MONETARY POLICY, CAPITAL REGULATION AND BANK LIQUIDITY: THE EVIDENCE FROM VIETNAM

Dr. T.S. Hanh Pham[1]

T.T. Loan Nguyen[2]

Abstract:

This article inspects the effectiveness of capital adequacy regulation and monetary policy instruments on bank liquidity. Analysing panel dataset of Vietnamese commercial banks during the period 2008- 2016 with an estimation model which controls for bank specific factors and macro-economic factors, we found capital adequacy has no statistically significant effect on bank liquidity and monetary policy instruments are more effective than capital adequacy regulation. Both required reserve ratio and refinancing interest rate have significant negative effect but the effect of central bank's transactions in open market operations is insignificant. Except non-performing loan, all of our control variables have significant impact on bank liquidity. Our paper provides several theoretical and managerial implications.

Keywords: Capital adequacy, the refinancing interest rate, required reserve rate, open market operations, bank liquidity, Vietnam.

[1] Senior Lecturer, Sheffield Business School, Sheffield Hallam University, the UK. email:s.h.pham@shu.ac.uk

[2] Lecturer, School of Banking and Finance, National Economics University, Vietnam.email: loanntq@neu.edu.vn

INTRODUCTION

A critical function of banks is to equip the economy with liquidity. Bank loans provide bank customers with the necessary funds to make investments. Bank liquidity creation is important for the economy but it plants the seeds of a financial catastrophe (Berger and Bouwman, 2017). Funding long-term, illiquid assets with short-term, liquid liabilities, banks encounter risk if some liabilities invested in illiquid assets are claimed at short notice (Distinguin *et al*., 2013).

The recent global financial crisis reveals the lesson that bank liquidity risk could cause the failure of banks and the whole financial systems. Part of the blame for the crisis has been put on monetary policy in which persistently low real interest rates fuelled a boom in asset prices and securitized credit, inducing financial institutions to take on increasing risk and leverage. In an attempt to avoid future crisis, governments around the world have tightened monetary policy to reduce bank liquidity risk since 2008. Regulators and policymakers tend to apply stricter regulations on banking systems. In particular, the Basel Committee on Banking Supervision (BCBS) issued the international endorsement of Basel III that requires enhanced quality and quantity of capital, a sufficient volume of stable funding, and the liquid assets (BCBS, 2009). Accordingly, in many advanced economies, banks must comply with capital adequacy ratios introduced Basel III- type regulation. In many developing economies such as Vietnam, their governments, despite not being ready to apply Basel III-type regulation, has taken macro-prudential measures, applying stricter regulation on bank capital adequacy.

The question of how monetary policy affects bank risk taking is key to the current debate over what role financial stability considerations should play in monetary policy decisions but few macroeconomic models have explicitly considered the impact of monetary policy on bank risk taking (De Nicolo et al., 2010). Meanwhile, little empirical evidence has been presented to back up the effectiveness of the tightening monetary policy in monitoring bank liquidity since the recent global financial crisis. In our best knowledge, Singh and Sharma (2016), Umar and Sun (2016) are the only studies we found considering the impact of capital

regulation on liquidity in the post crisis period but their studies did not consider other monetary instruments such as the required reserve ratio, the base interest rate imposed by the central bank to commercial banks.

To fill this gap, this article investigates the effect of monetary policy instruments and bank capital adequacy regulation on bank liquidity in the post crisis period. We developed conceptual model in which potential determinants of bank liquidity including bank specific factors and macro-economic factors are controlled. We applied a dynamic panel data estimation models with the use of GMM estimation method. We used panel data of commercial banks in Vietnam from 2008 - 2016.

The reason why we focused on the experience of Vietnam is the fact that the monetary policy framework has been extensively modified in Vietnam since 2008. The capitalization ratio of commercial banks in Vietnam has been remarkably raised in the period of the research. This was mainly propelled by Vietnamese government's regulation titled Decree No. 141/2006/ND-CP setting amount of legal capital which credit institutions must hold (Vietnamese Government Portal, 2006). Raising capital in a short period as stipulated by the regulation has created financial difficulties for many banks. Whether this policy has been active in reinforcing banks' liquidity capability and sheltering financial stability or causing such problems in Vietnam's banking system as using nominal amount of capital and cross ownership is questionable. Evidence from Vietnam could potentially facilitate understanding of the effectiveness of monetary policy instruments used to govern bank liquidity in the context of Vietnam, an emerging market which has been under researched.

Our paper makes four contributions to literature. *First*, our paper extends the debate on liquidity regulation by providing evidence that capital adequacy requirement is not an effective instrument. It even weakens the positive effect of the require reserve ratio on bank liquidity. *Second,* our paper contributes to the debates whether easing monetary policy can induce bank liquidity risk by providing evidence that the base interest rate has no statistical correlation with

bank liquidity. *Third*, our paper shows that among monetary policy instruments and regulations, only the require reserve ratio is a powerful instrument for monitoring bank liquidity. *Finally*, our paper adds to the literature an insight of monetary policy implementation in a context that is under researched.

THEORETICAL BACKGROUND AND HYPOTHESES

Bank liquidity

There are two key strands of literature studying bank liquidity: (i) funding liquidity literature emphasising on its definition and calculation, (ii) liquidity creation strand focusing on determinants of bank liquidity. One of significant research in funding liquidity strand is Drehmann and Nikolaou (2013) which argues that the sources of funding liquidity include depositors, asset market, interbank market, and central banks. A key research in liquidity creation strand is Berger and Bouwman (2009) which suggests a relationship between bank capital and liquidity creation and but the effect of bank capital is subject to bank size.

Funding liquidity literature proposes several definitions of bank liquidity. For instance, Brunnermeier and Pedersen (2009) define bank liquidity as the bank capability to raise cash at short notice. Drehmann and Nikolaou (2013) define bank liquidity as the bank's capability to settle obligations with immediacy. BCBS defines bank liquidity as the bank's capability to fund increases in assets and satisfy obligations at short notice (BCBS, 2009). These definitions all aim to indicate liquidity as bank's capability to settle its financial liabilities in a timely fashion and thus we define liquidity as such in this paper.

There are two main approaches used to develop the measurements of liquidity: (i) the liquidity gap and (ii) the liquidity/stock ratio. The liquidity gap approach considers the gap in bank's influx and efflux to decide the quantity of reserves needed during a period. The liquidity ratios/stock approach takes account of the balance sheet's asset and liability to determine liquidity tendencies. The liquidity gap method demands more data and it is more challenging to

measure than the liquidity/stock ratio method because is hard to anticipate incomings and outgoings. Thus, the liquidity ratios/stock method becomes widely used in empirical research (Hempel et al., 1994). Applying the liquidity ratios/stock approach, previous research developed several indicators to measure liquidity. So far, there are three measures of liquidity used in research: (i) the ratio of liquid asset per deposits and short-term borrowings; (ii) the ratio of liquid assets to total assets; and (iii) the ratio of cash and cash equivalent per total assets.

$$\text{Liquidity ratio (L1)} = \frac{\text{Liquid assets}}{\text{Deposits+Short term borrowing}}$$

$$\text{Liquidity ratio (L2)} = \frac{\text{Liquid assets}}{\text{Total assets}}$$

$$\text{Liquidity ratio (L3)} = \frac{\text{Cash and cash equivalent}}{\text{Total Assets}}$$

Among the three indicators, L1 is the most popularly used. It best reflects bank's capability to settle its financial liabilities in a timely fashion. L1 was recommended by Crosse and Hempel (1980), Hempel et al., (1994), Kosmidou et al. (2005) and Dinger (2009).

In practice, with the aim of specifying the liquidity measures at an operational level, the Basel Committee for Banking Supervision has recently introduced two indicators: (i) Liquidity Coverage Ratio (LCR) and (ii) the Net Stable Funding Ratio (NSFR) presented below:

$$\text{LCR} = \frac{\text{High Quality Liquid Assets}}{\text{Net cash out flows within 30 days}} \geq 100\%$$

$$\text{NSFR} = \frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} \geq 100\%$$

Bank capital adequacy requirement and liquidity

There are two set of theories presenting contrasting views about the relationship between bank capital and liquidity. One set of theories, referred to as the "financial fragility- crowding out", anticipate that a high volume capital which a bank keeps will reduce bank liquidity. This is

because: (i) higher capital kept is associated with less loans provided and leads to less liquidity creation – the ‘‘financial fragility structure’’; and (ii) higher capital ratios is associated with less deposits demanded and hence decrease liquidity creation - the ‘‘crowding-out of deposits’’(Distinguin et al.2013).

The second set of theories rest on the "risk absorption" hypothesis, which is directly linked to the risk-transformation role of banks, higher capital enhances banks' ability to create liquidity since it enables them to absorb bigger risk (Berger and Bouwman, 2009).

There are several empirical research reporting a negative impact of bank capital on liquidity (e.g., Berger and Udell 1994; Hancock et al., 1995). These studies are based on the panel datasets collected before 2008. The compound of changes in bank capital regulation and a recession makes it difficult to separate particular impacts and draw general conclusions (Berger and Bouwman, 2009).

The empirical evidence for the period after the crisis is scant. Singh and Sharma (2016) and Umar and Sun (2016) are the only studies we found considering the role of bank regulatory capital in the post crisis period. Using panel data set from India from 2000- 2013, Singh and Sharma (2016) found the positive impact of bank capital adequacy on liquidity. Umar and Sun (2016) using data from BRIC countries in the period 2002-2014 reported positive sign of capital adequacy on liquidity but the effect is not statistically confirmed.

Based on the "risk absorption" hypothesis, we argue that the more capital the bank has, the higher possibilities that the bank can mobilise amount of cash to settle its financial liabilities in short term or in other words the higher liquidity. As such, we propose that:

Hypothesis 1: Capital adequacy positively affects bank liquidity.

Monetary policy instruments and bank liquidity

Monetary policy consists of the actions of a central bank or other regulatory committee that determine the size of the money supply in an economy. Central banks use a number of tools to

shape monetary policy such as modifying the interest rate, buying or selling government bonds, and changing the amount of money that banks are required to keep in reserves. The require reserve ratio, refinancing interest rates and open market operations are believed to be the key monetary policy instruments that the central bank employs to regulate liquidity of the whole banking system.

The refinancing interest rate

The refinancing interest rate is the interest rate that the central bank charged for the loans it provides to commercial banks. It is also known as the base interest rate. Benchmark refinancing interest rates affect both deposit and lending rates which banks apply. The interest rate on deposits must not be higher than the cost of funds provided by the central bank, corrected for the cost of holding reserve requirements on deposits (Agénor and El Aynaoui, 2010). When refinancing interest rates is low, banks can set low deposit and lending rates. When borrowing is cheap, firms will take on more debt to invest in hiring and expansion; consumers will make larger, long-term purchases with cheap credit; and savers will have more incentive to invest their money in stocks or other assets rather than in saving accounts. This means less deposit and less financial liability which banks may have to settle in short notice while more cash earning comes from more lending and thus bank liquidity will increase. As such, we propose that:

Hypothesis 2: The refinancing interest rate negatively affects bank liquidity.

The required reserve ratio

The required reserve ratio is the ratio of cash and deposits which the central bank requires commercial banks to hold in the belief that with higher reserve ratio, a bank can better settle financial obligations short notice. However, higher reserve requirements put a damper on lending. An increase in the required reserve ratio means that the bank has less cash to lend so

less cash earning from lending, so lower capability to settle its financial liabilities in a timely fashion or in other word lower liquidity. As such, we propose that:

Hypothesis 3: The required reserve ratio negative affects bank liquidity.

Open market operations

A central bank use open market operations to regulate the money supply in an economy through buying or selling short-term government bonds. When a central bank sells bonds in OMO at attractive rates, banks buy bonds, so have less cash available to lend, leading to higher deposit and lending rates. Higher lending rate reduces demand for borrowing. Banks therefore earn less cash from lending, consequently less liquidity. When a central bank buys bonds in OMO at attractive rates, a bank sells bonds and has more cash available to lend, leading to lower deposit and lending rates. This leads to more lending and more cash earning from lending and thus more liquidity. Therefore, the net amount of bonds sold and bought by central bank in OMO negatively correlates to bank's cash availability and thus bank liquidity. As such, we propose that:

Hypothesis 4: Net amount of bonds sold by bought by a central bank in OMO negative affects bank liquidity.

Other potential determinants of bank liquidity

Bank specific factors

Bank size

It is not easy for small banks to raise capital from markets, and thus small banks incline to hold extra liquid assets (Freixas & Holthausen, 2005; Kashyap & Stein (2002); and Dinger (2009). Meanwhile, considering as "too big to fail", big banks tend to keep less liquidity. This results from an implicit guarantee of Lender of Last Resort in case of default occurrence as well as

low cost of funding (Iannotta et al., 2007). These arguments suggest bank size could be negatively related to bank liquidity.

Loan growth

Most loans are relatively illiquid asset. Thus, a rise in loans will lead to less liquidity (Pilbeam, 2005). In an investigation of the determinants of liquidity of English banks, Valla et al.(2006) found that liquidity is negatively related loan growth. However, more loans provided also means more cash earning inflows which raise bank liquidity. Vodova (2013) based on data from Hungary report a positive effect of loan growth. The evidence suggests loan growth could be a potential determinant of bank liquidity although the sign of the effect is ambiguous.

Non-performing loans (NPL)

Non-performing loans could undermine the confidence of depositors and investors in a bank. This could result in a bank run because of the fear of insolvency which consequently would weaken liquidity. Joseph et al. (2012) and Iqbal (2012) reported negative effect of NPLs on bank liquidity. The evidence suggests that non-performing loans could be a potential determinant of bank liquidity.

Bank interest margin (BIM)

Bank interest margin is the gap between bank's lending and deposit rate. The greater gap, the more bank wish to offer loans and consequently more loan giving reduces liquidity. Vodova (2013) report the negative effect of bank interest margin on liquidity. However, on the other hand, it can be said that BIM is one of key sources of bank net cash flows and income as thus the higher BIM, the more cash comes in and increase bank liquidity. Therefore, BIM could be a potential determinant of liquidity but the sign of its effect is ambiguous.

Macroeconomic factors

GDP growth

During the period of economic boom, economic entities invest more because of their confidence in the economy. However, when there are signals of economic downturn, investors decrease direct investment and keep more bank deposits (Acharya and Naqvi, 2012). The "loanable fund theory of interest" also suggests an increase in loan supply during an economic upturn and a decrease in economic downturn (Pilbeam, 2005). The negative effect of GDP growth on bank liquidity has been reported by Valla et al. (2006), Dinger (2009), and Delechat *et al.* (2012). The evidence indicates that GDP growth is a possible determinant of bank liquidity.

Inflation

Inflation rate reduces currency value. This induces bank customers to claim their deposits and put money in other investments with higher real yield, making banks more vulnerable in providing loans borrowing customers. Heffernan (2005) suggests that inflation rate significantly determine bank liquidity. Moussa(2015) based on data from Tunisian banks reports the negative effect of inflation rates on bank liquidity. Thus inflation is a potential determinant of bank liquidity.

Degree of liberalisation of financial market (FINDEP)

The ratio of total amount of deposits per GDP reflects the degree of liberalisation which is also known as a financial deepening of a financial market (Bunda & Desquilbet, 2008). Heffernan (2005) and Bessis (2009) propose that a highly developed financial system would have high ratio of deposit/GDP which create more business opportunities for banks, and thus the liquidity reserves held in the bank would become more plentiful. This suggests the degree of liberalisation of financial market is a potential determinant of bank liquidity.

Review of existing literature above suggests that bank size, loan growth, non-performing loan, bank interest margin, GDP growth, inflation, and financial depth can potentially affect bank liquidity. Our conceptual framework is presented in Figure 1 in which bank capital requirement, the base rate and the required reserve ratio are hypothesised to have significant effects on bank liquidity while size, loan growth, non-performing loan, GDP growth, inflation, and financial depth all potentially influenced bank liquidity and thus will be controlled in our empirical model.

(Insert Figure 1 here)

RESEARCH METHODOLOGY

Research context

Vietnam was selected as empirical context for this research. Vietnamese government implements its monetary policy through the operations of State Bank of Vietnam. The SBV has employed both administrative and money market instruments to monitor banking system. According to the State Bank of Vietnam Law of 2010, the SBV governor decides the use of tools for the implementation of the national monetary policy, including refinancing, interest rates, required reserves, open market operations and other measures as stipulated by the Government. The SBV provides short-term capital, or in other word, refinances financial institutions in the form of loans secured by the mortgage of valuable papers; discount of valuable papers and other forms of refinancing. The SBV is active open market operations, selling and buying government bonds. The SBV regulates the refinance rate and other types of interest rates to run the monetary policy. The SBV regulate the ceilings for deposit and lending rates applied by financial institutions. In the fear of bank run, the SBV has raised high capital adequacy level since 2008.

Data

Data related to banks is collected on the annual basis. We extracted bank specific data from banks' financial statements and Bank scope databases of 30 Vietnamese commercial banks in the period 2008- 2015. The sample represents 81% of Vietnam's commercial banks and 74% in terms of total assets. We extract macroeconomic data from World Bank's World Development Indicators (WDI, 2016).

As discussed earlier, there are several measures of liquidity but LCR and NSFR have yet been employed in Vietnam. According to FSI (2015), Vietnam was ranked as 2 (where: 1 = draft regulation not published, 2 = draft regulation published, 3 = final rule published, 4 = final rule in force, 5 = not applicable) in the survey of the status about the adoption of Basel II, 2.5 and III. This indicates, in Vietnam, draft regulations were published but final rule has not yet been published and enforced. Therefore, we use the traditional liquidity ratios/stock approach to measure liquidity. Specifically, we use L1, which is the most popularly used in previous research as it best reflects bank's capability to satisfy bank's capability to settle its financial liabilities in a timely fashion, to measure the liquidity of Vietnamese banks:

$$\text{Liquidity ratio} = \frac{\text{Liquid assets}}{\text{Deposits+Short term borrowing}}$$

Estimation model

Our dependent variable (liquidity) is possibly influenced by its own past values. We, hence, apply the dynamic panel model with a lagged dependent variable. The dynamic panel data model effectively tackles the reliance of dependent variable on its own past realizations. Accordingly, we develop the following equation to examine the impact of capital adequacy and other factors on bank liquidity:

$$L_{i,t} = \alpha + \beta_1 L_{i,,t-1} + \beta_2 CAP_{i,t} + \beta_3 FIR_t + \beta_4 RRR_t + \beta_5 OMO_t + \beta_5 Size_{i,t} + \beta_6 LG_{i,t} + \beta_7 NPL_{i,t} + \beta_8 BIM_{i,t} + \beta_9 GDP_t + \beta_{10} CPI_t + \beta_{11} FINDEP_t + \varepsilon_{it} \quad (1)$$

where:

L_{it} =Liquidity ratio of bank i at time t, measured by the ratio of liquid asset per deposits and short-term borrowings

$SIZE_{it}$, CAP_{it}, LG_{it}, NPL_{it}, $BIM_{i,t}$ are the size, capital adequacy, loan growth, non-performing loans and bank interest margin of bank i at time t.

$FIR_{t,}$ $RRR_{t,}$ $OMO_{t,}$ GDP_{t}, CPI_{t}, $FINDEP_{t}$ are the refinancing interest rate, the required reserve ratio, net amount central bank's bonds sold and bought, GDP growth, inflation rate and financial depth at time t.

ε_{it} = the error term.

$L_{i,t-1}$= The lagged dependent variable.

Table 1 provides details of our variables' measurements.

(Insert Table 1 here)

Estimation strategy

We conducted various tests to diagnose our panel dataset. First, we checked multicollinearity problem by examining correlation coefficients among predictors and their Variance Inflation Factor (VIF). As shown in Table 2, all of the VIFs are smaller than 10, suggesting that multicollinearity does not appear to be a problem with this data (Hair et al. 2006). Second, we examined the potential autocorrelation of dependent variable. Following Arellano and Bond (1991), we conducted AB tests. The results of p = 0.3291 for AR(1); p=0.5891 for AR(2); p = 0.1897 indicate that there is no autocorrelation in the sample. Third, we conducted Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. The result of p= 0.006 indicates that heteroskedasticity exist in our data. Fourth, we checked endogeinity by using instrumental variables Two State Least Square regression test. The results of p = 0.587 for Durbin score and p = 0.743 for Wu-Hausman suggest that endogeinity may exist in our sample. To address the issue of endogeinity caused by heteroskedasticity, we used Generalized Methods of Moments (GMM) estimation method. GMM is an effective method to address the econometric problems

associated with endogeneity which our data exposes to (see Arellano and Bond, 1991; Wooldrige, 2010 for detail explanation). GMM is also one of the most suitable methods to address the dynamic panel bias caused by the existence of lagged dependent variables (Hankins, 2013). This method is also able to address potential endogeneity problem by utilising the lags or first differences of instrument variables. To check robustness of our estimation model, we conducted Sargen tests, Arellano-Bond test for AR(1), (2).

RESULTS

The summary of statistics for the variables used in our study and correlations between explanatory variables is presented in Table 2.

(Insert Table 2 here)

Table 3 show the results obtained from our regression model. As shown in Table 3, p-values of Hansen test obtained from the two estimation models are all higher than 0.05, indicating that the validation of the instrumental variables is achieved (Hansen, 1982). Likewise, p-values of AR(1) and AR(2) in excess of 0.05 indicates that instruments are valid (Arellano and Bond, 1991). The results of these robustness tests suggest that our estimation method is appropriate and our estimation model is robust.

The regression results show that capital adequacy does not have statistically significant effect on bank liquidity (p =0.902). Therefore, Hypothesis 1 is rejected. The refinancing rate has statistically significant negative effect on bank liquidity (p=0.000; β=-78.860), so Hypothesis 2 is confirmed. The required reserve ratio also has statistically negative significant effect (p = 0.084, β = -259.100). Hypothesis H3, thus, is confirmed. The effect of the central bank's transactions in OMO is not statistically significant (p = 0.52). So hypothesis 4 is not confirmed.

(Insert Table 3 here)

DISCUSSION ANH CONCLUSION

This article investigates the effect of monetary policy instruments and bank regulatory capital on bank liquidity. Analysing panel data set of banks from Vietnam in the post crisis period 2008-2015 with the application of dynamic panel data regression model and GMM estimation method, we found that capital adequacy has no significant effect on bank liquidity and monetary policy instruments are more effective than capital adequacy regulation. Both the required reserve ratio and refinancing rate have significant negative effect but the effect of central bank's transactions in open market operations on bank liquidity is insignificant.

Our finding of insignificant effect of capital adequacy is consistent to Umar and Sun (2016) which use data from BRIC countries in the period 2002-2014 and reported no significant effect of capital adequacy on bank liquidity in both before and the post crisis period. However, our finding is not in line with the studies relying on the evidence from before or during the crisis period (Singh & Sharma, 2016; Vodova, 2013; Delechat *et al.*, 2012; Bunda & Desquilbet, 2008). In the pre-crisis period, easing monetary policy likely led to under-regulated financial markets which spread the recklessness of bankers. Consequently, the crisis occurred as result of illiquidity in insolvent banks. This explains why studies using data in this period show that higher capitalized banks would have a better liquidity position. In the post-crisis, the fear of the future financial crisis leads to the tendency of overregulating banking systems around the world. Our study shows that overregulation, specifically, the use of high bank regulatory capital rate like what Vietnamese government has applied since 2008 does not help banks to increase their liquidity, even worse it has tendency to damage liquidity.

Our finding suggest that monetary policy instruments including required reserve ratio and refinancing interest rate but not the central bank's transaction in OMO is effective tool for a central bank to influence bank liquidity.

Among our control variables, only non- performing loan does not have significant effect on bank liquidity, all other control variables including bank size, loan growth, bank

interest margin, GDP growth, inflation and financial depth have statistically significant effect on bank liquidity while non-performing loan and inflation do not have significant effect on liquidity. Although the control variables are not of our main concern, our results support for several existing assumptions. In particular, our result of significant effect of GDP on bank liquidity supports the theory of cyclical behaviour of liquidity holdings and the "loanable fund theory of interest". Our study supports Acharya and Naqvi's (2012) suggestion that the optimal monetary policy should involve a “leaning against liquidity” approach of which central banks should employ a tightening monetary policy when there is excessive bank liquidity to avoid bank risk taking, and apply an easing monetary policy in times of scarce liquidity to promote investment. Our finding of significant effect of financial depth on bank liquidity supports for Heffernan (2005) and Bessis (2009) proposition that a highly developed financial system would create more business opportunities for banks, and thus the liquidity reserves held in the bank would become more plentiful.

Based on our findings, we provide four contributions to literature. *First*, our paper extends the debate on liquidity regulation by providing evidence that capital adequacy requirement is not an effective instrument. It even worse tends to weaken bank liquidity. *Second,* our paper contributes to the debates whether easing monetary policy can induce bank liquidity risk by providing evidence that the base interest rate has no statistical correlation with bank liquidity. *Third*, our paper shows that among monetary policy instruments and regulation, required reserve ratio and refinancing interest rate are powerful instruments for monitoring bank liquidity. *Finally*, our paper adds to the literature an insight of monetary policy implementation in a context that is under researched.

Our paper provides several policy implications for regulators and bank managers. We suggest that regulators should not rely on capital adequacy regulation to manage bank liquidity. The central bank should use refinancing rate and required reserve ratior to manage bank liquidity. In addition, managing bank liquidity must be based on economic conditions and

credit policy. We suggest governments to counterbalance economic development policy and financial stability policy. During the boom of economy, it is necessary to apply monetary policy in combination with capital adequacy regulation while in the economic downturn it is not advisable. We advise bankers to assure a suitable level of loan growth and interest rate margin to enhance bank liquidity.

Our study has some shortcomings. *First*, our sample is small and has short time frame, only cover the post crisis period. Future research could select data from more countries in longer period. *Second*, we did not use the two measures of liquidity suggested by the BCBS as data is unavailable. We suggest that in order to make meaningful interpretation of effect of capitalization regulatory and monetary policy instruments in the post crisis, future research should use LCR and NSFR to measure liquidity.

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Table 1. Variables description

Variables	Description	Measurement	Data source
Liquidity	Liquid assets to deposits and short-term funding	Cash, short-term claims on other credit institutions and trading porfolio / customer deposits and short-term funding (USD)	BankScope
SIZE	Bank size	Natural logarithm of total assets	BankScope
CAP	Bank capitalization	Equity/Total assets (%)	BankScope
LG	Loan growth	Annual growth rate of loans (%)	BankScope
NPL	Non-performing loan ratio	Non-performing loans/Total loans (%)	BankScope
BIM	Bank interest margin	Lending rate minus deposit rate (%)	BankScope
GDP	GDP growth of Vietnam	Natural logarithm of GDP per capita (USD)	World Bank/WDI
FINDEP	Financial depth of Vietnam	Credit / GDP (%)	World Bank/WDI
CPI	Inflation rate	Consumer price index (%)	World Bank
FIR	Refinancing interest rate	the interest rate at which a central bank applies when lends commercial banks (%)	Vietnam State bank
RRR	Required reserve ratio	The ratio of cash and deposits required by the central bank to be kept at commercial banks (%)	Vietnam State bank

OMO	Amount of central bank's sale of bonds in OMO	Total amount of central bank's sale of bonds in OMO (USD)	Vietnam State bank

Table 2: Descriptive Statistic and Correlation Matrix

Variable	Mean	S.D	Min	Max	L	SIZE	CAP	LG	BIM	NPL	GDP	FINDE	CPI	DR	OMO	RRR	VIF
L	33.15	0.031	0.05	0.129	1												
SIZE	5.341	1.179	3.51	8.312	-0.149	1											2.34
CAP	12.55	15.35	-1	169.9	0.337	-0.195	1										1.85
LG	0.264	0.306	-0.299	1.649	0.031	0.05	-0.045	1									2.17
BIM	3.3	1.372	-0.3	9.75	-0.089	0.107	-0.021	-0.031	1								1.76
NPL	4.32	5.592	0.02	37.59	0.389	-0.266	0.381	-0.292	-0.098	1							1.53
GDP	6.87	0.105	6.709	7.032	-0.325	0.176	-0.112	-0.341	0.077	0.005	1						5.2
FINDEP	111.2	11.88	86.9	128.3	-0.154	0.09	-0.127	0.026	-0.007	-0.013	0.555	1					7.81
CPI	0.098	17.28	2.28	99.71	0.27	-0.109	0.142	0.023	-0.062	0.013	-0.72	-0.762	1				6.49
FIR	0.074	0.069	0.009	0.231	0.158	-0.02	0.166	-0.134	-0.087	0.029	-0.348	-0.496	0.79	1			5.35
OMO	0.013	0.024	0.045	0.118	0.225	-0.07	0.187	-0.011	-0.097	0.032	-0.614	-0.679	0.888	0.922	1		4.42
RRR	0.087	0.004	0.01	0.02	0.251	-0.133	0.036	0.205	-0.023	0.005	-0.626	-0.264	0.514	0.126	0.345	1	1.48

Table 3. Results of dynamic panel-data estimation, one-step difference GMM

Variables	Coef.	Std.E	P	Hypothesis testing result
Lt-1	-0.107	0.092	0.248	
SIZE	2.473	0.931	**0.008**	
LG	2.897	1.697	**0.088**	
NPL	-0.475	0.536	0.375	
GDP	-73.210	17.283	**0.000**	
BIM	-1.289	0.642	**0.045**	
CPI	-49.810	13.740	**0.000**	
CAP	-0.014	0.113	0.902	H1 is not confirmed
RRR	-259.100	150.100	**0.084**	H2 is confirmed
FIR	-78.860	20.550	**0.000**	H1 is confirmed
OMO	15.200	28.360	0.592	H1 is not confirmed

Arellano-Bond test for AR(1): p = 0.078

Arellano-Bond test for AR(2): p = 0.463

Sargan test of overid. restrictions: p = 0.783

Hansen test of overid. restrictions: p = 0.729

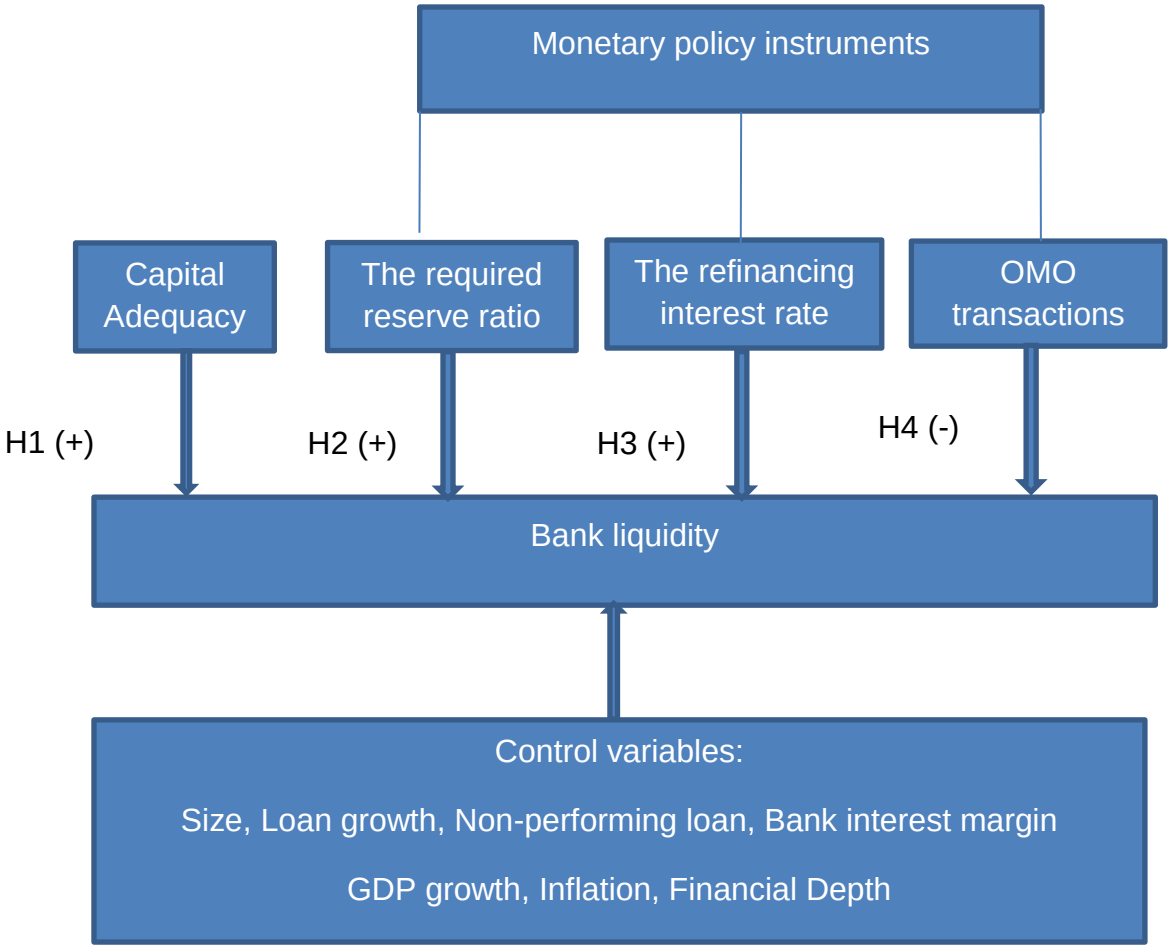

Figure 1: Conceptual model