

Determinants of banking liquidity in Vietnamese commercial banks

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Abstract—This paper measures the liquidity of Vietnamese commercial banks from 2007 to 2017 and tries to detect possible influencing factors. Using a multivariate dynamic panel regression, we examine the effects of two sets of possible determinants: macroeconomic factors, like monetary policy or economic strength, maybe bank characteristic factors, like size or profitability. Analyzing a dataset composed of 20 commercial banks in Viet Nam, we found highly significant impacts of economic indicators and bank-specific factors on banking liquidity. The study points out that increasing the national savings rate and the financial market's liquidity helps improve the liquidity ability of commercial banks in Viet Nam, while the consumer prices index has the opposite effect. Interestingly, both total assets and profitability of commercial banks have a positive impact on LDR.

Index Terms—Liquidity, commercial bank, Viet Nam.

I. INTRODUCTION

LIQUIDITY creation is proved to be one of the most important goals of the banking system (Berger and Bouwman, 2009). More broadly, banks can be seen as pools of liquidity in the economy through accepting deposits, sources of liquidity, and investing in long-term debt or holding less liquid assets [17]. This process allows banks to provide liquid assets to both depositors and borrowers: depositors are offered their deposits, borrowers are given long-term availability of cash through loans. Though, this structure is still the root of banks' potential fragility. Therefore, commercial banks must always store enough liquidity for operation [19].

After the global financial crisis in Viet Nam in 2008-2009, the economy has faced many difficulties, such as low GDP growth, high consumer price index (CPI), stagnated production, weakening purchasing power, and increasing unemployment... Commercial banks were influenced directly and powerfully, especially in liquidity on the systematic and individual aspects in the 2010-2012 period [24]. This situation indicated that bank liquidity was impacted by many macro and microeconomic factors. That is why our study tries to add deeper insight and more information to the minor existing body of literature. We build and test a panel regression model to determine possible influential factors on commercial banks' liquidity, mainly focusing on separate roles of bank-internal factors such as size or profitability and external factors like monetary supply growth, national savings rate and CPI.

We contribute to the available literature in some ways. First, it provides empirical evidence for the determinants of bank liquidity, which included macroeconomic and microeconomic factors in emerging economies. Second, this paper makes a trial to calculate the liquidity of the financial market,

formed from 4 separate segments, including interbank market, stock market, forex market, and bond market. Based on the obtained index, we estimate its influence on banks' liquidity in Vietnam, similar to [22] and [32] study.

By performing these analyses, following Section 1, the structure of this study includes 5 main Sections. The second section is a literature review about the influential factors on banks' liquidity. This is followed by section 3, which combines the variables description and research methodology. Section 4 analyzes the model results. The recommendations and conclusion are presented in sections 5 and 6, respectively.

II. LITERATURE REVIEW

In recent years, many studies have examined the determinants of bank liquidity, although very few are done in bank-based financial systems. The factors that were categorized affecting banks' liquidity can be grouped as banks' specifications and macroeconomic factors.

A. Banks' Specifications

Banking liquidity has been found to be impacted by many factors like bank borrows, profitability, equity/total asset, operational cost/total asset... Among them, the relationships between banking liquidity and total asset profitability have not been apparent.

Firstly, the results of the earlier research about the impact of size on liquidity are not homogenous. There are two opposing arguments regarding this relationship. The "too-big-to-fail" party states that large banks have considerable advantages in liquidity management, such as priorities in access to capital markets as well as central bank's lending window, more vital ability to screen and monitor borrowers... However, this fact leads to invert choice when the most significant bank has the least liquidity on its balance sheet to maximize profitability. Many studies support this tendency, such as [18], [26], [22]... In Viet Nam, [21] found a negative impact of the total asset on banking liquidity.

On the other hand, the opposite argument shows that bank size has a positive effect on liquidity. Smaller banks that focus on intermediaries and convertible operations have a smaller amount of liquidity. This phenomenon is also confirmed by [4] and [35]... Similarly, [28] had found identical outcomes in Vietnam.

Second, banks' liquidity and profitability are often on the two opposite sides of a rubric, and the effect of profitability on liquidity has been investigated. Ref [30], [26] and [31] found the negativity of this affection when they improved

that holding liquid assets rooted to lower profitability as an opportunity cost for banks. Reverse, the combination of two theories, name as "expected bankruptcy cost" and "liquid assets as a buffer" would explain the positive effect of profitability on liquidity, whereby banks having more liquid assets benefit from advantages in funding markets, lower their financing costs and higher profitability [5]. The close empirical evidence had been exposed in the research of 15 commercial banks in Malaysia from 2003 to 2012 [10]. In Viet Nam, the situation is not different, the applied researchers discovered that bank profitability has a positive impact on liquidity [21]; however, that is the only study we have found.

B. Macroeconomic Factors

At first, national savings rate: In nominal terms, bank liquidity may be increased when the national savings rate increases. Because people have more money to invest when savings grow. As a result, the bank loan demand reduces. Maybe, the exceeded "free" money also is spared in a bank. This leads to the supply of bank deposits increasing. These two tendencies keep bank liquidity in good condition. Though the results of empirical research show different stories, and sometimes they are contrasted. Such as [29] argued that the savings rate increases due to higher-income, which increases as a result of lower unemployment. All of these may come from the rise of bank loans for investment, resulting in more inferior funding liquidity. Through the empirical study in German saving banks from 1997 to 2006, Ref [26] also found a slightly significant and negative coefficient between savings rate and bank liquidity. In Viet Nam, we have not discovered any papers related to this issue.

Second, money supply growth: The increase of money supply from the Central Bank will immediately impact bank liquidity since the added money has to go through the bank system to reach the real economy. There are numbers of single-country papers that showed that tightened monetary policies, interest rates, harm liquidity ([9]; [16]; [32]). Nevertheless, in Viet Nam, this circumstance is not found [28].

Third, consumer price index: On the one hand, the informational friction theory means that a rise in the inflation rate reduces the return on assets subsequent to credit constraints and thus increases the bank's liquidity. This theory is supported by [7] findings and [2]. On the other hand, [27] argued that a high inflation rate increases customers' loans because inflation reduces purchasing power, leading to lower liquidity. The equivalent consequence has also been found in many other kinds of research, such as [32], [22]... In none of the above cases, Munteanua (2012) found that CPI positively impacts bank liquidity before the crisis period and converse relationship when the crisis has gone. In Viet Nam, [28] also discovered that the CPI in the previous year has a positive impact on current year bank liquidity.

Fourth, the liquidity of the financial markets: The empirical studies encompass a vast stream of examinations that measure the multi-level dependencies between liquidity level and financial asset price in the context of asset returns and aggregate market liquidity risk or financial market runs [35]. Ref [34] found a positive connection between market risk and changes in loan-to-core deposits ratio after 1994, against before 1994. Although the intimate relationship be-

tween financial market liquidity and banking liquidity has been proved, especially after the global crisis in 2008-2009, such as [25], [1]... However, the researchers mostly took part in the economy with the market-based financial system, and the results only focus on the effect of the stock market on bank liquidity. Typically, ref [12], [3]... reveal that bank liquidity and stock market turnover (liquidity) were inversely related. In like manner, the study conducted by [11] argues that banking and stock market activities are complements when banking development and stock market liquidity will positively impact each other and economic growth.

In summary, bank liquidity has been investigated in many kinds of research, but factors' impacts are unclear. That is why we develop this paper to determine possible influential factors of commercial bank liquidity. Through a dynamic panel model, the different roles of bank-internal factors such as size or profitability, and external factors like monetary supply, national savings rate, CPI will be transparent.

Based on the literature reviews, the following hypotheses are proposed:

Total asset: The stark variation in size differences between commercial banks in Vietnam helps us to investigate the impact of total assets on liquidity. Based on the "too big to fail" theory, we assume that the larger bank has less liquidity than the smaller one.

Hypothesis 1: Total asset has a positive effect on LDR

ROAA: We use ROAA to show whether a bank's profitability has any influence on liquidity. Profit may help increase the bank's equity and add more funds for business, such as lending, maturity transformation. Thereby, an increase in return might thus trigger an immediate increase in LDR.

Hypothesis 2: ROAA has a positive effect on LDR

National savings rate: The increase in the national savings rate can result in more sources for investment in the economy. As the result, the demand for lending capital from the bank may decrease. At the same time, the demand for bank deposits may grow. All of these may lead to reducing LDR in the condition of increasing the national savings rate.

Hypothesis 3: National savings rate has a negative effect on LDR

Monetary supply growth: A monetary policy contraction has a direct impact on banks and banks' customers (firms) because of not only decreasing the amount of loan supply or surging the price of loans but also making it harder for firms to borrow through additional financial constraints. The tightening in monetary policy will result in decreasing aggregate lending and vice versa. That is why we assume that monetary supply growth leads to a rise in LDR.

Hypothesis 4: Monetary supply growth leads to an increase in LDR

Consumer Price Index: When CPI gets higher, a commercial bank may lend more to offset the added interest expenses. Moreover, under competitive pressure, total deposits may decrease so that LDR may increase.

Hypothesis 5: Higher CPI leads to higher LDR

Financial market liquidity: based on the theory of liquidity management, the liquidity needs of a commercial bank can be met by internal or external resources. In reasonable terms of liquidity in the financial market, banks can quickly

mobilize capital from outsources. Furthermore, the demand for bank credit has also reduced as firms can easily access the capital market and raise money. Therefore, the better liquidity of the financial market can help reduce the LDR in the banking system.

Hypothesis 6: Better liquidity of the financial market helps reduce the LDR

The difference between the groups of banks: This model also investigates the difference in LDR between two groups of banks. In Viet Nam, the state banks or banks dominated by the state owners often have higher LDRs than the others. We assume that when the financial market liquidity changes, the difference may be higher.

Hypothesis 7: The difference between the groups of banks in LDR is higher when the liquidity of the financial market changes.

TABLE III
THE HYPOTHESES

Variable	Sign	Expected impact
<i>Dependent variable</i>		
Bank liquidity	LDR	
<i>Independent variables</i>		
Total asset	LnTA	+
Profitability	ROAA	+
National savings rate	SAV	-
Monetary supply growth	M2	+
Consumer Price Index	CPI	+
Financial market liquidity	MAR	-

Sources: Author

III. DATA AND METHODOLOGY

A. Data

This study uses panel data to examine the determinants of Vietnamese commercial bank liquidity. Because panel data that consists of both time series and cross-sectional elements has outstanding advantages. It helps increase the degrees of freedom, reduce collinearity, improve the efficiency of estimates, and assist in passing the inherent multicollinearity between the independent variables. Moreover, panel data can measure and identify effects that cannot be detected in pure time-series or cross-section data.

At first, this study adopted the ratio approach to measure bank liquidity because academic literature prefers it as a more standardized method [31]. There are several valuable indexes, but we chose the loan to deposit ratio (LDR) to proxy for bank liquidity. The reason is that it can cover the interaction between a risky asset (loan) and the major resource of the bank liquidity (deposit). The raw data is extracted from Vietnamese commercial banks' annual income statements and balance sheets from 2007 to 2017. The original sample contained 35 banks but the data cleaning process eliminated banks that had joined mergers and acquisitions or had missing values in 2007-2017. Finally, we got the strongly-balanced panel data, including 220 items from 20 commercial banks.

Second, financial market liquidity was calculated based on [15]. This method is quite suitable for VietNam because of the near nature of the economic systems in the two countries. Both of them are bank-based financial systems and at the same development level. However, we made some adjusted

points for Vietnamese to build the indicator with the exact meaning as in Czech. In the following paragraph, we describe what we had done with our financial market data in detail.

For each relevant market, time series data were first normalized (using mean and standard deviation) and then averaged on each side of the five dimensions are shown in Table I. They were treated as equal parts of the compiled sub-index for each market segment, which is subsequently smoothed. Finally, the overall market liquidity index is calculated as a simple (unweighted) average of these four (smoothed) sub-indices.

TABLE I
DIMENSIONS OF FINANCIAL MARKET LIQUIDITY INDEX

Dimension	Description	Interbank market	Forex market	Bond market	Stock market
<i>Tightness</i>	Bid-ask spreads	O/N, 1W, 2W, 1M, 2M, 3M spreads	Daily VND exchange rate to USD	1, 2, 3, 5, 7, 10 and 15-year government bond references prices	Highest and lowest price spreads
<i>Depth</i>	Daily turnover	Daily volume	Daily turnover between commercial banks	Daily trading volume on the secondary market	Daily turnover
<i>Resiliency</i>	Return to volume ratio	Daily change in interest rate/daily turnover	Daily USD/VND exchange rate/Daily turnover	Daily change in 7-year interest rate/ daily turnover	Daily change turnover
<i>Liquidity premia</i>	Spreads between alternative assets with different degrees of liquidity			Spreads between 2 and 1 years interest rate	
<i>Volatility</i>	30 days historical volatility	Change in O/N interest rate in 30 days (interest rate on day 30 minus in day 1)		Change in the 7-year interest rate in 30 days.	VNIndex in 30 days
<i>Indicator</i>		Interbank Indicator	Forex Indicator	Bond Indicator	Stock Indicator
		Market Liquidity Indicator			

Sources: Author

All the data must be collected from the most reliable resources in Vietnam. Firstly, the banking data resource is the commercial (and widely used) Bankfocus database compiled by International Bank Credit Analysis Limited (IBCA). The financial market figures were aggregated from Bloomberg, Reuters, Vietnamese Bond Association, Ho Chi Minh Stock Exchange (HOSE). The macro indicators were obtained from ADB's yearly statistical database, including national savings rate, monetary supply growth, CPI.

B. Empirical model

A linear equation is used to perform the regression. Based on [29], [22]..., the model is represented by equation (1).

$$\text{LDR}_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it} \quad (1)$$

β_0 : Constant;

LDR_{it} : Loan to Deposit Ratio of commercial bank i in year t ; $t = 2007$ to 2017 ;

X_{it} : independent variables, covering:

LnTA_{it} : Logarithm of the total asset of commercial bank i in year t ;

ROAA_{it} : Return on average total assets of commercial bank i in year t ;

SAV_t : National savings rate in year t ;

M2_t : Monetary supply growth in year t ;

CPI_t : Consumer Price Index in year t ;

MAR_t : Financial market liquidity in year t ;

D_i : commercial bank group, $D = 1$ if it is a state bank or a bank dominated by the state owner, and $D = 0$ if a bank is private.

β_j : parameters of independent variables to the dependent variable.

ε_{it} : residual of the model.

TABLE II
DIMENSIONS FOR VARIABLES

Sign	Variable	Type	Value	Unit
LDR	Loan to Deposit Ratio	Continuous	From 0 to 1	Point
LnTA	Logarithm of the total asset	Continuous	From 0 to ∞	Point
ROAA	Return on average total assets	Continuous	From 0 to 1	Point
SAV	National savings rate			
M2	Monetary supply growth			
CPI	Consumer Price Index			
MAR	Financial market liquidity			
D	Bank group	Disjointed	0 - 1	Dummy

Sources: Author

IV. EMPIRICAL RESULTS

A. Descriptive Statistics

The summary statistics of all upper variables are indicated in Table IV.

TABLE IV
SUMMARY STATISTICS OF VARIABLES

Variable	Obs	Mean	Std.Dev.	Min	Max
LDR	220	86.741	23.943	23.51	251.77
LnTA	220	11.414	1.314	7.219	13.975
ROAA	220	.998	.946	-5.99	7.94
SAV	220	29.562	1.538	27.25	32.01
M2	220	22.057	9.725	12.07	46.12
CPI	220	8.407	6.107	.6	19.89
MAR	220	.605	.122	.34	.72

Source: Author's calculation in STATA.

Table V presents the correlation matrix of the various variables used in our study. At the first glance, the correlations are all less than 0.8. Along with this, the correlations of the dependent variable with other independent variables are also small, from 0.094 to 0.565.

TABLE V
CORRELATION MATRIX OF KEY VARIABLES

Variables	LDR	MAR	LnTA	ROAA	SAV	M2	CPI
LDR	1.000						
MAR	-0.221	1.000					
LnTA	-0.070	0.357	1.000				
ROAA	0.094	-	-	1.000			
SAV	0.046	-	-	0.015	1.000		
M2	0.263	-	-	0.278	0.505	1.000	
CPI	0.238	-	-	0.263	-	0.255	1.000
		0.565	0.369		0.257		

Source: Author's calculation in STATA.

The magnification coefficient (VIF) shows that the multicollinearity phenomenon did not occur in the model. The average VIF is 2.154, the component VIFs range from 1.163 to 3.469 (Table VI).

TABLE VI
VIF

	VIF	1/VIF
LnTA	2.07	.483
ROAA	1.163	.86
SAV	1.833	.546
M2	2.884	.347
CPI	2.134	.469
MAR	3.469	.288
DMAR	1.525	.656
Mean VIF	2.154	

Source: Author's calculation in STATA

B. Regression Analysis

To regress the data, Pooled OLS, FEM, REM and GMM methods were applied to get the best result. We also included the first lag of the dependent variable to consider any possible autoregressive effects. Table VII shows that bank-specific and contextual variables have economically and statistically significant impacts on banks' liquidity.

The original model is estimated by the usual panel data regression method, and the hypotheses of the Pooled OLS model are tested. However, the hypothesis is violated.

Therefore, REM and FEM estimation methods continue to be considered for use. Hausman Test results show that FEM is more suitable for estimation. However, the model appears to be an endogenous phenomenon, so the estimated effects are not reliable. GMM regression method continues to be used (similar to the study of [22], [26]).

The study using the Sargan Test obtained the p-value coefficient of $1,000 > 0.05$. Thus, the instrumental variable used satisfies over-identifying. The second-order autocorrelation test obtained a p-value of $0.6929 > 0.05$, so the model's residuals are not quadratic autocorrelation. Therefore, using the GMM model has solved the model's defects. The results found are solid and fully analyzable. The final results are interpreted according to the GMM method.

Firstly, with the bank-specific factors, total assets and ROAA affect liquidity in two opposing ways. As can be seen in the table, the coefficient of LnTA is significant and posi-

TABLE VII
RESULTS OF THE REGRESSIONS

	Pooled OLS	FEM	REM	GMM
LD.LDR	0.145*	0.103*	0.109	-0.0247
	[1.75]	[1.83]	[1.17]	[-0.69]
L.LDR				0.0299
				[0.30]
LnTA	-0.772	1.264	0.666	16.82***
	[-0.48]	[0.41]	[0.19]	[3.79]
ROAA	2.169	4.447***	4.274***	9.774***
	[1.23]	[3.50]	[3.76]	[4.18]
SAV	-1.406	-1.339*	-1.335*	-1.782***
	[-1.28]	[-1.93]	[-2.43]	[-4.64]
M2	0.157	0.127	0.126	0.218
	[0.49]	[0.64]	[0.67]	[1.46]
CPI	0.738**	0.777***	0.764***	1.060***
	[2.48]	[3.94]	[3.34]	[7.80]
MAR	-36.75	-36.16	-34.90*	-109.5***
	[-1.05]	[-1.32]	[-1.81]	[-3.54]
DMAR	26.01***	14.06	20.88	94.13
	[3.62]	[0.38]	[1.40]	[0.61]
cons	147.2***	120.4***	126.1***	-24.10
	[3.25]	[3.30]	[3.34]	[-0.51]
N	180	180	180	160
R-square	0.214		0.332	
Breusch and Pagan test			0.0000	
Hausman test			0.999	
Sargan test				1.0000
Arellano-Bond test				0.9624

T statistics in brackets

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: Author's calculation in STATA

tive, so the first hypothesis is accepted. The "too big to fail" theory comes true in Vietnam. Since the banks increase total assets, they tend to let their customer borrow more money to get a higher LDR. This is in line with many earlier findings, such as [26], [22]... Similarly, ROAA is found to have a positive effect on LDR in all calculation methods. This suggests that a bank that generated high profit likely held a relatively high loan to deposit ratio as higher profitability would result from increasing engagements in lending activity.

Second, with the outside factors, SAV and the liquidity of the financial market have negative impacts on liquidity, against CPI. Specifically, SAV is found to negatively affect LDR, suggesting that Vietnamese banks face a reduction in credit demand and a rising deposit supply when the national savings rate increases. In the same direction, the relationship between LDR and financial market liquidity is negative ($p < 0.01$). In other words, financial market liquidity has a positive effect on bank liquidity. In line with the researcher's expectation, CPI positively links LDR with LDR ($p < 0.01$). This finding is consistent with [22] and [32]. As suggested banks tend to increase its interest revenue (through a more aggregate loan) to offset addicted interest expenses when CPI increases.

Nevertheless, the model did not find any evidence about the relationship of monetary supply growth and the group of banks with bank liquidity. The coefficient of monetary supply growth is not statistically significant, although the signals in all four models are positive. This result was enforced before by [28]. Of note, the model reveals that the correlation between bank groups and liquidity is insignificant.

V. RECOMMENDATIONS

Firstly, to avoid the harmful effect of increasing total assets on bank liquidity, banks need to consider their developing strategy carefully. Therefore, in the case of Vietnam commercial banks (LDR is relatively high, approximately 90%), scaling up should be done with several critical conditions. Some of them are satisfying the LDR ceiling, attracting more customer deposits...

Second, increased profits should go hand in hand with liquidity safety. The solution is to increase non-interest income, such as selling non-credit services/products, developing customer financial management services... At the same time, additional profit should be used reasonably. Accordingly, the capital structure should always be considered to ensure liquidity safety in the short term as well as increase the efficiency of long-term liquidity.

Third, the study proves that the national savings rate has a significant positive effect on bank liquidity. In the Vietnamese economy, improving the national savings rate is essential for faster growth. Experiences in other countries show that increasing private savings can be done through losing fiscal policy (tax), monetary policy (interest rate policy), pension reform programs...

Fourth, empirical evidence implies that stable CPI controls can limit their negative effect on bank liquidity. In Vietnam, the Government and ministries (the Ministry of Industry and Trade, the Ministry of Finance, the Ministry of Health, the Ministry of Education and Training), as well as localities (which authorized the price of health services and education), need to closely coordinate to control the increase in prices of essential goods strictly. In the long term, Vietnam needs to improve the economy's production capacity to less depend on the effects of the costs of imported goods.

The fifth is increasing the liquidity of the financial market to secure the bank's liquidity. Improving the liquidity of Vietnam financial market is one of the major tasks of the Government, measures that can be used include: increasing the number of goods in the stock and bond markets (especially the corporate bond market), increasing the number of investors in the market through enhancing the role of institutional investors, perfecting the legal framework...

VI. CONCLUSION

This study investigates the determinants of bank liquidity in Vietnam between 2007-2017. The results show that total assets, profitability and consumer price index are inversely and significantly correlated with the bank liquidity. In contrast, the national savings rate and financial market liquidity have positive impacts on the liquidity of banks. In Vietnam – a bank-based financial system, it is interestingly noted that the growth in monetary supply growth has no significant effect on bank liquidity.

To conclude, this research is a stepping effort to identify determinants of bank liquidity in developing economies with the bank-based financial market. Further studies can be considered to expand other critical factors of the economy that could affect the liquidity of commercial banks such as unemployment rate, financial crisis, interbank rate...

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