“The determinants of liquidity risk of commercial banks in Vietnam”

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ARTICLE INFO	Tu T. T. Tran, Yen T. Nguyen, Thuy T.H. Nguyen and Long Tran (2019). The determinants of liquidity risk of commercial banks in Vietnam. *Banks and Bank Systems*, *14*(1), 94-110. doi:10.21511/bbs.14(1).2019.09
DOI	http://dx.doi.org/10.21511/bbs.14(1).2019.09
RELEASED ON	Tuesday, 26 February 2019
RECEIVED ON	Monday, 17 December 2018
ACCEPTED ON	Wednesday, 06 February 2019

JOURNAL	"Banks and Bank Systems"
ISSN PRINT	1816-7403
ISSN ONLINE	1991-7074
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
23	3	14

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10, Sumy, 40022, Ukraine

www.businessperspectives.org

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THE DETERMINANTS OF LIQUIDITY RISK OF COMMERCIAL BANKS IN VIETNAM

Abstract

This research identifies factors that explain the liquidity of commercial banks in the Vietnam banking system from 2010 to 2015. Using the OLS regression method for analysis, it was found that:

(1) the interbank market helps commercial banks improve their liquidity;

(2) the larger the loan size, the higher the liquidity risk;

(3) good credit risk management has a positive impact on liquidity risk management; and

(4) long-term interest rate is negatively related to the liquidity of commercial banks.

The research also makes recommendations on liquidity risk management policies to banks and policy-makers from the Government and the State Bank of Vietnam.

Keywords commercial bank, risk management, liquidity risk

JEL Classification G10, G30, G33

Received on: 17th of December, 2018
Accepted on: 6th of February, 2019

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INTRODUCTION

Project 254 approved by the Vietnamese Government for restructuring credit organizations over the period 2011–2015 has achieved many remarkable results in Vietnam, an emerging economy. As a result, liquidity stability and a decrease in banking system crashes are the undeniable successes of the State Bank of Vietnam (SBV). In addition, it also improves the confidence of depositors. However, there has been a shortage of temporary liquidity in some banks since 2012. More than ever, bank leaders are aware of the importance of liquidity management not only for specific banks but also for the financial and credit institutions' system.

This research aims to examine the impacts of internal and external factors on the liquidity risk of the commercial banks of Vietnam during the 6-year period, from 2010 to 2015. According to Vodova (2011, 2012), Fola (2015), four ratios are used to assess bank liquidity, namely *LATA* – liquid assets over total assets, *LADST* – liquid assets over short-term deposit and mobilized capitals, *NLTA* – total loan over total assets, and *NLDST* – total loan over short-term deposit and mobilized capitals. The independent variables are grouped into internal and external ones, including: *SIZE* – size of the bank, *LTA* – the liquidity reserve over total assets ratio of a bank, *EFD* – the dependence on external funding of a bank, *CTA* –

http://dx.doi.org/10.21511/bbs.14(1).2019.09

the equity ratio, *LDR* – the loan over capital ratio, *LPTL* – the credit risk reverse over total loans, and *GDP* – economic growth rate, M_2 – Money supply 2.

Consistent with the result reported by Vu (2012), it was founded that the total loans to total capital ratio is negatively related to bank liquidity. However, the dependence on external financing sources improves bank liquidity, which is inconsistent with the finding of Vodova (2012) that is based on a sample of commercial banks in Slovakia. The inconsistency could be due to the differences in the interbank market of the two countries.

The current research contributes to the literature by suggesting two new factors that affect bank liquidity, which include the loan loss provision over total loan ratio and the long-term lending rate. It was found that both variables are positively related to bank liquidity. The findings have important implications for bank liquidity management for policy makers in emerging economies like Vietnam.

The paper proceeds as follows. Section 1 provides a literature review of bank liquidity and key determinants. Section 2 presents the sample and empirical models. Section 3 provides the results and discussions. Section 4 presents the authors recommendations to improve efficiency of liquidity management in Vietnam and the last section concludes the paper.

1. LITERATURE REVIEW

1.1. Liquidity, liquidity risk and liquidity risk management of a bank

Basel Committee (2015) defined liquidity as the ability of a bank to promptly meet its financial obligations incurred in the process of business operation. In this sense, liquidity represents qualitative factors of the banks' financial strength. The definition of the Basel Committee on Banking Supervision indicates that liquidity risk occurs when a financial institution lacks capital to meet its obligations without affecting its daily business operation and financial situation. Consequently, banks face a failure to supply sufficient cash for immediate liquidity needs (e.g., cannot convert assets into cash or borrow to meet the payment demand) or to raise liquidity at a high cost.

Duttweiler (2009) argues that one of the main causes of liquidity risk is the mismatch of duration between asset and bank's liability, i.e., mobilizing and borrowing short-term funds while lending and granting credit at long-term duration. The imbalance between the maturity of assets and debt leads to the imbalance between the source and the use of capital, which is one of the reasons for the loss of liquidity.

The second source of liquidity risk arises from liabilities. Liquility risk may occur whenever the bank has a mismatch between liabilities and assets, which forces banks to borrow more or sell assets to meet liquidity need. Due to the fire sale of property, its price may be lower than the actual value. Therefore, a number of properties will be converted into cash with lower value than its true value if they have enough time to sell (Duttweiler, 2009).

Another cause of bank liquidity risk stems from its assets relating to credit commitments. Banks typically allow borrowers to withdraw money anytime during a certain time period. When a credit commitment is created, banks must be in good financial condition to meet the immediate needs of customers. Otherwise, the bank will lose liquidity.

Nguyen (2013) suggests that the sensitivity of financial assets to interest rates volatility also affects liquidity. When the interest rates in financial markets fluctuate, depositors tend to withdraw money from the banks that pay low interest rates and deposit with banks that pay higher interest rates. Meanwhile, customers who have demand for credit may attempt to delay payment for debt that becomes due or draw more funds from banks that provide credit commitment with lower interest rates. As a result, the fluctuation in interest rates affects both incoming and outgoing cash flows of the banks negatively.

Domino effect: Banks have a close relationship with each other through transactions in the interbank market. When a bank loses liquidity and faces bankruptcy risk, other banks will also be affected. The degree of the contagion depends on the size of the transaction between banks. In addition, when depositors withdraw money from a bank, others may assume that all other banks will also face liquidity difficulty and withdraw all money from these banks. This phenomenon triggers the domino effect that causes trouble to the whole banking system.

Risk and expected profits are closely related. Risk is a part of the banking business. Banks must accept, manage, and quantify risk so that they can expand operation, increase profit, and ensure operational safety. The banks' operational safety depends on risk management in general and liquidity risk management in particular.

1.2. Assessment of bank liquidity

Banks (2005) uses three methods to assess bank liquidity, namely mobilization and use of capital method, capital structure method, and liquidity index method. However, the mobilization and use of capital method and the capital structure method are subjective estimation, largely based on the experience and judgment of managers on risk issues. Banks (2005) uses four liquidity indices including cash position index, stock liquidity index, lending turnover index, and outstanding loans over deposits to examine bank liquidity. This author finds that the higher the cash position index and the stock liquidity index, the higher the liquidity of the banks. He further reports that lending turnover and outstanding loans over deposits are negatively related to the liquidity of banks.

Some authors such as Rychtarik (2009), Fola (2015), and Vodova (2011, 2012) assess bank liquidity focusing on four indicators as follows:

$$LATA = \frac{Total\ liquid\ assets}{Total\ assets}. \quad (1)$$

This ratio indicates the proportion of liquid assets to the total assets. The higher this ratio, the better the bank liquidity because it means that banks hold more liquid assets out of total assets.

$$LADST = \frac{Total\ liquid\ assets}{Short\text{-}term\ deposits\ and\ mobilized\ capitals}. \quad (2)$$

This ratio indicates whether banks' total liquid assets are sufficient to meet their short-term debt payment obligation. When the ratio is low, banks are more sensitive to the deposit withdrawal by customers. This measure helps identify the vulnerability of banks to the funding sources. A higher ratio indicates better bank's ability to absorb liquidity shock.

$$NLTA = \frac{Total\ loans}{Total\ assets}. \quad (3)$$

This ratio indicates the percentage of assets relating to loans that are illiquid assets. The higher the ratio, the worse the liquidity of the bank because the bank is more vulnerable to liquidity risk. This dependent variable was used by Lucchetta (2007).

$$NLDST = \frac{Total\ loans}{Short\text{-}term\ deposits\ and\ mobilized\ capitals}. \quad (4)$$

This ratio indicates the percentage of total short-term deposits and funds that are related to illiquid assets. A low ratio means that loan, as an illiquid asset of the banks, is less financed by short-term fund. Thus, bank liquidity will be higher.

1.3. Determinants of bank liquidity

Valla et al. (2006) studied whether a number of internal factors and macroeconomic variables affect the ability to bank liquidity in France during a 12-year period, starting from 1993. The results of the regression analysis confirmed that the bank's scale has a positive impact on liquidity. The remaining factors are the growth of the gross domestic product, support from the ending lending, short-term interest rates, profit and credit growth that have an inverse relationship with the mobility of commercial banks in France.

Lucchetta (2007) examined determinants affecting liquidity risk of 5,066 European banks from 1998 to 2004. Unlike the studies of Valla et al. (2006), the paper did not focus on internal and macroeconomic variables such as bank size, government interest rate, loans on total assets and bad debt ratio, etc. but used them as control variables to consid-

http://dx.doi.org/10.21511/bbs.14(1).2019.09

er the relationship among banks on the interbank market through the process of interbank lending. Lucchetta demonstrated that interbank interest rate has affected the liquidity of banks.

Bunda and Desquilbet (2008) interpreted the influence of factors on the bank's liquidity risk for a data set of commercial banks in 36 emerging countries from 1995 to 2000. This study aims to find out the effect of the exchange rate on the liquidity of commercial banks. The authors believed that liquidity of the bank depends on the following factors: total assets as a measure of the size of banks, lending interest rates as a measure of lending profits, the crisis finance and inflation that have a negative impact on liquidity banks. Meanwhile, the ratio of equity to assets as a measure of capital safety and gross domestic product as a measure of economic growth and exchange rate have a positive impact on liquidity.

Vodova (2011) demonstrated that banking liquidity depends on both internal and external factors. Using the regression model on EViews 7, the study focuses on the 8-year period from 2001 to 2009 in Czech Republic. The result proved that there was a positive relationship between the liquidity of a bank and capital adequacy ratio, bad debt ratio and the interbank interest rate. Moreover, the research found an inverse correlation between the inflation rate, economic growth rate and financial crisis with liquidity. Vodova found that the relationship between banks' size and liquidity was not very clear. The author also concluded that the unemployment rate, profitability, and interest rates from monetary policy have no statistical significance affecting the liquidity of Czech commercial banks. Vodova (2012) re-implemented this study but focused on Slovakia and also showed similar results.

Fola (2015) studied factors affecting the liquidity of commercial banks in Ethiopia from 2002 to 2013. The author has assumed that profits, credit growth, economic growth, marginal interest rates would have an inverse relationship with the liquidity of banks. Fola supposed that bad debt and inflation have a positive relationship to liquidity status. The author also expected bank size and equity ratio would have an unclear impact on liquidity. After running the model, Belete Fola concluded that credit growth negatively correlated while equity, inflation and marginal interest rates positively correlated with the dependent variable. Contrary to the author's expectations, variables such as bad debt ratio, profit, bank size and economic growth have little or no impact on the liquidity status in Ethiopia.

Calomiris et al. (2013) proved that it is necessary to hold more cash, which plays a significant role in supporting for the commercial banks remain stable liquid status, because the bank has the capacity to encounter mass withdrawals which causes a bank illiquidity. DeYoung et al. (2018) also demonstrated that the relationship existed between the bank capital and bank liquidity at U.S. banks. The researchers concluded that a minimum capital compulsion significantly mitigates liquidity danger at the banks.

In Vietnam, there have been very little research papers relating factors affecting the liquidity of commercial banks. The most prominent research is that by Vu (2012). Vu (2012) considered the influence of the internal variables of commercial banks affecting liquidity with the sample of 37 Vietnamese commercial banks in the period from 2006 to 2011. Through statistical analysis, disproportionate correlation and regression of data with the fixed effect, the study found the impact of some factors on liquidity. Specifically, the equity ratio, bad debt ratio and profit ratio positively correlated while the ratio of loans on deposits negatively correlated with the liquidity of Vietnamese commercial banks. This survey did not detect the impact of loan loss provision and the bank's scale on the liquidity status.

Although several studies examine factors affecting the liquidity of commercial banks, most of them use data of banks in foreign countries. There have been some recent studies using Vietnamese data. However, the authors of these studies examine only the influence of internal variables without considering macro-economic variables, which are not consistent with the theoretical arguments and previous empirical evidence showing that bank liquidity depends on both internal and external factors. Therefore, the current research contributes to the literature by determining not only the internal factors of the banks but also the external factors, such as macroeconomic variables, then provide a comprehensive evaluation of factors affecting the liquidity of the banks in Vietnam.

2. RESEARCH METHODOLOGY

2.1. Data and sample

Data were collected from annual financial statements of 35 out of 38 commercial banks in Vietnam (except for three banks including Vietnam Bank for Agriculture and Rural Development, Vietnam Thuong Tin Commercial Joint Stock Bank and East Asia Bank, because these banks did not have enough data to run model) for the period 2010–2015. The banks included in the research account for over 90% of the number of banks in the Vietnam banking system. All financial reports used in this research were published by the banks and audited by external auditors, which validates the accuracy of financial data used in the research.

The final sample includes 149 firm-year observations of 35 unique banks over the 6-year period from 2010 to 2015, which represents a good sample size for regression analysis.

2.2. Empirical model

The bank liquidity model has the following form:

$$\begin{aligned} LIQ_{it} &= \beta_0 + \beta_1 SIZE_{it} + \beta_2 LTA_{it} + \\ &+ \beta_3 EFD_{it} + \beta_4 CTA_{it} + \beta_5 ROA_{it} + \\ &+ \beta_6 ROE_{it} + \beta_7 LDR_{it} + \beta_8 LPTL_{it} + \\ &+ \beta_9 GDP_{it} + \beta_{10} INF_{it} + \beta_{11} LTR_{it} + \\ &+ \beta_{12} M2_{it} + \varepsilon_{it}, \end{aligned} \quad (5)$$

where LIQ_{it} is the dependent variable that indicates the liquidity position of the bank i at time t, $SIZE_{it}$ is the size of bank i at time t, LTA_{it} is the ratio of liquidity reserve to total assets of bank i at time t, EFD_{it} is the dependence of the external funding of bank i at time t, CTA_{it} is the equity ratio of bank i at time t, ROA_{it} is the return on total assets ratio of bank i at time t, ROE_{it} is the return on equity ratio of bank i at time t, LDR_{it} is the loan to capital ratio of bank i at time t, $LPTL_{it}$ is the credit loss provision to total loans of bank i at time t, GDP_{it} is the gross domestic product of Vietnam at time t, INF_{it} is the inflation rate at time t, LTR_{it} is the long-term lending interest at time t, M_{2it} is the M_2 at time t, and ε_{it} is the random error term.

2.2.1. Dependent variables

Vodova (2011, 2012) uses four ratios to assess bank liquidity including *LATA*, *LADST*, *NLTA*, and *NLDST*. Fola (2015) uses two ratios, which are *LADST* and *NLDST*, as the dependent variables. We use all the four ratios in the four regression models to test factors affecting the liquidity risk of commercial banks in Vietnam. Then, it is evaluated which model has the highest explanatory power.

2.2.2. *Independent variables*

We follow the literature in selecting independent variables and focus on the factors that are considered to have power in explaining bank liquidity. 12 independent variables are used, therein there are 4 macroeconomic variables, 8 internal variables (Table A1 in Appendix A) and a control variable.

Size of the bank (*SIZE*): There is no consensus in the literature about the relationship between bank size and liquidity. Valla et al. (2006), Lucchetta (2007), and Vodova (2011, 2012) suggested that the greater the total assets, the lower the liquidity risk. Large banks could have many advantages. For example, it is easier for these banks to raise capital from customers, lend in the interbank market, or receive support from the central bank as the lender of last resort. However, Bunda and Desquilbet (2008) find opposite results. In particular, these authors report that large commercial banks typically enjoy implicit advantages and low cost in mobilizing capital. Therefore, these banks often invest aggressively in many venture projects, especially providing loans that are exposed to high risk but also have high expected returns. As a result, the liquidity risk of large banks is also higher, comparing to that of smaller banks. Applying the reality in Vietnam, a positive correlation is expected between the size and the liquidity status.

Dependence on external financing source (*EFD*): This variable is measured as the proportion of total interbank loans to total capital. Vodova (2011, 2012) argues that this dependence increases liquidity risk when banks have to borrow at high interest rates during the crisis, which increases the debt ratio. Therefore, the authors expect this index to have a negative relationship with bank liquidity.

http://dx.doi.org/10.21511/bbs.14(1).2019.09

Equity ratio (*CTA*): This ratio is measured as the proportion of equity to total assets. A low ratio indicates that the bank uses a high leverage strategy, which is risky and may decrease the bank's profit while the cost of borrowing is high. Previous studies of Bunda (2008), Vodova (2011, 2012), and Fola (2015) reported consistent results about the positive relationship between equity ratio and bank liquidity. Hence, we expect a similar result after running the regression model.

Net profit to total assets ratio (*ROA*) and net profit to total equity ratio (*ROE*): *ROA* and *ROE* reflect the efficiency of the banks in assets and equity utilization respectively. Previous research finds impacts in the same relationship between this rate and liquidity position (Bunda, 2008). Some studies such as Lucchetta (2007), Valla et al. (2006), and Vodova (2011, 2012) also find positive correlation between net profit ratio and liquidity position. We anticipate a positive correlation between the two variables.

Loans on total short-term deposits rate (*LDR*): Loan is a key asset of a bank, accounting for the largest proportion and generating the largest revenue on the financial statements of any bank but it is a less liquid asset. Vodova (2011, 2012) found a positive relationship between this variable and liquidity. This study also expects to find a negative correlation between this ratio and bank liquidity.

Economic growth (*GDP*): The total gross domestic product (*GDP*) is an indicator of the health of an economy. Banks tend to hold more liquidity reserve during recession periods due to loan risks. Conversely, in periods of economic growth with higher interest rates, banks reduce liquidity reserves to increase lending. Fola (2015), Bunda and Desquilbet (2008) reported that economic growth is positively related to liquidity, while studies of Valla et al. (2006), and Vodova (2011, 2012) find a negative relationship between these two variables. The paper examines the expectation of a negative relationship between economic growth rate and liquidity of banks.

Inflation (*INF*): Perry (1992) found that the effects of inflation on bank liquidity depend on the bank's expectation about the near future inflation. If inflation is expected to rise, banks will adjust interest rates to increase interest income faster than the rate of interest expense. In reality, banks do not always have accurate forecasts about inflation. This failure not only increases costs, reduces bank's net profit, but also creates challenges in mobilizing funds. Bunda and Desquilbet (2008), Vodova (2011, 2012), and Fola (2015) report a positive relationship between inflation and liquidity risk. The authors predict a similar result between these variables.

Long-term lending interest rate (*LTR*): Valla et al. (2006), Bunda and Desquilbet (2008), and Vodova (2011, 2012) suggested that the lending rates are inversely correlated with bank liquidity. When the lending rates rise, banks will earn more profit. Therefore, they will reduce liquidity reserves to support long-term loans. This behavior increases bank liquidity risk. Based on the previous papers, the authors anticipate that the higher the long-term lending interest rate is, the higher the liquidity risk of the bank is.

Other factors are controlled for such as *LTA*, *LPTL*, and M_2 in the regressions.

The ratio of liquidity reserve to total assets (*LTA*): Banks with high liquidity reserve ratio will face low liquidity risk as banks will use liquidity reserves to offset the liquidity deficit. Therefore, the paper awaits a positive relationship between liquidity reserve ratio and liquidity of commercial banks in Vietnam.

The credit loss provision to total loans (*LPTL*): The authors propose this variable to examine the effect of credit risk on liquidity risk. The higher the credit risk provision ratio is, the higher the stability of banks before credit risks. We expect this ratio to have a positive relationship with bank liquidity.

M_2 money supply (M_2): According to the actual observation, the smooth pumping of money through the open market from the beginning of 2012, the liquidity of the banking system was stabilized. The liquidity shortage period on special occasions is fully tackled, which makes a huge contribution to reducing the liquidity risk of the bank. Therefore, we expect that the M_2 money supply has a positive relationship with bank liquidity.

Besides, one of this paper's outstanding points is usage of a control variable named number of years of operation (NYO). The number of operating years of Vietnamese commercial banks was classified into 5 specific groups, namely operating for less than 10 years, 10-20 years, 20-30 years, 40-50 years and over 50 years (there is no bank with 30 to 40 years of operation). Dummy variables are used representing these groups. By using ANOVA testing, the research examines whether there are differences in the number of years of operation to bank liquidity status or not.

3. EMPIRICAL RESULTS AND DISCUSSIONS

3.1. Regression results

The regression results are reported in Table A2 (Appendix A). The variables in Model IV can explain 96.29% of the variation of the dependent variables. The reported R-squared and adjusted R-square indicate the strength of one model relative to that of other models, so model IV is chosen as the best fit model to explain the factors affecting the liquidity of Vietnamese commercial banks.

Table B1 reports the Akaike (*AIC*) and Schwarz (*SC*) information standards statistics. The results indicate that Model IV has the smallest *AIC* and *SC* values, which suggests that model IV can explain the outcome variables better than the remaining models. In Model IV, the coefficients of *EFD*, LDR, LPTL, *GDP*, and M_2 are statistically significant at the 1% and 5% levels. However, the coefficients of *C*, *SIZE*, *LTA*, *CTA*, *ROA*, *ROE*, *INF*, and *LTR* are not statistically significant at the 5% level. We drop the variables that do not have statistically significant effects on the outcome variable and rerun the regression. Table B6 of Appendix B reports the results.

3.1.1. Test for multicollinearity

We test for multicollinearity and report the results in Table B2 Appendix B. It is found that the pairs (*GDP*, *LTR*), (*GDP*, *M2*) and (*LTR*, M_2) are highly correlated, which raises a concern about multicollinearity problem. Several sub-models are estimated with different specifications and the results are reported in Table B3 of the Appendix B. According to Kelly (1994), multicollinearity problem is present if at least one of the R-squared of a sub-model is larger than the R-squared of the original model. Since the objective of the study is to identify factors that can explain the liquidity of the banks in Vietnam, it is necessary to address the multicollinearity problem. In this direction, *GDP* and M_2 variables are removed and all sub-models are re-estimated. It is found that the R-squared of all sub-models are less than the R-squared of the original regression model, which suggests that the multicollinearity problem has been successfully addressed. The final model is shown in EViews Result 2 (see Table B7, Appendix B).

3.1.2. Test for Heteroskedasticity

The White test is run to assess whether the model has heteroskedastic errors. The results are in Table 1.

Table 1. Heteroskedasticity test: the White test results

Test	Statistic	Test	Statistic
F-statistic	0.317890	Prob. F (4.144)	0.8656
Obs*R-squared	1.304194	Prob. Chi-Square (4)	0.8607
Scaled explained SS	7.408605	Prob. Chi-Square (4)	0.1158

It is noticed that Prob (F-statistic) = 0.8656 > 0.05, which indicates that heteroskedasticity is not an issue.

3.1.3. Test for autocorrelation

Serial Correlation LM is used to test for autocorrelation and obtain the following results (Table 2).

Table 2. Breusch-Godfrey Serial Correlation LM test

Test	Statistic	Test	Statistic
F-statistic	10.66958	Prob. F (2.143)	0.0000
Obs*R-squared	19.32673	Prob. Chi-Square (2)	0.0001

Prob (F-statistic) = 0.0000 < 0.05, which suggests that autocorrelation is an issue.

We control for AR (1) in the model and test Serial Correlation LM. The new model has Prob (F-statistic) = 0.1148 > 0.05, suggesting that the autocorrelation problem has been addressed.

http://dx.doi.org/10.21511/bbs.14(1).2019.09

After re-running regressions and re-testing the model, four independent variables are found that can explain the liquidity of Vietnamese commercial banks including *EFD*, *LDR*, *LPTL*, and *LTR* (Table B8, Appendix B). The direction of the relationships between independent variables and the dependent variables is presented in Table B4 of Appendix B.

The relationship between *NLDST* variable (total loans to short-term deposits and capital ratio) and liquidity is presented in Table B4 (Appendix B), the dependence on external financing sources and the loan loss provision to total loan ratio are negatively related to the dependent variable of *NLDST*, hence positively related to bank liquidity. Both the total loan to total capital ratio and the long-term lending interest rate covary with *NLDST*, so they are negatively related to bank liquidity. Therefore, the results of *LDR*, *LPTL*, and *LTR* are consistent with our expectation. The other variables also have the expected signs.

3.1.4. Test for the impact of a control variable on the dependent variable

Test of homogeneity of variances is runned to consider whether ANOVA analysis results could be used.

Table 3. Test of homogeneity of variances

Levene statistic	df1	df2	Prob.
2.257	4	144	.066

In Table 3, the variance of the dependent variable has Prob. > 0.05, so at a 95% confidence level, the assumption of equal variance is accepted (there is no difference in variance). Therefore, the ANOVA analysis results can be used.

After running ANOVA test, the results show Prob. coefficient < 0.05, so there is a difference of liquidity status among the groups among the number of years of operation.

Table 4. The results of the ANOVA test

	Sum of squares	df	Mean square	F	Prob.
Between groups	.833	4	.208	2.755	.030
Within groups	10.886	144	.076		
Total	11.719	148			

3.2. Analysis and discussions

The dependence on external sources of finance improves liquidity of banks.

Vodova (2012) reported that borrowing increases liquidity risk in Slovak market: borrowing at a higher interest rate allows banks to offset many obligations associated with a lower interest rate. However, our results are inconsistent with the finding of Vodova (2012). What causes the inconsistency in these results are arguably the differences in the interbank markets of Vietnam and Slovakia. It is observed that commercial banks in Vietnam borrow on the interbank market to quickly offset liquidity as interest rates are lower than the cost of deposits and the interest earned from loans on the Vietnamese interbank market.

In Figure B1, the three-month deposit rate of banks in December 2015 was 5.8%, while the interbank average interest rate for that duration was 5.09% in Table B5 (Appendix B) and the lending rate was always above 7% in Figure B1. It is noticed that the interest rate on the interbank market is usually lower than the deposit rate and the lending rate of the same maturity. Therefore, lending on the interbank market is a quick and effective way to enhance liquidity position. Short-term borrowing will enable banks to meet the requirements for reserve and liquidity shortage in the short term.

The year 2011 witnessed the serious shortage of liquidity in the whole commercial bank system. The interest rate of all term reached a peak of up to 14%. However, the restructuring the banking system in Vietnam was enforced from the end of November 2011 by the SBV. The first move is to continuously cut the ceiling interest rate, which plays a significant role in decreasing lending rates and interbank interest rate (Vnibor). It began to have a gap between interest rates at different terms. The 12-month term interest rate was the highest, and the one-month one was the lowest fluctuating around 4%-6.5% in the third quarter of 2013. The drop in Vnibor and lending rate plays an important role in addressing the liquidity problem at that time. In early 2015, liquidity in the Vietnamese banking system was abundant. However, due to seasonal factors of credit, the lending activity on the in-

terbank market was less robust at the end of that year. As a result, commercial banks had difficulty in borrowing from other banks. According to a report of Vietcombank Security (2016), liquidity of the banking system has declined but is still under control (Figure B1). It is observed that the interbank rate in Vietnamese market is still on the decline. It has been gradually decreasing from around 5% in all three maturities in early 2016 to the current all-time low. In particular, the overnight, one-week, and two-week interest rates dropped to 0.57%, 0.61%, and 0.79%, respectively (Phuong Diep, 2016). This trend has facilitated interbank transactions, which makes bank liquidity more abundant (Figure B2).

The total debt to total capital ratio is negatively related to liquidity of banks. It is found that a 1% decrease in the total loans to total capital ratio will increase bank liquidity risk by approximately 0.97%. The result is consistent with previous studies of Vu (2012). Banks that lend most of their short-term funds will finance less for liquid assets. In addition, loans of commercial banks, which are considered as the least liquid assets on the balance sheet, are mainly loans to customers. Therefore, the higher the ratio is, the less liquid the bank is.

In Vietnam, a negative relationship it also found between *LDR* and bank liquidity from April 2012 to October 2015. The liquidity status of each bank is measured by determining the difference between deposits and credit activities. *LDR* was high in April 2012, up to 95%. The difference between deposit and lending credit at this time was calculated to be VND 300,000 billion. Liquidity is poor all over the system. From April 2012 to April 2013, *LDR* decreased sharply to 86%. It is easy to see that the liquidity position has improved and fluctuates inversely to *LDR* (VCBs, 2016) (Figure B3).

The loan loss provision to total loan ratio is negatively related to the liquidity position of banks. It is found that a 1% decrease in this rate will reduce liquidity risk by 2.43%. In this research, liquidity risk has been reviewed in relation to credit risk. Liquidity risk can be triggered by other types of risk, especially credit risk. Banks prepare provisions and regard them as operating expenses to cover possible losses to their loans to be more secure against credit risk. As a result, bank liquidity can limit the impact of borrowers' failure to repay their loans.

The long-term lending rate has an inverse relationship with bank liquidity. It is found that bank liquidity will decrease by 0.23% if this rate rises by 1%. When long-term lending rate increases, banks tend to mobilize short- and medium-term deposits to fund long-term loans. However, the long-term loan is the most illiquid asset on the balance sheet. Moreover, the more long-term loans a bank provides, the less liquidity reserve it has. The bank will reduce its cash amount. Or else, instead of investing in assets of higher liquidity, bank will lend long-term loans, which are less liquid assets.

According to the reports of the State Bank of Vietnam (SBV, 2016), from May 2015 to early 2016, the long-term lending interest rate remained at a high level. State-owned commercial banks applied the higher medium- and long-term lending rates for many priority areas (such as agriculture, small and medium enterprises, supporting industries, exporters, high-tech enterprises). They raised these rates from 9% to 10% per year for medium- and long-term lending rates respectively. The rates for regular production and business also increased from 9.3% to 10.5% a year. For many joint stock banks, the medium- and long-term lending interest rates for priority areas rose from 10% to 10.5%. These rates for the normal business manufacturing sector also went up from 10% to 11% (SBV, 2016). Medium- and long-term interest rates in Vietnam are much higher than other countries in the region. For instance, in Thailand, these rates were at only 5-6% per annum (Vu Phong, 2015). It is noticed that this not only affects the liquidity of commercial banks but also reduces the competitiveness of domestic enterprises.

From the end of April 2016, state-owned commercial banks officially reduced interest rates for medium- and long-term loans to a maximum of 10% for each borrower in production and business (KyDuyen, 2016). The State Bank of Vietnam (SBV) has been encouraging commercial banks to lower interest rates for long-term loans. However, this is difficult for banks, especially small joint-stock banks, because it is difficult to reduce deposit rates (Giang, 2016).

http://dx.doi.org/10.21511/bbs.14(1).2019.09

4. RECOMMENDATIONS TO ENHANCE LIQUIDITY OF THE VIETNAMESE COMMERCIAL BANKING SYSTEM

The regression model with the ordinary least squares method is employed to determine factors that affect liquidity of Vietnamese commercial banks from 2010 to 2015. It is demonstrated that:

(1) the interbank market help commercial banks improve their liquidity;
(2) greater loan size leads to higher liquidity risk;
(3) good credit risk management has a positive impact on liquidity risk management;
(4) long-term interest rate is inversely related to the liquidity of commercial banks.

A direct relationship has not been found between the macroeconomic variables (such as *GDP* growth, inflation, and money supply M_2) and bank liquidity. The results indicate that effective risk management will allow commercial banks to respond to the impacts of these macro factors. The size of a bank is not statistically significant, possibly due to the fact that the use of logarithm neutralizes the effects of total assets. Moreover, the size of a bank, the ratio of loan to total assets, and the equity to total assets ratio do not affect liquidity. When these indices increase, banks tend to invest in liquid assets. However, the goal of increasing liquid assets is to make profit rather than to improve liquidity. It is found that the efficiency of using assets and equity does not affect bank liquidity.

In the following section, recommendations are made on how to improve the liquidity of commercial banks in Vietnam.

4.1. Recommendations for commercial banks

It is important for commercial banks to:

4.1.1. Enhance access to capital

Excessively focusing on a few capital sources will increase liquidity risk. Banks need to diversify their funding sources, especially funds from foreign financial institutions, to alleviate the negative impact of domestic market changes. Moreover, to attain the most absolute assessment, the banks need to evaluate the degree of dependence of each source. The funding department of the banks should be responsible for monitoring, searching, and selecting optimal funding sources to increase liquidity.

4.1.2. Handle bad debts and improve credit quality effectively

Although banks often sell their debts to Vietnam Asset Management Company (VAMC) to clean up the balance sheet, this is not the optimal solution. The bad debts sold to VAMC must be charged a 20% risk premium per year. To solve the bad debts effectively, the following solutions are proposed.

Firstly, banks should cooperate actively with their customers to restructure debt, extend repayment period and lower interest rates to encourage repayments of customers. As a result, in case of temporary financial difficulties, they will manage to repay debt after recovering their business.

Secondly, banks need to adhere to the guidance of the State Bank to classify debt and credit loss provision. As for debts that cannot be recovered, the banks need to speed up their selling and handling of all guaranteed assets to recover capital. Furthermore, it is suggested that banks should inspect and supervise all risk management activities to ensure that each of its branch strictly complies with safety regulations in banking operations.

4.1.3. Improve internal regulations on bank liquidity management

It is recommended that commercial banks take initiative in making orientations and implementing plans for risk management in general and liquidity risk management in particular, both of which have to be in accordance with their financial situations. Accordingly, commercial banks will have to issue internal regulations on liquidity management that contain the basic requirements by law. Moreover, the banks should apply Basel II on the basis of Vietnamese standards. Although Vietnam aims to meet Basel II standards until the

end of 2018, Basel II does not mention any indicators related to liquidity. Therefore, in the long run, we need to both adopt Basel II as the main quality standard for capital adequacy and rely on the standard framework of Basel III.

4.2. Recommendations for the government and the State Bank of Vietnam

It is important for the Government and the State Bank of Vietnam to:

4.2.1. Improve the legal framework for liquidity risk management

It is suggested that the Government improves the legal regulations about the operational process related to bank liquidity risk management. These regulations should consider international standards on liquidity risk both for short-term and long-term problems. Furthermore, regulations to adjust the liquidity risk management of the entire banking system should be issued.

4.2.2. Support commercial banks in diversifying capital sources

It is suggested that the SBV uses flexible monetary policy tools such as interest rates, compulsory reserves, and open market operations to regulate the amount of capital available for commercial banks, thus influencing the bank capital supply. The interbank market is an effective channel for solving temporary capital shortages for commercial banks. However, the fund from the interbank market is not stable and depends on the market itself. Therefore, the SBV should build a more appropriate mechanism for refinancing to enhance the liquidity of commercial banks.

CONCLUSION

As far as previous studies are concerned, the results in the paper are consistent with the findings of Vu (2012) which indicate that the total loans to total capital ratio is inversely related to bank liquidity. Similar to the result of the studies by Valla et al. (2006), Bunda and Desquilbet (2008), and Vodova (2011, 2012), it was found that the credit loss provision to total loan ratio has the negative correlation with the liquidity status of the bank. Therefore, Vietnamese commercial banks need to strictly comply with the classification of debt groups, comply with credit risk provisions with Circular No. 02/2013/TT-NHNN on classification of assets, deductions, methods and the use of reserves to address risks in operation of credit institutions. Hence the provisioning will increase the cost and reduce the profitability of Vietnamese commercial banks, they tend to minimize the provision or deliberately misclassify debt groups to reduce the level of provisioning. It exerts dire consequences on the liquidity of banks. It is necessary for the State Bank of Vietnam to closely monitor the credit risk management of commercial banks to avoid these manipulations.

One of the highlights of this paper is the finding that the dependence on external sources of financing improves bank liquidity ability, which is inconsistent with the finding of Vodova (2012). The difference can be traced to the differences in the interbank markets of Vietnam and Slovakia. Vodova states that banks have to borrow at a higher interest rate to offset many obligations at the lower interest rate in Slovakia, causing liquidity risk to increase. Meanwhile, it is found that borrowing on the Vietnamese interbank market is an effective way to offset liquidity. Furthermore, the interest rates in Vietnamese interbank market are lower than the cost of deposits. Therefore, lending in the interbank market in Vietnam is considered as an efficient method to address liquidity problems. However, it is likely difficult to remain stable in the interbank market, especially on special occasions such as Lunar New Year. Hence, it is necessary to diversify capital sources of commercial banks.

Moreover, this study examines the impacts of macroeconomic factors on the liquidity status of banks as no research in Vietnam has yet done it. The paper does not find the effect of M_2, *GDP* and Inflation on liquidity risk-taking at Vietnamese commercial banks. However, the study points out that the high-

http://dx.doi.org/10.21511/bbs.14(1).2019.09

er the long-term lending interest rate is, the higher the capability which the bank faces liquidity risk is. The finding is expected to help policy-makers in regulating bank liquidity in Vietnam by facilitating the control of the long-term lending rate.

The paper finds the nexus between the control variable and the dependent variable. In other words, the number of operating years affects the liquidity risk of the commercial banks in Vietnam.

ACKNOWLEDGEMENT

This research is funded by Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 502.02–2015.15.

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APPENDIX A

Table A1. The internal variables in the study

No.	Acronym	The names of variables	The variable description	The reference papers	Expected relation
1	*SIZE*	Size of a bank	Log (Total assets)	Vodova (2011), Lucchetta (2007)	+
2	*LTA*	Liquidity reserve to total assets ratio	$\frac{Liquid\ reserves}{Total\ assets}$	According to the authors	+
3	*EFD*	Dependence on external financing source ratio	$\frac{Total\ interbank\ borrowing}{Total\ resources}$	Vodova (2011, 2012)	–
4	*CTA*	Equity ratio	$\frac{Equity}{Total\ assets}$	Bunda and Desquilbet (2008), Vodova (2011), Fola (2015), Vu Thi Hong (2012)	+
5	*ROA*	Return on assets ratio	$\frac{Net\ income}{Total\ assets}$	Bunda and Desquilbet (2008), Lucchetta (2007), Valla et al. (2006), Vodova (2011, 2012)	+
6	*ROE*	Return on equity ratio	$\frac{Net\ income}{Total\ assets}$	Valla et al. (2006), Vodova (2011, 2012)	+
7	*LDR*	Total loans to total capital ratio	$\frac{Total\ loans}{Total\ capital}$	Fola (2015)	–
8	*LPTL*	Credit risk reserves to total loans ratio	$\frac{Total\ credit\ risk\ reserves}{Total\ loans}$	According to the authors	+
9	*INF*	Inflation rate	Inflation rate is calculated on the basis of consumer price index (CPI) at the end of a quarter this year and the equivalent quarter in the previous year in Vietnam (%) (Bunda & Desquilbet, 2008; Vodova, 2011, 2012; Fola, 2015)	The General Statistics Office of Vietnam	–
10	*LTR*	The long-term lending interest rate	It is the interest rate of loans in terms of 60 months or more (Valla et al., 2006; Bunda & Desquilbet, 2008; Vodova, 2011, 2012)	IMF	–
11	*M2*	Money supply M2	It is the total amount of cash issued by the Central Bank, the deposits at the central banks and other credit institutions	IMF	+
12	*GDP*	Gross domestic product	The increase/decrease rate in GDP is compared with the figure in the same period of the previous year (%) (Fola, 2015; Vodova, 2011, 2012)	The General Statistics Office of Vietnam	–

Note: (+) – positive impact, (–) – negative impact.

http://dx.doi.org/10.21511/bbs.14(1).2019.09

Table A2. The results of four regression models

Dependent variables	Model I (LATA)	Model II (LADST)	Model III (NLTA)	Model IV (NLDST)
Constant (*C*)	0.033131	(0.225819)	0.038062	(0.1754)
The size of a bank (*SIZE*)	0.021227	0.041795	0.036222	0.008718
The liquid reserves to total assets ratio (*LTA*)	0.049961	0.111559	(0.21706)**	0.080246
The dependence on external financing source (*EFD*)	0.242196	0.316337	(0.199559)***	(0.42272)*
The equity ratio (*CTA*)	0.091695	0.584802**	(0.303366)	0.139774
The return on assets ratio (*ROA*)	1.799692	1.134467	1.358217	(1.281168)
The return on equity ratio (*ROE*)	(0.000423)	(0.000977)	(0.000939)	(0.001132)
The total loans to total capital ratio (*LDR*)	(0.092729)**	0.024168	0.312855*	0.981318*
The credit risk reserves to total loans ratio (*LPTL*)	0.146742	(1.574560)	(0.998300)	(2.1083)*
The economic growth (*GDP*)	1.36E-12	(6.38E-11)	2.30E-11	(1.0E-10)**
Inflation rate (*INF*)	(0.204576)	(0.185907)	(0.056947)	0.016077
The long-term lending interest rate (*LTR*)	0.029601	0.593123	(0.059117)	1.101557
Money supply M_2 (M_2)	1.66E-12	4.91E-11	(3.86E-12)	8.58E-11**
R-squared	0.112065	0.082050	0.678844	0.962890
Adjusted *R*-squared	0.031950	–0.00077	0.64867	0.959615
Prob (*F*-Statistic)	0.173966	0.461299	0.000000	0.000000

Note: *, ** and *** denote significance level at 1%, 5% and 10%, respectively.

APPENDIX B

Table B1. The results of Akaike (AIC) and Schwarz (SC) tests

Information criterion	Model I	Model II	Model III	Model IV
Akaike (AIC)	–1.634386	–0.843699	–0.936502	–2.947427
Schwarz (SC)	–1.372297	–0.581609	–0.673962	–2.685338

Table B2. Correlation matrix of the variables

Correlation	EFD	LDR	LPTL	GDP	LTR
EFD	1.000000				
LDR	–0.000481	1.000000			
LPTL	0.162662	0.188719	1.000000		
GDP	0.251836	0.214683	0.065452	1.000000	
LTR	–0.201618	–0.201365	–0.010232	–0.794920	1.000000
M_2	0.222927	0.210213	0.007713	0.961761	–0.907110

Table B3. R-squared value of sub-models

No.	The original regression model	R-squared of the original model
	NLDST EFD LDR LPTL GDP LTR M_2	R^2 = 0.960431
	Sub-regression models	**R-squared of the sub-models**
Model 1	*EFD LDR LPTL GDP LTR* M_2	R^2 = 0.101198
Model 2	*LDR EFD LPTL GDP LTR* M_2	R^2 = 0.068368
Model 3	*LPSTL EFD LDR GDP LTR* M_2	R^2 = 0.100628
Model 4	*GDP EFD LDR LPTL LTR* M_2	R^2 = 0.955892

Table B4. Relationship between independent variables and dependent variables

No.	Independent variables	Acronym	Relationship with the dependent variables	Relationship with liquidity position	Expectation
1	The dependence on external financing source	*EFD*	–	+	–
2	The total loans to total capital ratio	*LDR*	+	–	–
3	The credit risk reserves to total loans ratio	*LPTL*	–	+	+
4	The long-term lending interest rate	*LTR*	+	–	–

Note: (+) – positive impact, (–) – negative impact.

Table B5. The interbank rate from January 2015 to December 2015

Source: The State Bank of Vietnam.

	Overnight	1 week	2 weeks	1 month	3 months	6 months	9 months
VND	4.67	4.84	4.92	4.98	5.09	5.30	6.50
USD	0.23	0.35	0.64	0.56	0.99	2.28	-

Dependent variable: *NLDST*
Method: Least Squares
Date: 11/11/16
Sample: 1149
Included observations: 149

Table B6. EViews result 1

Variable	Coefficient	Std. error	t-Statistic	Prob.
EFD	–0.335665	0.043917	–7.643215	0.0000
LDR	0.968225	0.017044	56.80836	0.0000
LPTL	–1.922370	0.518571	–3.707051	0.0003
GDP	–1.06E-10	3.09E-11	–3.437083	0.0008
LTR	0.717026	0.177371	4.042513	0.0001
M_2	7.47E-11	2.12E-11	3.523139	0.0006

R-squared	0.960431	Mean dependent variable	0.722535
Adjusted *R*-squared	0.959048	S. D. dependent variable	0.264583
S. E. of regression	0.053543	Akaike info criterion	–2.977239
Sum squares residual	0.409955	Schwarz criterion	–2.856275
Log likelihood	227.8043	Hannan-Quinn criterion	–2.928094
Durbin-Watson stat.	1.890818		

Table B7. Eviews result 2

Dependent variable: *NLDST*
Method: Least Squares
Date: 11/12/16 Time: 19:29
Sample: 1149
Included observations: 149

Variable	Coefficient	Std. error	t-Statistic	Prob.
EFD	–0.347796	0.043382	–8.017038	0.0000
LDR	0.978225	0.013713	71.33615	0.0000
LPTL	–2.234537	0.521423	–4.285459	0.0000
LTR	0.191207	0.087674	2.180874	0.0308

R-squared	0.956964	Mean dependent variable	0.722535
Adjusted *R*-squared	0.956074	S. D. dependent variable	0.264583
S. E. of regression	0.055453	Akaike info criterion	–2.920089
Sum squares residual	0.445878	Schwarz criterion	–2.839446
Log likelihood	221.5466	Hannan-Quinn criterion	–2.887325
Durbin-Watson stat.	1.3333366		

http://dx.doi.org/10.21511/bbs.14(1).2019.09

Table B8. Eviews Result 3

Dependent variable: *NLDST*
Method: Least Squares
Date: 11/12/16 Time: 20:13
Sample (adjusted): 2149
Included observations: 148 after adjustments
Convergence achieved after 9 iterations

Variable	Coefficient	Std. error	t-Statistic	Prob.
EFD	–0.327873	0.047027	–6.97206	0.0000
LDR	0.973217	0.014445	67.37427	0.0000
LPTL	–2.431545	0.5205581	–4.670831	0.0000
LTR	0.231944	0.088689	2.615244	0.0099
AR(1)	0.342405	0.079569	4.303229	0.0000

R-squared	0.961822	Mean dependent variable	0.723226
Adjusted R-squared	0.960754	S. D. dependent variable	0.265346
S. E. of regression	0.052566	Akaike info criterion	–3.020280
Sum squares residual	0.395141	Schwarz criterion	–2.919023
Log likelihood	228.5007	Hannan-Quinn criterion	–2.979139
Durbin-Watson stat.	1.890818		

Inverted AR Roots	0.34W

Source: CEIC, VCBs.

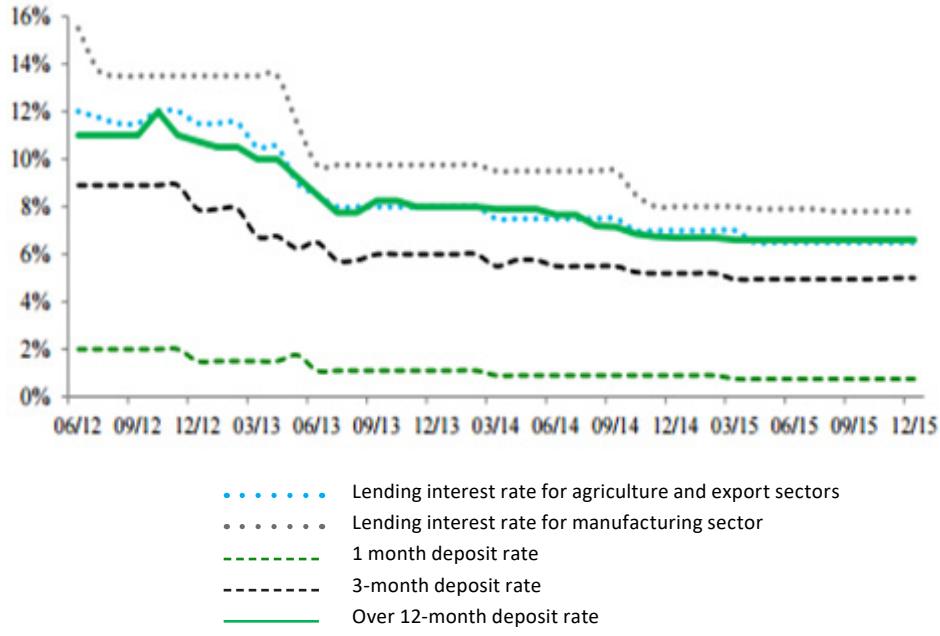

Figure B1. Deposit and lending rates of the commercial banks in Vietnam from June 2012 to December 2015

Source: BVS, Bloomberg.

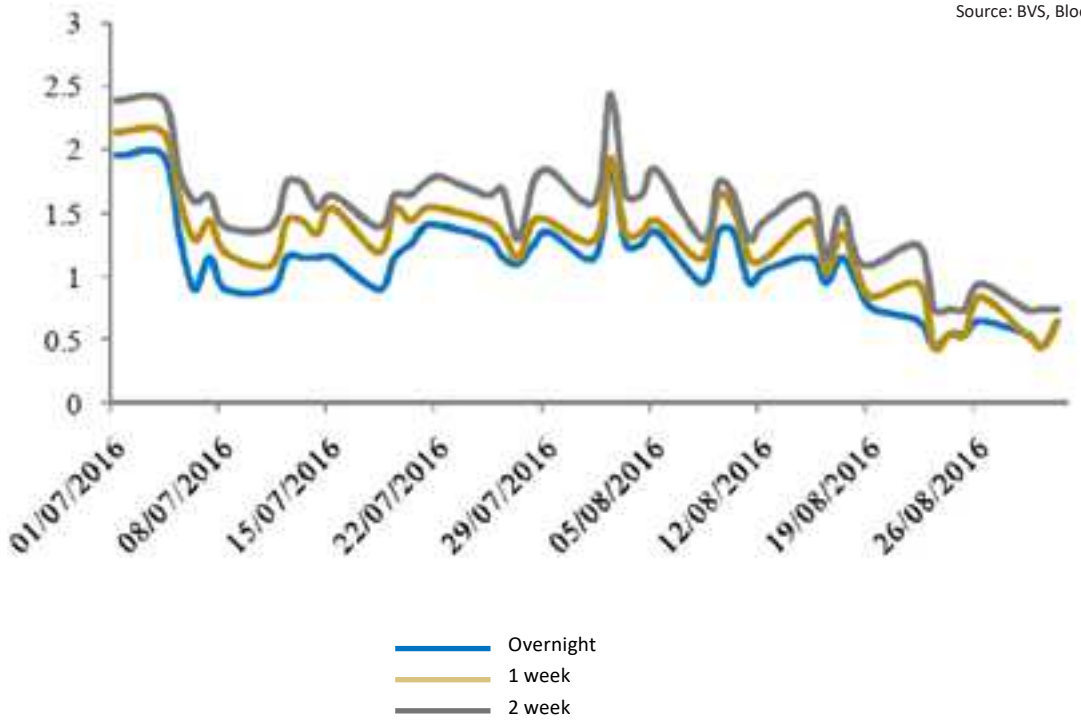

Figure B2. Interbank interest rate from July 1, 2016 to August 26, 2016

Source: SBV, VCBS.

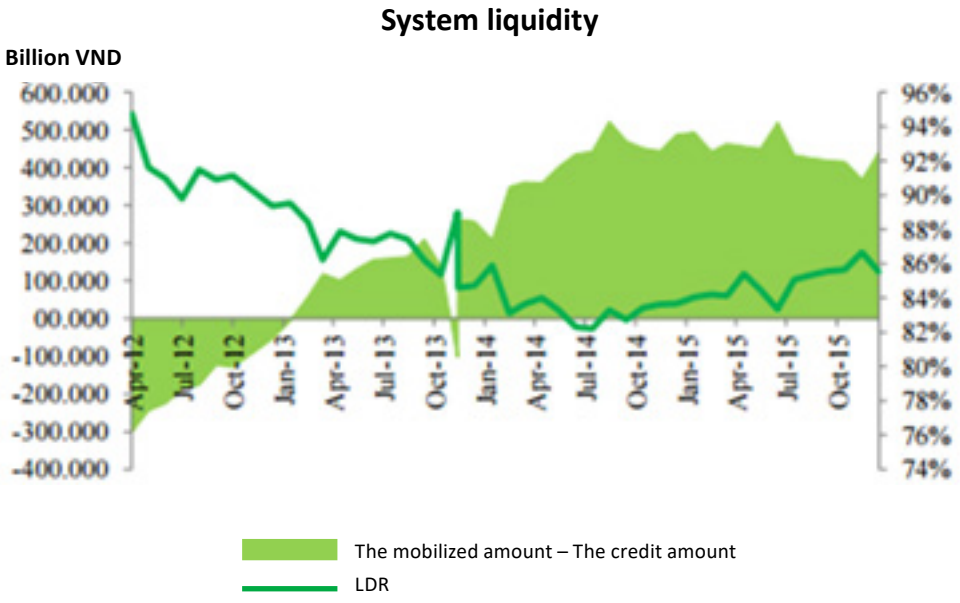

Figure B3. Liquidity of Vietnamese commercial banking system and LDR ratio from April 2012 to October 2015

http://dx.doi.org/10.21511/bbs.14(1).2019.09