An Evaluation of the Determinants of Bank Liquidity: A Case Study of Commercial Banks in Sri Lanka

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Abstract

Being liquidity creators, banks confront illiquidity with high liquidity demands of customers, which could increase the bank's vulnerability to liquidity risk not only at the bank-level, but also at the market level. In this context, the study investigates the factors that impact the liquidity of licensed commercial banks (LCBs) in Sri Lanka. Considering the sample of eleven commercial banks from 2008 to 2018, the study investigates bank-specific and macro-economic variables against the liquidity ratios of the liquid assets to total assets, total loans to total deposits, and short-term borrowings using fixed effects panel data regression model to explore the relationships among them. Results confirmed that bank-specific and macro-economic variables are differently related to bank liquidity. From bank-specific variables, capital adequacy ratio is negative and statistically significant, while profitability and funding cost is positive and statistically significant with bank liquidity. Results revealed that bank size negatively impacts liquidity, affirming too-big-to-fail status of commercial banks. Further, comparative analysis between total deposits ratio and fixed deposits ratio with bank liquidity shows that an increase in both total deposit ratio and fixed deposits ratio will decrease bank liquidity. However, asset quality measured by impaired loans has no explanatory power over the liquidity. In the case of macro-economic variables, bank liquidity varies negatively with real Gross Domestic Production (GDP) and the inflation rate, and positively with unemployment rate. The findings of the study have important implications for regulators and policy makers to design better policies for the current liquidity framework. Regulators should monitor the capital adequacy ratio to prevent the deterioration of bank liquidity, and policy makers should consider the bank-size when preparing the liquidity framework.

Keywords: *Bank capital, Bank size, Commercial banks, Liquidity*

1. Introduction

According to the theory of financial intermediation, the preeminent role of banks as financial intermediaries is liquidity creation through transfer of funds to deficit saving units (borrowers), done by channelling funds from surplus saving units (depositors) (Diamond and Dybvig, 1983, cited in Berger et al., 2016). Thus, on the statement of financial position, banks finance the long-term illiquid assets with short-term liquid liabilities to provide cash for the economy. Also, banks create liquidity through off-balance sheet activities, such as lending on commitment basis to their customers (Berger and Bouwman, 2009).

Liquid banks improve the allocation of capital, and accelerate economic growth through financing illiquid business activities with liquid liabilities (Berger and Sedunov, 2017). However, this process is vulnerable to the liquidity risk if banks' liabilities invested on illiquid assets are withdrawn on short notice; it increases exposure to liquidity risk resulting a bank run by depositors (Diamond and Dybvig 1983, cited in Zheng et al., 2019). Liquidity risk is followed by bank illiquidity barriers that can cause a contagious effect on the financial system's stability (Malik and Rafique, 2013). It has been revealed that during the global financial crisis period (2007-2009), banks were undergoing severe stress due to the lack of prudent risk management practices (Hemachandra, 2012). In addition to the deteriorating bank performance, liquidity problems had worsened bank's reputation (Jenkinson, 2008, cited in Maduwanthi and Morawakage, 2019). Accordingly, bank liquidity is a double-sided concept. On one hand, banks play a significant role in fostering economic growth by converting liquid liabilities to illiquid liabilities; on the other hand, funding the long-term illiquid assets with short-term liquid liabilities to meet the obligations increases the banks' liquidity risk exposure.

Unlike in developed economies, bank liquidity is vital for economies in which the securities market is at a developing stage, i.e. emerging economies (Umar and Sun, 2016). In the Sri Lankan context, the banking industry dominates the financial system, and it is a key engine of growth, similar to other emerging economies (Arif and Anees, 2012). Banking sector in Sri Lanka accounts for 72.3% of total assets of the financial system in year 2019, which implies that soundness of the banking industry is essential to stabilize the country's financial system. However, prevailing monetary policy reforms have significantly pressured the liquidity of banks (CBSL, 2015), and it has become critical for banks to manage adequate liquidity levels. As with the Central Bank annual report (2018), total gross loans in the banking sector grew by 23%, while total deposits declined by 3% over the last ten years. Despite the credit growth, liquid assets to total assets of banks have declined by 20%, and credit to deposit ratio of banks have stood at 91% at the end of year 2018, indicating that the Sri Lankan banking sector has not succeeded in mobilizing deposits at a higher rate following the high demand for

credit. Therefore, banking sector in Sri Lanka has been a victim of liquidity problems, given the growth of high credit demand. Exploring the key determinants' impact on bank liquidity is extremely important for regulatory authorities, since they are more concerned about financial system's stability, and also for bank management to adopt proper liquidity management strategies.

According to existing literature, there exist a number of determinants that impact bank liquidity. It is viewed that firm-specific determinants of bank capital, bank size, cost of funds, asset quality, management efficiency, bank size and profitability have a causal relationship with bank liquidity (Repullo, 2004; Berger and Bouwman, 2017; Hovarth et al., 2012; Singh and Sharma, 2016; Shah et al., 2018; Zheng et al., 2019; Muteanu, 2012). On the other hand, some studies contributed to identify the impact of macro-economic factors, such as monetary policy, government intervention and GDP growth rate, on the bank liquidity (Berger and Sedunov, 2017; Hovarth et al., 2012; Umar and Sun, 2016; Delechat et al., 2012; Vodova, 2011). Many studies have been devoted to the investigation of determinants of bank liquidity in developed economies, while few studies have been focused on emerging economies. Since liquidity factors impact the liquidity level of a bank differently, it is necessary to evaluate those factors based on different liquidity measures.

Against this background, the main objective of the study is to evaluate the determinants of liquidity of domestic LCBs in Sri Lanka, considering both bank-specific and macro-economic variables, during the period between 2008 and 2018. Bank-specific indicators include bank size, bank capital, total deposits, fixed deposits, funding cost, profitability, and asset quality, while macro-economic indicators include inflation rate, unemployment rate and real Gross Domestic Production (GDP). Panel data regression model has been employed to estimate the coefficient of the liquidity factors.

The findings suggest that the bank size and the capital adequacy ratio negatively impact bank liquidity, whereas funding cost and profitability impact bank liquidity positively and statistically significantly. In the case of macro-economic variables, unemployment is positively related, while GDP and inflation rate negatively impact bank liquidity. Negative coefficient of bank size affirmed the too-big-to-fail status in LCBs in Sri Lanka. Comparative analysis carried out between total deposits and fixed deposits, confirmed that both variables are negative and statistically significant to bank liquidity. However, variation in bank liquidity is not explained by asset quality, indicating that impaired loans are not a determinant of liquidity. The results have important implications for the regulatory bodies and policy makers in the designing of better policies for the current liquidity framework, and in strengthening the banking system to maintain financial system stability in Sri Lanka.

The remainder of the paper is structured as follows: the next section discusses the relevant literature, then methodology and data selection are presented. The fourth section explains results of the study and the final section concludes the paper.

2. Literature Review

Financial intermediary theory states that liquidity creation and delegated monitoring are key roles played by banks (Berger and Bouwman, 2009). Banks as a financial intermediary facilitates an increase in liquidity when it converts illiquid assets to liquid liabilities, where it reduces liquidity when it converts liquid assets to illiquid liabilities (Berger and Bouwman, 2009). It does not increase or reduce liquidity when it transforms liquid assets to liquid liabilities, or illiquid assets to illiquid liabilities. On the other hand, theory of delegated monitoring states that banks act as delegated monitors to invest on behalf of their customers (Diamond, 1984 cited in Berger and Bouwman, 2013). This role itself creates agency problem, which could result in a conflict of interest between customers' and shareholders' expectation. According to Acharya and Naqvi (2012), agency problem exacerbates the risk-taking behaviour of banks by allocating excessive liquidity from large deposit inflows to finance loans to improve banks' performance. Following the theoretical background, several studies explored determinants of liquidity in commercial banks in both developed and emerging economies.

2.1. Bank-specific Determinants

When the bank size is considered, small banks have less access to financial markets compared to large banks since small banks are not known in financial markets. Thus, access to funding sources depends on size of the bank and differ from bank to bank, implying bank size is a significant factor for bank liquidity (Alger and Alger, 1999, cited in Shah et al., 2018). According to Beccalli et al. (2015) large banks provide higher economies of scale and at the same time hold too-big-to fail status. When larger banks hold the too-big-to-fail status, their motivation to hold liquid assets is limited, while small banks are more liquid. However, in the event of liquidity crunch, large banks depend on lender of last resort for liquidity assistance (Vodova, 2011; Kaufman, 2013). Equally, DeYoung and Jang (2015) found that bank size is negatively related to liquidity. However, Aspachs et al. (2005) found that change in the bank size has no impact on liquidity with the UK banks.

Similarly, causal relationship with bank capital, which has been identified as significant, has been tested by two theories. Accordingly, financial fragility/crowding out hypothesis states that higher capital ratio leads to less fragile banks, which in turn minimizes the monitoring role of depositors and reduces the ability of liquidity creation (Diamond and Rajan, 2000,

cited in Zheng et al., 2019). On the contrary, risk absorption hypothesis indicates that increase in bank capital leads to increased liquidity creation, as a higher capital buffer against illiquidity risk, enhancing the capacity of risk-bearing, improves liquidity creation (Allen and Gale, 2004, cited in Zheng et al., 2019). Berger and Bouwman (2009) empirically tested both hypotheses and revealed that risk absorption hypothesis is consistent with large banks, whereas financial fragility hypothesis is consistent with small banks. Distinguin et al. (2013) discovered that bank capital impacted liquidity creation of the European and publicly traded U.S. banks during the pre-crisis period from 2000 to 2006; however, it depends on the bank size. Zheng et al. (2019) found that bank capital has a positive relationship with liquidity creation; however, there is a significant and negative effect on the small sized banks. However, Lei and Song (2013) and Fu et al. (2015) found that bank capital is negatively related to bank liquidity for emerging economies.

High profitability increases the flow of funds available to meet liquidity needs, whereas poor profitability minimizes the cash flow required to cater liquidity to demand depositors. According to Vodova (2011) and Singh and Sharma (2016) profitability has a significant and positive relationship with bank liquidity. However, Delechat et al. (2012) and Umar and Sun (2016) found that bank profitability is negatively related to bank liquidity. In the context of Sri Lanka, liquidity has a negative relationship with Return on Assets (ROA) of commercial banks (Weersainghe and Perera, 2013). Further, Jeevarajasingam (2014) discovered that there is a strong correlation between profitability and liquidity of private banks in Sri Lanka.

Prior studies in banking identified that Non-Performing Loans (NPLs) have an inverse association with bank liquidity (Roman and Sargu, 2015). This implies that when loans become impaired, bank tends to decrease the lending operations, leading to a decrease in the ratio of loans to total assets. However, Munteanu (2012) discovered that loan loss provision is positively associated with liquidity, while impaired loans related negatively for commercial banks in Romania. On the contrary, Melese and Laximikantham (2015) found that NPL is not statistically significant with liquidity for Ethiopian commercial banks.

Bonner et al. (2015) discovered that demand deposit has a significant and positive impact on the liquidity. Similarly, Singh and Sharma (2016) found a positive relationship between deposits and bank liquidity. Alger and Alger (1999) study (cited in Shah et al., 2018) found that banks tend to hold more liquid assets in the event of economic recession, since there is a high risk for borrowers. However, Dinger (2009) found that deposit rate negatively impacts liquidity. In contrast, Moussa (2015) argued that deposits have no explanatory power over liquidity.

High funding cost leads the banks to hold high liquid assets, indicating that banks become

less dependent on external funding sources. Munteanu (2012) investigated the impact of cost of funds on the liquidity and found a significant positive relationship. Contrarily, Shah et al. (2018) found that funding cost is positively associated with liquid assets to total assets, whereas it is inversely related to total loans to total deposit ratio.

2.2. Macro-economic Determinants

Vodova (2011) claimed that there is a positive association with GDP growth rate. However, the impact of GDP growth rate on the liquidity can have a negative relationship (Chen et al., 2014). Delechat et al. (2012) showed an inverse relationship for developed economies. Similar results have been shown for commercial banks in India (Singh and Sharma, 2016). Horvath et al. (2014) found that increase in unemployment rate negatively impacts bank liquidity. In contrast, Bhati et al. (2015) and Moussa (2015) discovered a positive relationship between unemployment rate and bank liquidity. Even though the rising unemployment rate increases the loan supply, it decreases the liquidity due to the decrease in deposits, resulting in a decline in the liquidity of banks in South Europe (Madhi, 2017). Beger et.al (2016) investigated the government intervention following the capital support on the bank liquidity and risk-taking behaviour, and it is proved that the impact of a regulatory intervention and capital support on liquidity creation was statistically significant in the short-run, but not in the long-run. In the context of Sri Lanka, the monetary policy instruments of policy tools, policy rates and statutory reserve ratio significantly impact liquidity creation (CBSL, 2019).

The review of literature emphasized that there are limited empirical studies on the determinants of bank liquidity in Sri Lanka, and the present study attempts to fill the gaps that exist in the previous studies on the banking industry in Sri Lanka. Many studies on Sri Lankan banking focused on specific bank determinants and liquidity.

3. Methodology

3.1. Sample Selection and Variables

The study has considered eleven domestic LCBs, which comprise two state banks, Systematically Important Banks (SIBs), and private domestic LCBs. Among the banking sector assets, LCBs account for 75.78 percent of shares, representing their significance in the banking industry (CBSL, 2019). Eleven years of sample period, from 2008 to 2018, were considered for the study, given the regular presence of eleven banks.

Data was gathered from the comprehensive income statement, the income statement, the statement of financial position and notes to the financial statements of individual annual

reports, the Central Bank of Sri Lanka (CBSL) website, and related websites to construct panel data over the eleven-year sample period.

Previous studies which were carried out in emerging economies have used different liquidity ratios to measure the liquidity. Among these studies, Munteanu (2012), Singh and Sharma (2016), and Vodova (2011) have used similar ratios to measure the bank's liquidity. Present study has considered two measures from these empirical studies as dependent variables. The first measure focuses on overall bank liquidity, which is scaled as total liquid assets to total assets. Liquid assets are categorized according to the classification adopted by Lei and song (2013). Second measure is estimated as total gross loans to deposits and short-term financing. An increase in the ratio leads to decrease the bank liquidity and vice-versa. The main objective of the second measure is to provide precise understanding of the bank liquidity, which assesses the impact on liquidity in two different perspectives. Accordingly, the first measure explains general liquidity shock absorption capacity of the bank, while the second measure evaluates the impact of bank liquidity with total gross loans.

3.2. Hypotheses Development and Econometric Model

Hypothesized relationship, in relation to selected independent variables of bank-specific and macro-economic variables, is illustrated in table 1.

Table 1: Operationalization of Variables and Hypothesised Relationship with Bank Liquidity

Variable	Empirical definition	Expected sign
$lnTA_{i,t}$	The natural logarithm of total assets (bank size) of bank i for the period t	(+)
$tDep_{i,t}$	Total deposits to total assets of bank i for the period t	(-)
$fDep_{i,t}$	Total fixed deposits to total assets of bank i for the period t	(-)
$ROA_{i,t}$	Operating profits to total assets of bank i at time t	(-)
$TR_{i,t}$	Tier I capital ratio (bank's core capital ratio) to total assets for bank i at period t	(+)
$FC_{i,t}$	Total interest expense to total liabilities ratio of bank i at time t	(-)
$AQ_{i,t}$	Total impaired loans to total gross loans of bank i at time t	(-)
ΔGDP_t	Annual growth rate of real GDP at time t	(+)
ΔINF_t	Annual rate of Consumer Price Index at time t	(+)
$UNEMP_t$	Annual unemployment rate at time t	(-)

Source: Researcher's construction

The relevant indicators have been developed following the critical analysis of previous empirical studies in the literature survey to demonstrate the variables that are most appropriate for the country's financial system.

Bank size represents the market power, which is measured using the natural logarithm of total assets (lnTA) of LCB's in the country. Evidence in the literature survey stated that high liquid assets lead to dependency on other external sources of funding. When depositors demand cash suddenly, banks are forced to borrow funds from the inter-bank market or the Central Bank (Munteanu, 2012). Therefore, the study employs total interest expense to total liabilities as a proxy of Cost of Funds (CF) of LCBs. The impaired loans to total gross loans ratio is taken as an indicator to estimate the asset quality (AQ) of LCBs on liquidity. Researcher has used the ROA ratio as an indicator of profitability. Naeem et al. (2017) identified that ROA is the more useful and critical measure of bank's profitability than Return on Equity (ROE). The tier I capital ratio has been used as a proxy to measure the risk absorption capacity of banks. The study has used the deposit ratio, and it has segregated it into total deposit ratio and fixed deposit ratio to analyse the sensitivity of the liability portfolio of the total deposits (tDep) and fixed deposits (fDep) are measured against the banks' liquidity.

As macro-economic factors, the change in real the GDP (ΔGDP) growth rate is considered. The fluctuation in Consumer Price Index (CPI) as an annual percentage is used as the measure of the inflation rate of the country. The study employs unemployment rate (UNEMP) to estimate the impact of labour force without occupation from total labour force on the banks' liquidity.

3.3. Estimating Methodology

The study has used two different econometric models to estimate the relationship between liquidity and its' determinants of LCBs in Sri Lanka. Since the nature of the data set of the study was balanced panel database, which comprised cross-section and time-series dimensions, two techniques are used, namely: fixed effects and random effects modelling. The fixed effects model is appropriate when a serial correlation exists between the error term and the explanatory variables, while the random effects model is suitable only if the error term is uncorrelated to the explanatory variables, otherwise the fixed effects model should be adopted (Bell et al., 2018; Hill et al, 2011). Therefore, Hausman test has applied by the study to determine the appropriate model.

The null hypothesis of the Hausman test indicated that the error term was uncorrelated to the explanatory variables. The Chi-square results depicted in table 2 showed that the cross-

section variance was invalid and the Hausman statistics was zero. At this point, it was inconclusive whether the fixed effect or the random effect technique should be adopted when developing the panel model.

Table 2: Correlated Random Effects: Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
LQ_I			
Cross-section random	0	10	1
LQ_II			
Cross-section random	0	10	1

*Cross-section test variance is invalid. Hausman static set to zero.

Therefore, the inclusion of fixed effects was investigated using the redundant fixed effects test in the E-views software. The null hypothesis of the model used as fixed effects is redundant and thus, unnecessary. The results for the likelihood ratio for redundant fixed effects presented in table 3, which showed the use of fixed effect estimation, is adequate for both models, since the null hypothesis is rejected at 1 % significance level.

Table 3: Redundant Fixed Effects Test -Likelihood Ratio

Dependent variable LQ_I				Dependent variable LQ_II			
Effects Test	Statistic	d.f.	Prob.	Effects Test	Statistic	d.f.	Prob.
Cross-section F	7.141	-10,100	0.00	Cross-section F	18.93	-10,100	0.00
Cross-section Chi-square	65.211	10	0.00***	Cross-section Chi-square	128.57	10	0.00***

Note: * significant at 10%, ** significant at 5% and *** significant at 1%.

3.4. Model Specification

The model of the study is similar to the model developed by Munteanu (2012) to investigate the determinants of commercial bank's liquidity in Romania. The same model has been employed by Shah et al. (2018) by adding different variables for Pakistani commercial banking sector. Following the empirical clarification of both sets of variables, the fixed effect panel model is constructed by the researcher.

Model 01

$$LQ\_I_{i,t} = \beta_{1,t} + \beta_2 lnTA_{i,t} + \beta_3 tDep_{i,t} + \beta_4 fDep_{i,t} + \beta_5 TR_{i,t} + \beta_6 FC_{i,t} + \beta_7 AQ_{i,t} + \beta_8 ROA_{i,t} + \beta_9 \Delta GDP_t + \beta_{10} \Delta INF_t + \beta_{11} UNEMP_t + \eta + \epsilon_{i,t}$$

Model 02

$$LQ\_II_{i,t} = \beta_{1,t} + \beta_2 lnTA_{i,t} + \beta_3 tDep_{i,t} + \beta_4 fDep_{i,t} + \beta_5 TR_{i,t} + \beta_6 FC_{i,t} + \beta_7 AQ_{i,t} + \beta_8 ROA_{i,t} + \beta_9 \Delta GDP_t + \beta_{10} \Delta INF_t + \beta_{11} UNEMP_t + \eta + \epsilon_{i,t}$$

Where; LQI i, t represents total liquid assets to total assets of bank i at time t, LQII denotes total gross loans to deposit and short-term borrowings of bank i at time t, lnTA i,t shows natural log of total assets (bank size) which captures the size of bank i for the period t, dsDepi, t represents the share of demand and savings deposits to total assets of bank i at time t, fDepi,t represents ratio of fixed or time deposits to total assets of bank i for the period t, ROAi,t represents the profitability of bank i for the period t, TRi, t captures the capital adequacy for bank i at time t, FCi,t represents the interest expense to total liabilities for bank i at time t to capture the funding cost, ΔGDPt represents the real GDP growth rate at time t, UNEMPt denotes unemployment rate at time t, ΔINFt represents the change in inflation rate at time t, AWPRt represents the average prime lending rate for the period t, η captures the fixed effect of the model, εi,t represents the error term of the model.

4. Results and Discussion

4.1. Descriptive Statistics

As shown in table 4, the mean value of LQ_I of all banks across the sample period is 0.33, which suggests that banks in Sri Lanka held 33% of liquid assets from the total assets portfolio as liquidity buffer. The highest LQ_I is 0.52, while lowest is 0.1. Thus, the general liquidity shock absorption capacity of banks ranges from 52% to 10%. On the other hand, the mean value of LQ_II indicates that 76% of the total loans generated were from the total deposit portfolio of banks. Thus, banks in Sri Lanka had 24% of adequate funding to finance new loans. The mean value of total deposits suggests that banks held 70% of the deposits from the total assets in the statement of financial position. Considering the total deposits, fixed deposits held 45% of the total assets over the sample period. The maximum funding cost ratio is 0.13 indicating that some banks in Sri Lanka had undergone credit problems with larger debt portfolios; while lowest value is 0.03. Asset quality of banks is 0.048 on average, indicating that banks had not collected 4.8% for every loan given over the sample period. The mean value of capital adequacy ratio is 8.7%. As per the Basel III accord imposed by CBSL, common Tier I requirement for assets of less than 500 Bn LKR in value is 8.5%, and for assets of more than 500 Bn LKR in value is 10%, indicating that banks had been in-line with the Total tier I capital buffer (CBSL, 2019). The highest ratio is 32 percent, while the lowest is 2%. The mean value of the bank size is 19.341, with the highest deviation being 1.171. The

mean value of ROA remains at 0.021, which has implied that the profitability of the banks' asset in generating profit was 2.1% for all banks in the sample period. ROA has the lowest standard deviation of 0.009 among bank-specific variables.

Regarding macro-economic variables, the mean value of GDP growth rate over the 11 years' period was 5.4%. The highest growth rate was 9.1% (recorded in 2012), while the lowest growth of 3.2% was reported in 2018. The standard deviation is 2.1%, which has shown the deviation from the mean value. Inflation growth rate was 6.7% on average across the sample period. The highest inflation growth rate of 22.6 was recorded in 2008, whereas the lowest rate of 2.1 was in 2018. The deviation of mean value is 5.4% which is the highest among macro-economic variables. The mean rate of unemployment rate is 4.6% with the lowest standard deviation of 0.05%. The highest unemployment reported in 2009 as 5.8%, and the lowest rate of 4% was recorded in 2012.

Table 4: Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.
Liquidity ratio I (LQ_I)	0.333	0.320	0.520	0.100	0.068
Liquidity ratio II (LQ_II)	0.766	0.780	1.020	0.520	0.094
Bank size (LNTA)	19.341	19.450	21.540	16.340	1.171
Total deposits (tDeP)	0.701	0.730	0.860	0.260	0.118
Fixed deposits (fDep)	0.456	0.460	0.710	0.210	0.088
Funding cost (FC)	0.069	0.070	0.130	0.030	0.019
Asset quality (AQ)	0.048	0.040	0.240	0.010	0.038
capital adequacy (TR)	0.087	0.080	0.320	0.020	0.054
Profitability (ROA)	0.021	0.020	0.050	0.000	0.009
GDP growth (ΔGDP)	0.054	0.050	0.091	0.032	0.021
Inflation growth (ΔINF)	0.067	0.059	0.226	0.021	0.054
Unemployment (UNEMP)	0.046	0.044	0.058	0.040	0.005

Source: Research's construction

4.2. Regression Results

As represented in table 5, regression output of model 01 and model 02 indicate that bank size has explanatory power over the liquidity at 1% significance level, with the t-statistic value of 2.553 and 2.869 respectively. The total number of observations of both models is 121 for the sample period from 2008 to 2018. Coefficient estimate is negative, which does not correspond with the hypothesized table. It indicates that large banks held fewer assets,

whereas small banks kept a higher percentage of liquid assets.

Findings affirm the too-big-to-fail principle for banks operating in Sri Lanka. When larger banks hold the mentality of too-big-to-fail, their motivation to hold liquid assets is limited, and they depend on Lender of Last Resort, while small banks possess more liquidity (Vodova, 2011; Kaufman, 2013). Similarly, Delechat et al. (2012) explained that small banks are required to hold large liquid assets due to limited access to external sources of funding, while large banks obtain funds from the inter-bank market and other sources. The findings are in line with those of DeYoung and Jang (2015), and Shah et al. (2018). Contrarily, Bonner et al. (2015) argued that bank size positively impacts liquidity.

Coefficient estimate of TR is representing mixed results between capital adequacy and liquidity. The findings of the study are consistent with the financial fragility hypothesis, indicating that the bank capital minimizes the monitoring role of deposits over banks, and reduces the ability of liquidity creation. On the other hand, results confirmed the crowding out hypothesis of Gorton and Winton (2000), indicating that higher capital ratios lead to shifting of investors' funds from liquid deposits to illiquid bank capital (Distinguin et al., 2013). However, it was insignificant for the second liquidity model, indicating higher capital ratios have no effect on the loans to deposit ratio. It can be argued that banks in Sri Lanka collect more deposits and grant more, and it does not cause any negative consequences since banks are maintaining adequate capital reserves. Similarly, Lei and Song (2013), and Fu et al. (2016) confirmed the financial fragility hypothesis.

Despite the positive coefficient estimate with liquidity ratio, tDep is statistically insignificant with the LO_I measure. However, LO_II reveals tDep is statistically significant at 10% significance level. The coefficient estimate for tDep is negative in accordance with the hypothesized sign.

Empirical results of the present study have revealed that increasing total deposits decrease the liquidity, since banks tend to fund loans with new deposits, and covering the loans ultimately shrinks the liquidity. Similar findings were discovered by Dinger (2009), and Shah et al. (2018). However, Bonner et al. (2015) revealed opposite results, which show a positive effect for Indian banks. In addition, the researcher has investigated the impact of the fixed deposit ratio on bank liquidity. Results of both models revealed mix results regarding the fixed deposit ratio. fDep is significant with LQ_I, while it is insignificant at LQ_II. Coefficient estimate is negative as expected by the study. Similar results as total deposit ratio which shows a significant negative relationship overall liquidity position of LCBs. As for the delegated monitoring theory, banks act as agents on behalf of depositors with an intention to improve the returns (Berger and Bouwman, 2013). Therefore, increase in fixed deposits with

high maturity profiles increases the supply of loans, since banks' motive is to improve earnings with high interest income, rather than to invest those funds in money market instruments. This reduces the liquid assets available for the bank.

Table 5: Regression Results of Model 01 and Model 02

Dependent Variable: LQ_I					Dependent Variable: LQ_II			
Variable	Coefficient	Std. error	t-Statistic	Probability	Coefficient	Std. error	t-Statistic	Probability
Bank-specific determinants								
C	1.616	0.501	3.227	0.001	-0.261	0.519	-0.502	0.616
$lnTA_{i,t}$	-0.050**	0.019	-2.553	0.012	0.058***	0.020	2.869	0.005
$tDEP_{i,t}$	0.001	0.145	0.007	0.994	0.286*	0.153	1.871	0.064
$fDEP_{i,t}$	-0.431**	0.166	-2.584	0.011	-0.087	0.175	-0.498	0.619
$FC_{i,t}$	0.569	0.393	1.445	0.151	-0.784*	0.412	-1.899	0.060
$TR_{i,t}$	-0.504**	0.199	-2.527	0.013	0.297	0.204	1.452	0.149
$AQ_{i,t}$	-0.108	0.169	-0.641	0.522	0.246	0.177	1.391	0.167
$ROA_{i,t}$	-0.175	0.827	-0.212	0.832	-1.482**	0.765	-1.936	0.055
Macro-economic variables								
ΔGDP_t	-0.719**	0.407	-1.764	0.080	0.175	0.429	0.407	0.684
ΔINF_t	-0.464***	0.111	-4.160	0.000	0.305**	0.117	2.605	0.010
$UNEMP_t$	-0.543	1.853	-0.293	0.770	-5.401***	1.953	-2.764	0.006
R-squared		0.606			R-squared		0.773	
Adjusted R-squared		0.528			Adjusted R-squared		0.727	
F-statistic		7.713			F-statistic		17.0503	
Prob(F-statistic)		0.000***			Prob(F-statistic)		0.0000***	
Durbin-Watson stat		1.542			Durbin-Watson stat		1.5631	

Note: * significant at 10%, ** significant at 5% and *** significant at 1%.

Source: Researcher's construction

Results of the study have a different impact when analysing the funding cost with two liquidity measures. Despite the positive coefficient estimate with the liquidity ratio, FC is statistically insignificant implying it has no explanatory power over the liquidity ratio of banks. Findings were consistent with Sharma and Singh (2016). However, funding cost is statistically significant with the LQ_II model. Coefficient estimate indicates a positive effect and does not correspond with the expected sign. Accordingly, when the funding cost increases banks in Sri Lanka become less dependent on external sources of funding and hold more liquid assets. Disalvo and Johnston (2017) argued that banks with too few deposits to finance loans rely heavily on external or other debt sources whose price is more sensitive to changes

in macro-economic conditions.

Regarding the other bank-specific determinants of liquidity, most of the findings are compatible with the previous studies. The most relevant bank-specific factors to explain bank liquidity are AQ and ROA. The profitability of LCBs shows mixed results with both models. Results of the LQ_I stated that the ROA is statistically insignificant, whereas it was significant with LQ_II. Findings of study have two different perspectives. In the first instance, increase in earnings has not impacted liquidity, since banks are keeping adequate liquidity buffer. This is consistent with Shah et al. (2018) on Pakistani banks. On the other hand, it corresponded with the delegated monitoring theory; higher earnings encourage banks to supply more loans to generate more interest income, as a result the liquidity assets available within the bank decrease. Similarly, Umar and Sun (2016) explained that profitability is negatively related to liquidity.

Impaired loans affect the asset quality of banks, and the higher ratio increases NPLs, which leads to loss of confidence on the part of depositors resulting immediate fund withdrawal (Bolem and Gorter, 2001 cited in Gadzo, 2018). Regardless of the negative coefficient as expected, AQ is statistically insignificant with both LQ_I and LQ_II models of the study. It has revealed that impaired loans have no explanatory power over liquidity. This implies that no moral hazard problem exists in Sri Lankan banks, and asset quality remained at 4.8%, a low level on average compared to capital adequacy, which is 8.7% on average.

According to Boudriga et al. (2009) the high capital adequacy ratio reduces the risk level of impaired loans, which corresponds with figure 04. The study findings are consistent with Melese and Laximikantham (2015). However, results contradicted Roman and Sargu (2015), Munteanu (2012), and Delechat et al. (2012) who found a negative association with liquidity.

From macro-specific variables, the GDP growth rate is statistically significant with model one, whereas it is statistically insignificant with model two. This suggests that the GDP growth rate has no explanatory power over the loans to deposit ratio during the sample period. However, the second liquidity measure indicates supplying excessive loans to borrowers negatively relates to liquidity, and it has no variation. This is inconsistent with Shah et al. (2018), who found that the GDP negatively impacts total loans to total deposit ratio for Pakistani banks. Inflation growth rate has a statistically significant relationship with both models. Coefficient estimates suggest a negative relationship, which is inconsistent with the expected hypothesized effect. Findings of the study revealed that the rising inflation rate discourages loan repayments by lenders, which leads to an increase in NPLs resulting in a decline in the liquidity of banks. Findings were consistent with Vodova (2011), Munteanu (2012), and Umar and Sun (2016). In contrast, Bhati et al. (2015), and Moussa (2015) showed a positive

relationship with bank liquidity. Regarding the unemployment rate, results of the study have yielded contradictory findings with the two liquidity models. The variable unemployment rate has a negative relationship with LQ_I as expected, and it is statistically insignificant. However, the second model indicates explanatory power over liquidity with LQ_II, and it has a positive impact on liquidity, which is not as expected. In contrast to the first model, rising unemployment increases loan demand during difficult periods in the labour market. Similar results were revealed by Munteanu (2012), and Umar and Sun (2016) for emerging economies. However, the results were contradicted by Madhi (2017).

5. Conclusion and Implications

Table 6 summarises the major results of the study. Findings confirmed that liquidity of banks is impacted significantly by the independent variables employed in model 01 and 02. Bank size, capital adequacy, and deposit ratio have a significant negative impact on liquidity, whereas funding cost and profitability are significant and positively related. Simultaneously, deposit ratio, funding cost, capital adequacy, and profitability from bank-specific factors has different impacts on both liquidity measures. Total deposit ratio has been critically analysed separately using the fixed deposit ratio. Thus, total deposit ratio and capital adequacy are significant for the liquid asset ratio (first model), but it is insignificant with loans to deposit ratio (second model). Contrarily, fixed deposit ratio and profitability are found insignificant with the first model; it is significant with the second model. On the other hand, asset quality measured by impaired loans has no significant impact on banks' liquidity. Simultaneously, macro-economic variables responded differently in the two liquidity models. GDP growth rate is negative and statistically significant with liquid asset ratio, but it is insignificant with loans to deposit ratio. Inflation rate is significant and negatively impacts the banks' liquidity. Finally, unemployment rate is statistically insignificant with the first model and is significant with the second model. The impact of unemployment rate is higher with the higher coefficient value compared to other determinants considered in the study.

Table 6: Summarized Results of the Study

	Domestic LCBs	
Bank-specific	Relationship with liquidity	Relationship with liquidity with total loans
Bank size	Significant (negative)**	Significant (negative)***
Profitability	Insignificant	Significant (Positive)***
Total deposit ratio	Insignificant	Significant (negative)*
Fixed deposit ratio	Significant (negative)**	Insignificant
Capital adequacy	Significant (negative)**	Insignificant

Asset quality	Insignificant	Insignificant
Funding cost	Insignificant	Significant (Positive)*
Macro-economic factors		
GDP growth rate	Significant (negative)**	Insignificant
Unemployment rate	Insignificant	Significant (Positive)***
Inflation rate	Significant (negative)***	Significant (negative)**

Note: * significant at 10%, ** significant at 5% and *** significant at 1%.
Source: Researcher's construction

Results of the study have several policy implications. The negative impact of the bank size on liquidity indicates that small banks are more exposed to high liquidity than large banks. SIBs, as a large banking segment in Sri Lanka, are of the mentality of "too big to fail", exhibiting high risk-taking behaviour. On the other hand, banks hold 33% of total liquid assets on average, which generates an opportunity cost for banks short-term. Therefore, the study recommends bank managers to conduct a rational analysis when decision making to optimize the balance between liquidity and profitability.

In this regard, as an effective mechanism it is suggested to strengthen the monitoring tools of the management to reduce conflict of interest between shareholders' expectations. Also, total deposits and fixed deposits positively impact liquidity, which could be a positive signal for small banks to improve their returns. Findings revealed that decrease in regulatory capital results in an increase in bank liquidity, indicating the fragile financial structure of LCBs in Sri Lanka. This has a significant implication for SIBs, since those banks underestimate the liquidity risk with the too-big-to fail view. It is suggested that the current framework for liquidity ratio needs to be revised by considering the capital adequacy ratio. Regulators impose liquidity requirements to maintain safety and soundness in the banking system. In this regard, regulators need to consider bank size when preparing the liquidity framework to improve regulation efficiency. Regarding macro-economic factors, inflation rate has the highest variation, while unemployment rate shows the lowest dispersion; therefore, policy makers should be vigilant and rational when adopting policies to regulate bank liquidity to minimize the chances of liquidity crunch in the future.

5.1. Further Investigation and Limitations

Even though researcher states 'the banking industry in Sri Lanka', the scope of study has focused only on domestic LCBs in the Sri Lankan banking sector. The Licensed Specialised Banks (LSBs) have been excluded, since there is a strategic difference in banking operations. Due to the difference in the accounting format, because of the multi-currency transactions of

foreign LCBs, the study has not included foreign LCBs to address the determinants of bank liquidity. The study has excluded other private commercial organisations, which had not commenced operations during the sample period from 2008 to 2018. Despite the scope and these limitations, the study provides considerable opportunities for future researchers to further investigate this area. The study attempted to evaluate key determinants of bank liquidity of domestic LCBs in Sri Lanka. Therefore, the study can be further extended to investigate other financial institutions of LSBs, and Finance and Leasing companies operating in Sri Lanka. Also, the research can be further expanded to include key types of bank liquidity of funding liquidity and stock liquidity, and critically investigate its determinants separately to enhance the understanding of the liquidity cycle to avoid financial turmoil in future.

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