	1st Difference	Level	1st Difference	
BS	Levin, Lin & Chu t*	-1.45841	-42.8744	0.0724	0.0000	I(I)
	ADF - Fisher Chi-square	16.9588	44.6253	0.8504	0.0064	I(I)

6.2. Unit Root Test

Before starting any regression analysis, variables had to be tested for knowing if data the set should be stationary or non-stationary. In the present study, the data set was tested with the unit root test. If any variable has a unit root, it says that each variable must be non-stationary. Therefore, each variable was tested using the unit root test before running the regression.

The unit root test hypothesis can be described as follows.

HO: Variable has a unit root. (Non-Stationary)

H1: Variable doesn't have a unit root. (Stationary)

If the probability value is lesser than 5%, it indicates that the null hypothesis will be rejected, and the alternative hypothesis will be accepted. Then each variable will be stationary and, in any case, if the variables failure to reject null hypothesis, it means that each variable has a unit root. That mean that is nonstationary.

That study is mainly using 5% significant level to identify the stationary of variable and if the probability is lesser than 5%, it defines the null hypothesis is rejected and alternative hypothesis is accepted.

According to the unit root test bank size is not stationary at level, because the P value is greater than 5% significant level. All other variables are named as capital adequacy ratio, credit risk, market risk, liquidity risk, profitability and operational efficiency which have 5% significant level in the level section. Hence the null hypothesis was rejected and accepted alternative hypothesis. That defines those variables doesn't have unit root. Then those are stationary at level section.

In the above case, the bank size doesn't have a 5% significant level in the level section. Then it goes for the 1st difference section. So that so 1st difference section bank size has a P value that is lower than 5% value. Therefore, the null hypothesis was rejected, and the alternative hypothesis

accepted. This determines that data set doesn't have a unit root. So, that the data set is stationary.

For running the regression model, firstly an appropriate model was selected for applying to this research study. From the fixed effect model, random effect model and pool regression model. For selecting the most appropriate model from effect model or pooled model firstly run the fixed redundant test.

6.3. Redundant Fixed Effect Test – Likelihood Ratio

That is the first test to identify what is the most accurate model for running the regression the summary of fixed redundant test can be described as follows.

Table 4. Summary of fixed redundant test.

Redundant Fixed Effects Tests			
Equation: EQ02			
Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.609447	(11,54)	0.0001
Cross-section Chi-square	47.67498	11	0.0000

According to the results, the sum of squares (F test) 4.609447 likelihood ratio (chi square test) 47.67498 and P value (Prob) 0.0001 in capital adequacy ratio that strongly reject null hypothesis. In other words, all the results indicate that the effects are statistically significant.

6.4. Random Effect Model

The random effect model can be called as the variance components model. In addition, it can be described as a special case of fixed effect model. If fixed effect model is not appropriate for the regression, then random effect model is used to the regression. Random effect model results can be described as follows.

Table 5. Summary of random effect test.

Dependent Variable: CAR				
Method: Panel EGLS (Cross-section random effects)				
Sample: 2013 2018				
Periods included: 6				
Cross-sections included: 12				
Total panel (balanced) observations: 72				
Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.257566	0.124796	2.063891	0.043
CR	0.489434	0.219143	2.233403	0.029
ISR	0.001293	0.003254	0.397445	0.6923
LR	0.155717	0.050377	3.091026	0.0029
ROA	1.857185	0.857666	2.165393	0.034
OE	-0.02333	0.012805	-1.821909	0.0731
BS	-0.006088	0.004904	-1.241388	0.2189
Weighted Statistics				
R-squared	0.287048			
Adjusted R-squared	0.221237			

According to this model the credit risk, the liquidity risk and the profitability share a positive and significant relationship between the capital adequacy ratio. Through the random effect model the study could identify that the market risk, the operational efficiency, and the bank size don't have significance relationship between the capital adequacy ratio of the domestic licensed commercial banks in Sri Lanka.

6.5. The Hausman's Test

Before running the regression model, the Hausman's test was used to determine the most accurate model from the fixed effect model and random effect model. Here the random effect model was estimated under the null hypothesis. Then the fixed effect model was used under the alternative hypothesis.

H0: Random effect model is appropriate.

H1: Fixed effect model is appropriate.

The Hausman's data results can be described as follows.

Table 6. Summary of Hausman's test.

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.91856	6	0.0096

This test usually used 5% confidence level to select either the fixed effect model or the random effect model was appropriate for running the panel regression model. The random effect model is appropriate if the probability value for Chi – Sq is greater than 0.05. In this case fixed effect model was appropriate for the running the panel regression model. Because the probability value is lessor than 0.05. As well as the fixed effect model is the ideal model in the empirical analysis.

Interest sensitivity ratio is the highest mean value and profitability had lowest mean value. After that, before running the regression the study checked whether the data set is stationary or not. The dependent variable and independent variables except bank size were stationary at level section and bank size was stationary at 1st difference section.

Since data set was stationary, the researcher selected what the most appropriate model for run the regression model from the pool regression model or fixed effect model or random effect model. Firstly, tested fixed redundant test. Through the results of this test, the researcher identified effect model was appropriate for run the regression model. Then the researcher done the Hausman's test to identify what the most appropriate model for this research as data analysis tool. The result of the Hausman's test revealed fixed effect model was the appropriate model for the present study. Although this study intended to collect data from a sample of 13 domestic licensed commercial banks in Sri Lanka, one bank was removed from the sample due to some deviations. Because of that reason the results of the study comprised only 12 domestic licensed commercial banks in Sri Lanka.

Further, ordinary least squared assumptions also tested in this research.

The results of the fixed effect model concluded the credit risk, the liquidity risk, the profitability share a positive significant relationship with capital adequacy ratio. The operational efficiency has a negative significant relationship with capital adequacy ratio. Whereas, the market risk and bank size did not show an impact on the capital adequacy ratio. Finally, the present study concluded explanatory power of the model is approximately 66%.

The study firstly applies the descriptive statistic to identify mean, median and mode. Secondly applies the unit root test to identify whether the data set stationary or not stationary. According to unit root results, all independent variables without bank size are stationary at level. As well as the bank size is stationary at 1st difference section. After the unit root test second step was to identify what the appropriate method is run the regression model. Accordingly, firstly run fixed redundant test to identify the best model is pooled model or effect model. According to the results it was able to identify the best method and it was the effect model.

Effect model described in to two categories. They are fixed effect model or random effect model. Then i was identified best method to analyzed panel data. Applying the Hausman's test the i was identified appropriate method for the regression analysis. The results of the Hausman's test, the fixed effect model is the best for the run the panel regression model. As well as for measured model efficiency I checked OLS assumptions. There is no multicollinearity between independent variables and residuals are not normally distributed. Finally, I concluded model estimation part. To run the regression model i used fixed effect model.

Capital Adequacy ratio is the key financial indicator and it is maintained under Central Bank banking act directions capital requirements under Basel III for LCB and LSB in Sri Lanka. Earlier capital adequacy is maintained under Basel II regulation and now it is maintained under Basel III regulation. Bank Specific risk factors affecting to the capital adequacy ratio.

7. Conclusion

All the objectives are successfully achieved by employing the above models and methods. The study concludes that the credit risk, the liquidity risk, and the profitability have positive significant relationship between the capital adequacy ratio of licensed commercial banks in Sri Lanka. The operational efficiency has a negative significant relationship with the capital adequacy ratio of licensed commercial banks in Sri Lanka. Market risk and bank size don't have a significant relationship with capital adequacy ratio of licensed commercial banks in Sri Lanka. The credit risk, results is same with some previous accordance but that providing mixed results, comparing with previous studies done by some researchers. liquidity risk has a positive significant relationship with capital adequacy ratio (CAR).

This results also same with previous global context studies. Further, this study shows that there is no multicollinearity with independent variables. The Durbin Watson value is near the 2. Finally, the researcher concludes following results.

In summery,

- 1) Credit risk, Liquidity risk and profitability have a positive significant relationship between capital adequacy ratio.
- 2) Operational efficiency has a negative significant relationship between the capital adequacy ratio.
- 3) Market risk and bank size don't have a significant relationship between the capital adequacy ratio.

Overall, the results of this studies identified what are the bank specific risk factors affecting to risk management efficiency in domestic LCB in Sri Lanka and identify the relationship is between them.

8. Limitation of the Study

- 1) The study concentrates on the bank specific risk factors over the period of 2013 to 2018.
- 2) The study relies on accuracy of secondary data.
- 3) This study is only considered domestic licensed commercial banks in Sri Lanka.

This research only selects domestic licensed commercial banks in Sri Lanka and not consider foreign domestic licensed commercial banks in Sri Lanka. There are 13 domestic licensed commercial banks in Sri Lanka. One bank data do not consider due to some deviations in the present study.

9. Suggestion for Future Studies

Identify the factors which are affected to risk management efficiency in domestic licensed commercial banks in Sri

Lanka is essential to carry further studies locally and globally. Dependent variable is capital adequacy ratio and independent variables are credit risk, market risk, liquidity risk, profitability, operational efficiency, and bank size.

Domestic licensed commercial banks details over the period from 2013 to 2018 was used to the present study. Then future researchers can increase data period, independent variables. Further can be better to obtained data from foreign licensed commercial banks.

10. Significance of the Study

This study is important to the licensed commercial banks in Sri Lanka. Because the thesis shows the impact and the bank specific risk factors on risk management efficiency in banks. In addition, its result might be helps to various parties, either individual or group investors to maintaining their investments. As well as it helps to achieve the highest return with the lowest risk for investors. Furthermore, it may be important to the relevant authority parities for decision making process. Finally, this study is a useful guide for future researchers to identify relationship between bank specific risk factors and capital adequacy ratio in domestic licensed commercial banks in Sri Lanka.

List of Abbreviations

CAR: Capital Adequacy Ratio

NPL: Non-Performing Loan

ISR: Interest Sensitivity Ratio

LR: Liquidity Ratio

ROA: Return on Assets

LCB: Licensed Commercial Banks

LSB: Licensed Specialized Banks

Appendix

Table 7. Panel least square test results.

Dependent Variable: CAR				
Method: Panel Least Squares				
Periods included: 6				
Cross-sections included: 12				
Total panel (balanced) observations: 72				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.351932	0.105428	3.338118	0.0014
CR	0.183369	0.213791	0.857701	0.3942
ISR	0.007043	0.003192	2.206179	0.0309
LR	0.168815	0.061665	2.737621	0.008
ROA	0.96173	0.957855	1.004046	0.3191
OE	-0.0122	0.013855	-0.880315	0.3819
BS	-0.0146	0.004379	-3.334466	0.0014
R-squared	0.348727	Mean dependent var		0.155215
Adjusted R-squared	0.288609	S.D. dependent var		0.040464
S.E. of regression	0.034129	Akaike info criterion		-3.82516
Sum squared resid	0.075712	Schwarz criterion		-3.60382
Log likelihood	144.7059	Hannan-Quinn criter.		-3.73705
F-statistic	5.800756	Durbin-Watson stat		1.471468
Prob (F-statistic)	0.00007			

Table 8. Fixed Redundant Test results.

Redundant Fixed Effects Tests				
Equation: EQ02				
Test cross-section fixed effects				
Effects Test		Statistic	d.f.	Prob.
Cross-section F		4.609447	(11,54)	0.0001
Cross-section Chi-square		47.67498	11	0.0000
Cross-section fixed effects test equation:				
Dependent Variable: CAR				
Method: Panel Least Squares				
Sample: 2013 2018				
Periods included: 6				
Cross-sections included: 12				
Total panel (balanced) observations: 72				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.351932	0.105428	3.338118	0.0014
CR	0.183369	0.213791	0.857701	0.3942
ISR	0.007043	0.003192	2.206179	0.0309
LR	0.168815	0.061665	2.737621	0.008
ROA	0.96173	0.957855	1.004046	0.3191
OE	-0.012197	0.013855	-0.880315	0.3819
BS	-0.014602	0.004379	-3.334466	0.0014
R-squared	0.348727	Mean dependent var		0.155215
Adjusted R-squared	0.288609	S.D. dependent var		0.040464
S.E. of regression	0.034129	Akaike info criterion		-3.82516
Sum squared resid	0.075712	Schwarz criterion		-3.60382
Log likelihood	144.7059	Hannan-Quinn criter.		-3.73705
F-statistic	5.800756	Durbin-Watson stat		1.471468
Prob (F-statistic)	0.00007			

Table 9. Random Effect Test results.

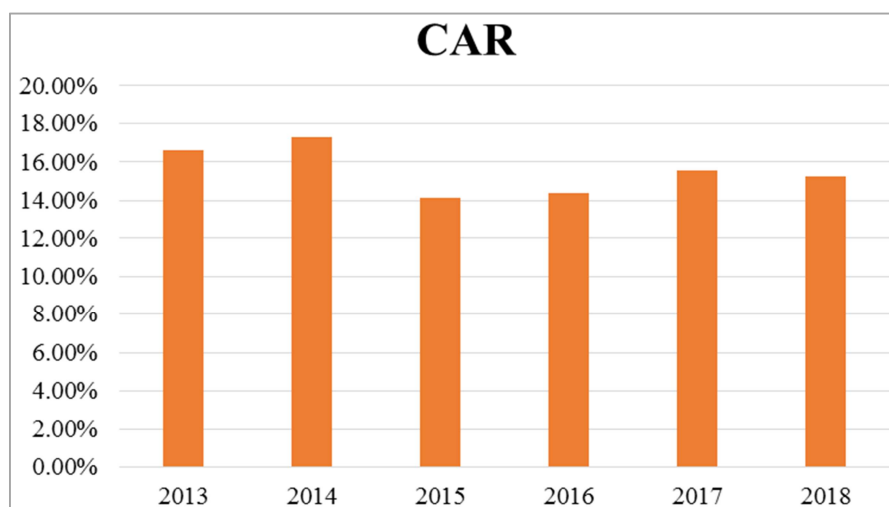
Dependent Variable: CAR				
Method: Panel EGLS (Cross-section random effects)				
Sample: 2013 2018				
Periods included: 6				
Cross-sections included: 12				
Total panel (balanced) observations: 72				
Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.257566	0.124796	2.063891	0.043
CR	0.489434	0.219143	2.233403	0.029
ISR	0.001293	0.003254	0.397445	0.6923
LR	0.155717	0.050377	3.091026	0.0029
ROA	1.857185	0.857666	2.165393	0.034
OE	-0.02333	0.012805	-1.821909	0.0731
BS	-0.006088	0.004904	-1.241388	0.2189
Effects Specification				
			S.D.	Rho
Cross-section random			0.018027	0.3101
Idiosyncratic random			0.026891	0.6899
Weighted Statistics				
R-squared	0.287048	Mean dependent var		0.080732
Adjusted R-squared	0.221237	S.D. dependent var		0.032932
S.E. of regression	0.029062	Sum squared resid		0.054897
F-statistic	4.361706	Durbin-Watson stat		1.677764
Prob (F-statistic)	0.000925			
Unweighted Statistics				
R-squared	0.268104	Mean dependent var		0.155215
Sum squared resid	0.085085	Durbin-Watson stat		1.082505

Table 10. Hausman's Test results.

Correlated Random Effects - Hausman Test				
Equation: Untitled				
Test cross-section random effects				
Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random		16.91856	6	0.0096
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var (Diff.)	Prob.
CR	0.877854	0.489434	0.019639	0.0056
ISR	-0.003854	0.001293	0.000006	0.034
LR	0.150945	0.155717	0.000104	0.6393
ROA	3.160535	1.857185	0.158699	0.0011
OE	-0.03879	-0.02333	0.000047	0.0247
BS	0.008445	-0.00609	0.000028	0.0064

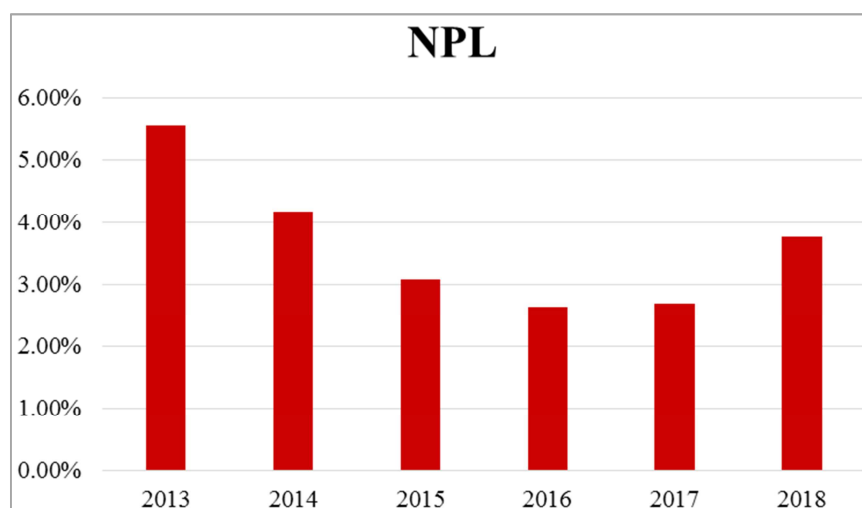
Table 11. Fixed Effect Test results.

Dependent Variable: CAR				
Method: Panel Least Squares				
Sample: 2013 2018				
Periods included: 6				
Cross-sections included: 12				
Total panel (balanced) observations: 72				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.010047	0.207865	-0.048334	0.9616
CR	0.877854	0.260121	3.374794	0.0014
ISR	-0.003854	0.00406	-0.9492	0.3467
LR	0.150945	0.051396	2.936914	0.0049
ROA	3.160535	0.945669	3.342114	0.0015
OE	-0.03879	0.014539	-2.668071	0.0101
BS	0.008445	0.007241	1.16628	0.2486
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.664112	Mean dependent var		0.155215
Adjusted R-squared	0.55837	S.D. dependent var		0.040464
S.E. of regression	0.026891	Akaike info criterion		-4.18176
Sum squared resid	0.039048	Schwarz criterion		-3.612594
Log likelihood	168.5434	Hannan-Quinn criter.		-3.955173
F-statistic	6.280476	Durbin-Watson stat		2.12838
Prob (F-statistic)	0.000000			



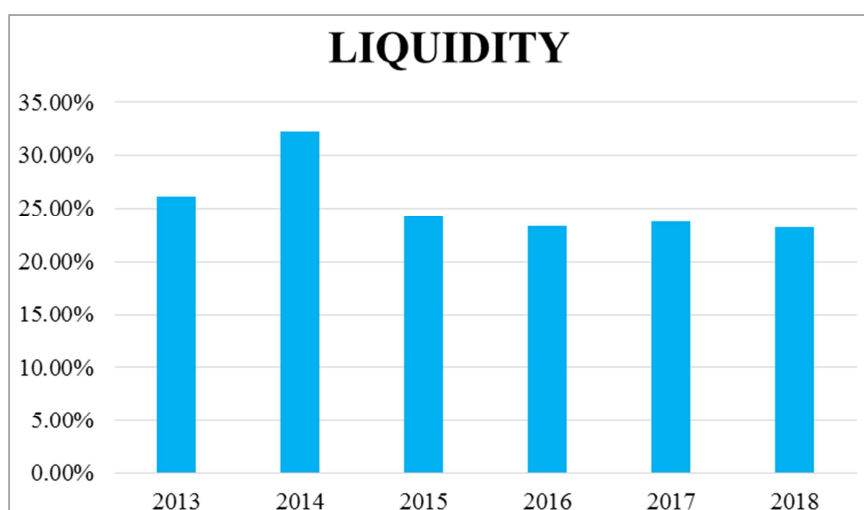
Source – Domestic Licensed commercial banks annual reports

Figure 1. Average capital adequacy ratio from 2013 to 2018 of 12 domestic licensed commercial banks in Sri Lanka.



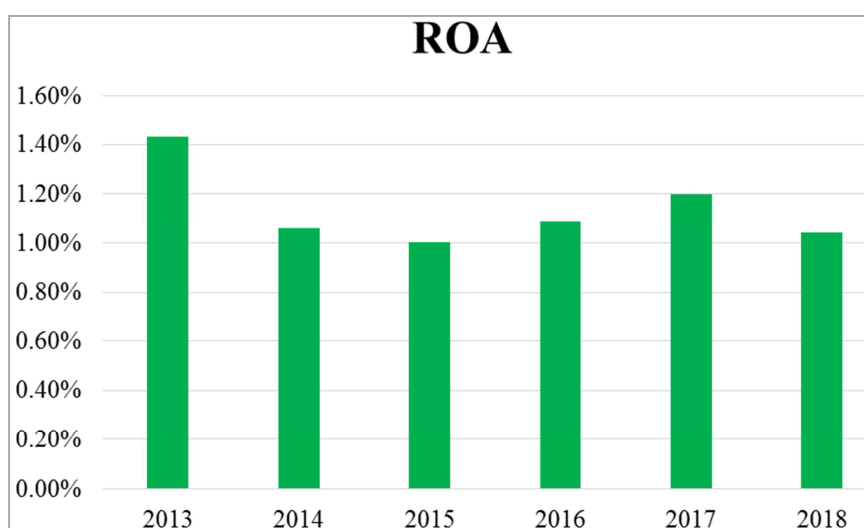
Source – Domestic Licensed commercial banks annual reports

Figure 2. Average Non-Performing loan ratio from 2013 to 2018 of 12 domestic commercial banks in Sri Lanka.



Source – Domestic Licensed commercial banks annual reports

Figure 3. Average liquidity ratio from 2013 to 2018 of 12 domestic commercial banks in Sri Lanka.



Source – Domestic Licensed commercial banks annual reports

Figure 4. Average Return on Assets ratio from 2013 to 2018 of 12 domestic commercial banks in Sri Lanka.

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