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Factors Affecting Liquidity Risks of Joint Stock Commercial Banks in Vietnam*

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Abstract

The study uses the audited financial statements of 26 Vietnamese commercial banks listed on the Ho Chi Minh City Stock Exchange (HOSE) and Hanoi Stock Exchange (HOSE) during the 2008–2018 period to estimate the system GMM model, which provides empirical evidence on the effect of the variables of customer deposit to total assets (DEPO) ratio, loan to assets (LTA) ratio, liquidity of commercial banks (LIQ), credit development (CRD) ratio, external funding (EFD) ratio, and credit loss provision (LLP) ratio on liquidity risk. The study confirms that commercial banks' internal factors play the most important role, and there is no empirical evidence on macro variables that affect liquidity risk. Finally, in accordance with the theoretical framework, the study uses an estimation method with the R language and the bootstrap methodology to give empirical proof of the nonlinear correlation and U-shaped graph between commercial bank size and liquidity risk. The importance of commercial bank size in absorbing and moderating the effects of liquidity shocks is demonstrated, however, excessive growth in commercial bank size would increase liquidity risk in commercial bank operations.

Keywords: Commercial Bank, Liquidity Risk, Total Assets, Liquidity, GMM System

JEL Classification Code: G21, C33, C13

1. Introduction

According to Arif and Anees (2012), a commercial bank is an important part of the financial sector of the economy, performing activities that enhanced both parts of the balance sheet. Specifically, Diamond and Rajan (2005) argued that in terms of assets, the commercial bank performed financing function by using cash flow to lend to undercapitalized entities in the economy, while the liquidity of the commercial bank system mainly came from capital mobilized from savers. The commercial bank plays the role of payment intermediary and contributed to the circulation of the commodity market and transportation. These financial institutions ensure investment capital would contribute to economic growth, support the development of new industries, create more jobs and promote the development. As a result, commercial banks often faced liquidity risk (LR) - the risk that a bank might not meet its obligations (Jenkinson, 2008) because depositors could withdraw money before maturity when commercial banks were unable to balance their capital promptly, thereby they could not repay their depositors (Diamond & Rajan, 2005); Besides, this risk could also reduce the profitability of commercial banks (Chaplin et al., 2000a, 200b). However, commercial banks had not paid due attention to liquidity risk (Arif & Anees, 2012). Liquidity risk occurred partially because the commercial banking system had not been fully secured with common risk management practices, which led to the collapse of many banks during economic crises (Crowe, 2009). Therefore, the commercial banking system and money management agencies had a more comprehensive view of the role of liquidity in commercial banks.

LR not only affected the profitability but also affected the reputation of the commercial banking system (Jenkinson, 2008). And indeed, LR became a concern and challenge in the era of modern commercial banks (Comptroller of the Currency, 2001). The deposit competition to expand

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the credit product portfolio including wholesale and capital market with technological innovations changed the structure of capital and risk management (Akhtar, 2007). A bank with good asset quality, high income, and abundant capital could still fail if it failed to maintain liquidity (Crowe, 2009). Therefore, the study provides empirical evidence that the commercial banking system should pay attention to liquidity to cope with changes in monetary policy (Akhtar, 2007). There were a number of other risks that a bank had to face such as credit risk, operating risk, and interest rate risk, which could culminate in form of liquidity risk (Brunnermeier & Yogo, 2009). Therefore, this study is conducted with the expectation of adding to the group of empirical studies on the effect of factors on the liquidity risk of commercial banks.

2. Literature Review

2.1. Theoretical Basis of Risk

There are four main risks that can threaten the sustainability of banks, namely credit risk, market risk, operational risk, and liquidity risk (Puspitasari et al., 2021). Risk is uncertainty or an unstable state. However, not every uncertain state was called a risk (Nguyen, 2020). Only uncertain states that could have the probability of occurrence predicted were called risks (Nguyen, 2011). They could be financial risk and banking risk. Specifically, this study refers to bank liquidity risk, thereby commercial banks fall into insolvency, self-file bankruptcy, or are declared bankrupt by competent authorities (Altman, 1968; Xiaoqing & Hefferman, 2005; Nguyen & Hoang, 2019). Therefore, commercial banks must find ways to meet their liquidity needs in many different ways: (i) Borrowing money in the interbank monetary market, (ii) selling assets in the financial market, (iii) performing foreign exchange swaps, (iv) rediscounting or refinancing operations from the central bank.

2.2. Theoretical Basis of Liquidity and Liquidity Risk

Duttweiler (2011) defined liquidity as the ability to meet all payment obligations upon coming due, the ease to convert an asset into cash, and the acceptance level of the market. For commercial banks, liquidity was the ability to meet the needs of using available funds for business activities at any time such as deposit payment, lending, payment, and capital transaction (BIS, 2009; Praet & Herzberg, 2008).

Liquidity was a term mentioned by Keynes (1930) and Fisher (1930). Under this theory, money is an asset with the highest liquidity, so holding a lot of money will increase liquidity but at the expense of investment opportunities to generate profits. Accordingly, commercial banks with low profits, when focusing on the purpose of increasing profits, would increase their investment in high-risk portfolios, resulting in a decrease in the proportion of liquid assets and a decrease in liquidity (Nguyen, 2016). In contrast, banks with high profits often paid attention to safety and limited excessive credit development and enhancement of more liquid assets to avoid default risk (Bunda & Desquilbet, 2008; Chatterjee & Eyigungor, 2009; Rychtarsik, 2009).

Wilson, Casu, Girardone & Molyneux (2010) argued that credit was still the main business operation of banks. In the condition that the capital of banks is mostly short-term capital, commercial lending and short-term financing for liquid assets of enterprises were the best way to ensure liquidity. However, Smith (1776) argued that credit operation could be highly risky during a financial crisis related to meeting requests to withdrawal deposits of customers due to psychological factors.

Moulton (1918) asserted that liquidity was the shiftability or the ability of commercial banks to hedge against liquidity risk through diversification of the portfolio of highly liquid assets or the convertibility of assets at a certain rate (Toby, 2006) as well as the ability to create profits and retained earnings for reinvestment. In contrast, the theory showed that credit operations would not secure liquidity when large numbers of depositors decided to withdraw their funds.

Prochnow (1949) argued that incomes from assets came from assets that matured once and regularly during the life of assets, this expected source of income would increase the liquidity of assets. This theory laid an important foundation for studying the term structure, expected income, or profitability on assets as a measure of liquidity. Profitability is the most appropriate indicator to measure the performance and health of banks (Lopez & Saurina, 2007). Bank profits have a significant negative effect on bank failures (Mayes & Stremmel, 2012; Fukuda et al., 2008; Lopez & Saurina, 2007).

This signaling theory arises (Spence, 1973) because of asymmetric information problems caused by asymmetric conditions of information existing from time to time. Bank size had a positive relation to liquidity, the larger commercial banks were, the easier they were to mobilize capital from many different sources of capital (Sumani & Roziq, 2020). Meanwhile, the too large to fail theory (Greg, 2009) showed that the larger the bank size was, the lower the liquidity of the bank was. Large-scale banks often tend to boldly invest in high-risk assets with the expectation of increasing profits.

According to Basel Committee on Banking Supervision (BIS) (2009), liquidity risk came from the failure of a bank to fulfill its payment obligations because depositors withdrew their funds from the bank, which would create a liquidity trap for the bank (Jeanne & Svensson, 2007) that led to the fact that the bank was unable to increase funding or the ability to finance but had to borrow from the central bank or the interbank market at a high cost (Diamond & Rajan, 2005). Indeed, Bonfim and Kim (2014) argued that commercial banks often faced liquidity risk because the role of a financial intermediary generated liquidity risk when commercial banks had to mobilize deposits to meet credit requirements. Some commercial banks used short-term capital structure to finance long-term loans to increase profits, but it was also the cause of credit risk (Diamond & Dybvig, 1983). Many banks focused on wholesale lending (Akhtar, 2007) or long-term lending, which affected the maintenance of the bank's liquidity position (Kashyap et al., 2002).

LR could be classified into two forms: financing liquidity risk and market liquidity risk (Decker, 2000; Pham, 2019; Gomes & Khan, 2011). Market liquidity risk was a risk that a bank failed to sell assets in the market in a fast time and at a low cost. Financing liquidity risk was a risk that a bank would not be able to meet its debt obligations when such obligations came due to failure to liquidate assets or a lack of funding. These two types of risks often interacted with each other through contagion effect in the financial markets and financial institutions (Diamond & Rajan, 2005). In addition, liquidity risk could also be derived from macro factors and the financial, operating, and management policies of banks (Ali, 2004).

From the perspective of bank liquidity management, surplus or deficit both described the imbalance of banks. Liquidity surplus occurred when the economy fell into a state where investment projects were stagnant, capital failed to be disbursed due to credit appraisal capacity, or capital developed so fast. In contrast, Liquidity deficit was the fact that banks failed to have enough funds to operate, causing banks to lose business opportunities, lose customers, lose markets and reduce the trust from the public (Truong, 2012; Brunnermeier & Yogo, 2009; Falconer, 2001; Plochan, 2007; Ahmed & Duellman, 2012; Goodhart, 2008; Goddard & Wilson, 2009).

LR could be measured by: Financing Gap (Lucchetta, 2007; Bunda & Desquilbet, 2008; Saunders & Cornett, 2006; Chen & Gursoy, 2001; Chen et al., 2018; Ferrouhi & Lahadiri, 2014) and liquidity ratios were various ratios calculated from balance sheets of banks, often used to predict the development trend of liquidity (Bunda & Desquilbet, 2008; Vodová, 2011; Bonfim & Kim, 2014; Munteanu, 2012; Delechat et al., 2012, Ferrouhi & Lahadiri, 2014; Giannotti 2010; Van den End, 2010; Angora & Roulet, 2011; Cucinelli, 2013). According to Vodová (2013a), the liquidity gap was the difference between assets and capital for both the present and the future.

2.3. Study Works on Factors Affecting Liquidity Risk

Aspachs et al. (2005) determined the factors affecting the liquidity of 57 commercial banks in the UK (1985–2003) and used the measurement method by the ratio of total liquid assets to total assets and ratio of total liquid assets to mobilized capital. The result of the fixed effects model showed that the influencing factors were divided into two groups: internal factor and external factor. An internal factor was such as profit margin that measured the opportunity cost of holding liquid assets as well as measured profitability and credit growth of banks. Profit was negatively correlated with liquidity. This study also showed that the higher the credit growth is, the less liquid assets the banks held. In addition, the study also showed that commercial banks that received a lot of support from the central bank often had low liquidity.

Valla et al. (2006) focused on some intrinsic factors and macro variables affecting bank liquidity in France in the 1993–2005 period. They assumed that the correlated factors were the possibility to get support from the central bank, loan growth, GDP growth, short-term interest rates, profitability, and bank size. The result of the regression analysis affirmed that bank size had a positive effect on liquidity. The remaining factors had a negative relation to liquidity.

Lucchetta (2007) at commercial banks in European countries was interested in the effect of macro factors, the role of the interbank market, and the relation among banks. The study used panel data for the 1998–2004 period to examine the relation between investment and lending activities in the interbank market under variable interest rate conditions. The study result showed that GDP, monetary policy (represented by short-term interest rates) affected the bank liquidity. Holding more or less liquid assets of banks depending on whether total assets and total mobilized capital during the period had strong or weak GDP growth rate and therefore banks often built a liquidity buffer (Delechat et al., 2012) during the economic recession. This showed that to stimulate economic development, the central bank used the policy of cutting down interest rates and increasing the amount of base money accordingly, thereby increasing the liquidity supply of banks.

According to the theory of total asset size, Bunda and Desquilbet (2008) used different ratios to evaluate the liquidity of banks in the emerging markets including 36 countries in the 1995–2004 period. This study used the equity-to-asset

ratio to evaluate the capital adequacy ratio, thereby, it was found that bank size and equity-to-asset ratio had a positive effect on liquidity risk. The result also identified factors affecting the bank liquidity such as the factor of implementing Basel's fundamentals (dummy variable) forced banks to have sufficient liquidity reserves; lending rates had a positive effect on liquidity. In addition, macro factors also had an effect on liquidity: the ratio of government spending to GDP, the factor of inflation rate had a positive effect on liquidity. An empirical study also showed that the financial crisis had a positive effect on the liquidity risk in the case of the fixed exchange rate mechanism and a negative effect in the case of the floating exchange rate mechanism.

Rauch et al. (2010) studied panel data of 457 banks in the 1997–2006 period in Germany. The result showed that macro factors such as tight monetary policy had a negative effect on liquidity. If the unemployment rate was high, banks had a lot of highly liquid assets; discount rate had negative relation; GDP growth rate had a strong and positive effect. Micro variables such as savings limit had a positive relation to liquidity, but the study showed that bank size had no effect on liquidity. Rauch et al. (2009) also studied 1,107 commercial banks in 36 emerging economies in 1997–2006 period. The study result showed that macro factors such as monetary policy had an effect on liquidity risk, which showed the contagion effect from economic crisis to the crisis of the commercial banking system. Diamond and Rajan (2005) stated that a bank might refuse to lend when its liquidity demand was quite high. The study suggested that diversifying loan terms would help create a buffer against liquidity shocks (Holmstrom & Tirole, 2000). Diamond and Rajan (2005) emphasized that the difference in mobilization needs and the ability to finance loans forced commercial banks to change their policy of interest rates.

Vodová (2011, 2013) studied the factors affecting the liquidity of commercial banks in the Czech, Hungary, and Finland. The independent variables included 4 internal variables (equity ratio, total bank assets, NPL ratio, profitability ratio, and 8 external variables of banks (GDP growth, inflation rate, interbank interest rate, unemployment rate, marginal interest rate, credit interest rate, and financial crisis dummy variable. The study result showed that liquidity had a positive relation to equity ratio, the credit interest rate used in all three countries; the NPL ratio, the interbank interest rate in Czech and Finland. In contrast, financial crisis, inflation rate, the economic growth rate had a negative relation to liquidity in the Czech Republic but in the positive relationships in Finland. Total bank assets and liquidity had a negative relation in Slovakia and Finland but nonlinear relation in the Czech Republic. In addition, the study also showed that unemployment rate, marginal interest rate, return on capital and monetary policy rate had no effect on liquidity in the Czech Republic; marginal interest rate and monetary policy interest rate had a negative relation in Hungary and Finland; return on capital had a positive relation in Hungary and negative relation in Finland; unemployment rate had a positive relation to liquidity in Finland.

Munteanu (2012) studied the liquidity risk of 27 commercial banks in Romania before and after the economic crisis in 2002–2007 and 2008–2010 periods. The result showed that the factors contributing to the stability of the commercial banking system played an important role in affecting liquidity risk. Aspachs et al. (2005) studied the factors affecting the liquidity risk (using the ratio of liquid assets to total assets) of 57 commercial banks in the 1985–2003 period in the US. The study result showed that the holding of liquid assets and the expected profit of commercial banks had a positive relation to the liquidity risk. Gomes and Khan (2011) argued that the interaction between two types of liquidity risk - financing liquidity risk and market liquidity risk could lead to serious consequences, when financing liquidity risk increases, market liquidity reduces and vice versa. Brunnermeier and Pedersen (2009) argued that a series of banks sought to sell assets in the financial markets, creating the risk of market liquidity risk. The sell-off of assets in the market raised interest rates, lowered the price of the collateral. Commercial banks with excess liquidity were also concerned about the contagion effect, so they did not provide liquidity despite high interbank interest rates and this might freeze the asset market.

The financing gap was used by Truong (2013) to assess liquidity risk. The study believed that credit risk was influenced by factors such as total asset size, liquidity reserve, interbank market liquidity, and macroeconomic factors. External financing had a good effect on total capital, equity had a positive effect on total assets, and the loan had a negative effect on total assets, while liquidity reserve had the opposite effect. Furthermore, the overall asset size had a non-linear relationship with LR. Depending on the lag of the variable, the GDP variable had a multi-signal effect. Furthermore, boosting the prior year's inflation rate INF_{t-1} would lower this year's LR.

Nguyen (2020) studied the effect of non-interest income on risk and profitability. The empirical result at 26 Vietnamese joint-stock commercial banks in the 2008–2018 period showed that non-interest income increased the risks in commercial banking activities. Vo and Mai (2017) determined the effect of foreign ownership on the liquidity risk of 35 Vietnamese commercial banks in the 2009–2015 period. The result showed that the higher the foreign ownership was, the lower the liquidity risk of commercial banks was and vice versa. Besides, the study also showed that the LR lagged variable had a positive relation to LR. Vu (2012) studied 37 commercial banks in Vietnam in the

2006–2011 period. The result showed that the effect of the ratio of equity to total assets, the ratio of return on total assets, and the ratio of non-performing loans to total loans had a positive relation with liquidity, while the variables of asset size and the ratio of credit risk provision to total loans were negatively correlated with liquidity.

Tram and Tran (2021) used unbalanced panel data from Bankscope from 171 banks in 9 countries in Southeast Asia over the period 2004–2016 and the Generalized Method of Moments (SGMM) to analyze the impact of liquidity risk on bank performance in Southeast Asian countries. The results show that liquidity risk has a positive effect on the performance of banks or that most banks with good performance have a high liquidity risk under normal conditions. However, if there is a financial crisis, the effect of liquidity risk on bank performance is negative. This means that during the crisis, banks will seek to increase liquidity assets, to improve profitability, which will increase financial costs and reduce bank efficiency. Besides, bank performance in Southeast Asian countries is also influenced by the following factors: impact of the lag variable of bank performance, quality of liquid assets, bank size, bank capital, loan loss provision, GDP growth, money supply, and inflation.

With the above studies, the author clarified the theories that explained the liquidity risk, some liquidity measures for commercial banks, and the policies of the SBV in liquidity management. At the same time, the study also showed the current status of liquidity of commercial banks based on the study model.

3. Research Methods

3.1. Data Source

The data source of the study was taken from the audited financial statements of 26 Vietnamese commercial banks listed on Ho Chi Minh City Stock Exchange (HOSE) and Hanoi Stock Exchange (HNX) during 2008–2018 period including the following joint stock commercial banks: An Binh Commercial Joint Stock Bank (ABB), Asia Commercial Joint Stock Bank (ACB), Bank for Investment and Development of Vietnam (BIDV), Bao Viet Bank (BVB), Vietnam Joint Stock Commercial Bank for Industry and Trade (CTG), Vietnam Export Import Commercial Joint-Stock Bank (EIB), Ho Chi Minh City Development Joint Stock Commercial Bank (HDB), Kien Long Bank (KLB), LienViet Post Joint Stock Commercial Bank (LPB), Military Commercial Joint Stock Bank (MB), Vietnam Maritime Commercial Joint Stock Bank (MSB), Nam A Commercial Joint Stock Bank (NAB), National Citizen Commercial Joint Stock Bank (NCB), Orient Commercial Joint Stock Bank (OCB), Petrolimex Group Commercial Joint Stock Bank (PGB), Saigon Commercial Joint Stock Bank (SCB), Southeast Asia Commercial Joint Stock Bank (SEA), Saigon Bank For Industry And Trade (SGB), Saigon-Hanoi Commercial Joint Stock Bank (SHB), Sai Gon Thuong Tin Commercial Joint Stock Bank (STB), Vietnam Technological and Commercial Joint Stock Bank (TCB), Tien Phong Commercial Joint Stock Bank (TPB), Joint Stock Commercial Bank for Foreign Trade of Vietnam (VCB), Vietnam International CJS Bank (VIB), Vietnam – Asia Commercial Joint Stock Bank (VAB) and Vietnam Prosperity Joint Stock Commercial Bank (VPB).

3.2. Experimental Model

Study model of the effect of factors on liquidity risk (Pavla, 2011):

$$L_{it} = \alpha + \beta * X_{it} + \delta_i + \varepsilon_{it} \tag{1}$$

In which, L_{it} is LR indicator of the bank I year t, X_{it} is the vector of the explanatory variable, Beta (β) is the regression coefficient representing the angle factor of the variable. Accordingly, the model is rewritten as follows (Table 1):

$$\begin{aligned} \text{LIQR}_{i,t} = {} & \beta_0 + \beta_1 * \text{LIQR}_{i,t-1} + \beta_2 * \text{LIQ}_{i,t} + \beta_3 * \text{ETA}_{i,t} \\ & + \beta_4 * \text{CRD}_{i,t} + \beta_5 * \text{SIZE}_{i,t} + \beta_6 * \text{SIZE}^2_{i,t} \\ & + \beta_7 * \text{DEPO}_{i,t} + \beta_8 * \text{LLP}_{i,t} + \beta_9 * \text{LTA}_{i,t} \\ & + \beta_{10} * \text{EFD}_{i,t} + \beta_{11} * \text{ROA}_{i,t} + \beta_{12} * \text{ROE}_{i,t} \\ & + \beta_{13} * \text{NNII}_{i,t} + \beta_{14} * \text{LST}_{i,t} + \beta_{15} * \text{FCR}_{i,t} \\ & + \beta_{16} * \text{GDP}_{i,t} + \beta_{17} * \text{INF}_{i,t} + \beta_{18} * M2_{i,t} + e_{i,t} \end{aligned} \tag{2}$$

3.3. Study Method

The study used the panel data regression approach with fixed effects model (FEM), random effects model (REM), feasible generalized least squares (FGLS) (Wooldridge, 2002), and D&K (Drisscoll & Kraay, 1998), but the study result was still unsatisfactory for interpretation due to endogeneity. As a result, the study used the System GMM model - SGMM to overcome endogenous defects in specific as well as model problems in general (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998; McLachlan & Peel, 2004; Nguyen, 2018). Finally, the study employed an estimation method based on the R programming language and the Bootstrap technique to assess the impact of all micro and macro variables on joint-stock commercial banks' liquidity risk in Vietnam from 2008 to 2018.

Table 1: Detailed Description of Variables in the Regression Model

Variables	Calculation & Description of Variables	Sources
Dependent Variables		
LIQR	Liquidity risk – financing gap ratio	Ferrouhi and Lahadiri (2014), Chen et al. (2018), Saunders and Cornett (2006), Arif and Anees (2012)
Endogenous Determinant of Bank Performance		
LIQ	Liquidity ratio	Delecha et al. (2012), Vodová (2011), Demirgüç-Kunt & Huizinga (1999), Athanasoglou et al. (2006), Chen et al. (2018), Ferrouhi and Lahadiri (2014), Altman (1968). *(Data collected from audited financial statements of banks)*
ETA	Bank's equity ratio - Equity/Total Assets	
CRD	Credit growth ratio - Increase (decrease) of loan balance during the year/Total loan balance at the beginning of the year	
SIZE	Size of total assets of the bank - Logarithm of bank's total assets to proxy size	
DEPO	Term deposit - The ratio of customer deposits to total assets - the size of deposits	
LLP	The loan loss provisions to loans ratio	
LTA	Loans to total assets ratio	
EFD	The ratio of external funding to total liabilities Interbank loan + Loan from other credit institutions)/ Total capital	
ROA	Return on asset – net income/ Total assets	
ROE	Return on equity – net income/shareholder equity	
NNII	NIM – Net Interest Margins – (total interest income - total interest expense)/ Total earning assets or	
LST	Listed bank - Listed = 1, non listed = 0	
Macroeconomic Variables		
GDP	The growth rate of gross domestic product growth	World Bank & IMF database
INF	Inflation rate	
FCR	Financial crisis - From 2005 to 2006 and from 2009 to 2019 are 1, the others are 0.	
M2	The Money Supply - M2 is a broader measure of the money supply than M1, which just includes cash and checking deposits.	
ε	Residual & i, t is country i at year t respectively	

4. Results and Discussion

4.1. Descriptive Statistics

The selected regression model showed no major multicollinearity problem, according to the correlation matrix (Table 2 & 3), because the correlation coefficients had the greatest value of 0.79, which was still less than 0.8 (Farrar & Glauber, 1967).

4.2. Regression Results and Discussion

According to the study result estimated by the SGMM method (Table 4), the study gave the following comments:

Firstly, the ratio of customer deposit to total assets (DEPO) had a negative effect on liquidity risk. The study result showed that commercial banks with good deposit mobilization capacity would create a buffer against liquidity risk in business activities. This result was in contrast to the experimental result of Shah (2018), Assfaw (2019), and Mahmood et al. (2019) when arguing that according to the financial intermediary function of commercial banks, the greater the deposit mobilization capacity was, the higher the ratio, the more commercial banks promoted capital use operations for-profit purpose, credit growth and this made commercial banks limit the reserves of liquid assets, thereby leading to a decrease in the liquidity of commercial banks.

Table 2: Descriptive Statistical Parameters

	Obs	Mean	Std. Dev	Min	Max
LIQR	286	0.0731	0.1553	–0.2793	0.8653
LIQ	286	0.2016	0.1022	0.0450	0.6103
ETA	286	0.1044	0.0594	0.0322	0.4624
CRD	286	0.2393	0.3028	–0.4307	1.6722
SIZE	286	31.972	1.2508	28.5142	34.8111
DEPO	286	0.6144	0.1348	0	0.8937
LLP	286	0.0248	0.0727	0.0005	0.58077
LTA	286	0.5266	0.1332	0.1138	0.8447
EFD	286	0.1743	0.1089	0	0.56207
ROA	286	0.5202	0.2046	0.0927	0.8964
ROE	286	0.0910	0.0935	–0.8200	0.6592
NNII	286	0.0748	0.0626	–0.1551	0.3034
LST	286	0.5	0.5008	0	1
FCR	286	0.9090	0.2879	0	1
GDP	286	0.0610	0.0059	0.0525	0.0708
INF	286	0.0798	0.0661	0.0063	0.2297
M2	286	1.2427	0.2210	0.93657	1.580

Secondly, the loan-to-asset (LTA) ratio of banks had a positive effect on liquidity risk in accordance with commercial lending theory. The study result showed that commercial banks with high credit ratios constantly faced liquidity risks in their business activities (Truong, 2013; Truong & Pham, 2014). Conventional loans in the face of large and unpredictable withdrawals of customers could lead to the loss of liquidity of commercial banks (Bonin et al., 2008).

Thirdly, the liquidity of the commercial banking system had a positive relation to liquidity risk. The higher the liquidity was, the higher liquidity risk commercial banks often faced, this result was similar to the study result of Aspachs et al. (2005).

Fourthly, the credit growth ratio (CRD) is positively covariant to liquidity risk. The study result once again confirmed the role and importance of credit growth factors, so it was necessary to be cautious to avoid liquidity risk. Indeed, the Vietnamese commercial banking system still mainly relied on income from credit activities to evaluate business performance (Nguyen, 2020). From a macro perspective, this came from the characteristics of the Vietnamese economy with economic growth mainly relying on money pumps (Pham, 2019). As a result, Vietnam's debt-to-GDP ratio (or level of financial leverage) in recent years had always been high, specifically in the 2011–2015 period, it was approximately 1, but in the 2016–2019 period, it was 1.3 times - an increase of 28% (Pham, 2019). Along with the operating model of the SBV under the Government, economic growth was a key task that the Government requires the SBV to support, resulting in the fact that commercial banks increased their disbursement to the economy. This was not only because of the business performance of commercial banks but also the task that the commercial banking system must meet under the requirements of the SBV as the case may be, therefore, liquidity risk was unavoidable.

Fifthly, the external financing ratio of commercial banks had a positive effect on liquidity risk. This study result was consistent with the study results of Chung-Hua Shen et al. (2009) and Truong (2013). The study showed that commercial banks had a high external financing ratio, which meant that a low equity ratio in the capital structure often put pressure on the liquidity risk of commercial banks (Vodová, 2013). Moreover, the fact that commercial banks borrowed from outside to meet the withdrawal needs of depositors could increase the debt-to-equity ratio, thereby affecting the bank's efforts to maintain an optimal capital structure (Arif & Anees, 2012). Meanwhile, commercial banks with a high equity ratio were considered safe, avoiding liquidity risk and creating trust with customers. At the same time, these commercial banks had good advantages and resources to provide more financial services for customers, helping

Table 3: Correlation Matrix Among Variables in the Study Model

	LIQR	LIQ	ETA	CRD	SIZE	DEPO	LLP	LTA	EFD	ROA	ROE	NNII	LST	FCR	GDP	INF	M2
LIQR	1																
LIQ	0.54	1															
ETA	0.35	0.16	1														
CRD	0.22	0.22	−0.1	1													
SIZE	−0.3	−0.2	−0.7	−0.1	1												
DEPO	−0.7	−0.5	−0.3	−0.2	0.42	1											
LLP	−0.1	0.05	−0.0	−0.0	−0.0	0.07	1										
LTA	−0.0	−0.65	−0.1	−0.2	0.19	0.53	−0.1	1									
EFD	0.55	0.52	0.02	0.26	−0.3	−0.7	−0.1	−0.5	1								
ROA	0.0	−0.1	0.01	0.03	0.0	−0.1	−0.2	0.01	0.14	1							
ROE	0.101	0.038	−0.13	0.103	0.31	0.0192	−0.07	0.13	−0.17	−0.08	1						
NNII	−0.112	−0.06	−0.01	0.159	0.189	0.0788	0.02	0.018	−0.19	0.002	0.32	1					
LST	−0.115	0.011	−0.32	0.032	0.523	0.1745	−0.2	0.051	−0.23	−0.13	0.28	0.25	1				
FCR	−0.23	−0.27	−0.35	0.25	0.32	0.1551	0.04	0.05	−0.05	−0.00	−0.02	0.04	0.00	1			
GDP	−0.15	−0.3	−0.27	−0.04	0.31	0.19	0.03	0.22	−0.06	−0.01	0.06	0.07	0.00	0.24	1		
INF	0.44	0.45	0.35	−0.10	−0.36	−0.479	−0.07	−0.26	0.19	−0.01	0.05	−0.15	−0.00	−0.71	−0.37	1	
M2	−0.41	−0.49	−0.36	−0.06	0.42	0.4915	0.07	0.35	−0.19	0.02	−0.01	0.13	0.0	0.43	0.73	−0.8	1

Table 4: Effect of Factors on Liquidity Risk

	Pool OLS	FEM	REM	FGLS	D&K	SGMM	LM by R language
L.LIQR	0.0744****	0.0719***	0.0722***	0.0426***	0.0719***	0.0721***	
	[5.12]	[4.98]	[5.17]	[3.87]	[5.62]	[4.21]	
LIQ	0.822***	0.796***	0.817***	0.859***	0.796***	0.816***	0.8577***
	[35.06]	[27.49]	[33.78]	[41.60]	[31.26]	[29.23]	[33.2871]
ETA	–0.00753	0.0336	0.0120	0.0245	0.0336	–0.00254	–0.0166
	[–0.13]	[0.48]	[0.20]	[0.56]	[1.05]	[–0.03]	[–0.2858]
CRD	0.0181***	0.0167***	0.0174***	0.0227***	0.0167***	0.0211***	0.0115**
	[3.32]	[2.98]	[3.30]	[5.94]	[4.36]	[4.49]	[2.1313]
SIZE	–0.0631	0.0621	–0.0129	–0.0269	0.0621	–0.0590	–0.2597***
	[–0.86]	[0.67]	[–0.17]	[–0.43]	[0.79]	[–0.60]	[–3.0355]
c.SIZE##c.SIZE	0.00102	–0.000888	0.000260	0.000490	–0.000888	0.000961	0.00403***
	[0.91]	[–0.62]	[0.22]	[0.51]	[–0.73]	[0.65]	[3.0443]
DEPO	–0.930***	–0.915***	–0.923***	–0.960***	–0.915***	–0.918***	–0.988***
	[–38.12]	[–34.56]	[–38.17]	[–55.24]	[–64.37]	[–32.73]	[–37.6095]
LLP	0.0355*	–0.0245	0.0230	0.0280*	–0.0245	0.0290***	0.03180
	[1.87]	[–0.72]	[1.01]	[1.83]	[–1.21]	[4.50]	[1.0721]
LTA	0.910***	0.886***	0.903***	0.935***	0.886***	0.906***	0.9064***
	[48.07]	[35.22]	[45.73]	[60.49]	[57.20]	[38.85]	[40.7226]
EFD	0.0805***	0.116***	0.0904***	0.0643***	0.116***	0.104***	0.0549*
	[3.01]	[3.86]	[3.41]	[3.17]	[5.46]	[3.08]	[1.8228]
ROA	–0.0117*	–0.00242	–0.00861	–0.00424	–0.00242	–0.00922	–0.0039
	[–1.70]	[–0.28]	[–1.16]	[–0.75]	[–0.66]	[–1.13]	[–0.4267]
ROE	–0.0122	–0.0255	–0.0205	–0.00561	–0.0255	–0.0113	0.0065
	[–0.73]	[–1.41]	[–1.22]	[–0.37]	[–1.57]	[–0.57]	[0.3613]
NNII	0.00189	–0.0124	–0.00841	–0.00821	–0.0124	–0.00655	–0.0488*
	[0.07]	[–0.41]	[–0.32]	[–0.42]	[–0.54]	[–0.16]	[–1.736]
LST	–0.000865	.	–0.000646	–0.00310	0	–0.000372	–0.0005
	[–0.25]	.	[–0.13]	[–1.01]	.	[–0.08]	[–0.089]
l.FCR	0.00481	–0.00416	.	.	–0.00416	0.00251	0.0085
	[0.75]	[–0.60]	.	.	[–1.48]	[0.34]	[0.9532]
GDP	–0.0890	0.0912	0.00994	–0.0358	0.0912	0.0672	–0.2038
	[–0.22]	[0.24]	[0.03]	[–0.14]	[0.34]	[0.24]	[–0.5382]
INF	0.00400	0.0143	0.0121	0.00373	0.0143	0.00317	0.0020
	[0.07]	[0.27]	[0.24]	[0.10]	[0.82]	[0.07]	[0.0383]
M2	0.0157	0.0160	0.0155	0.0111	0.0160**	0.0123	0.0261
	[0.86]	[0.74]	[0.89]	[0.89]	[3.12]	[0.69]	[1.311]
Coefficients	0.932	–1.119	0.103	0.330	–1.119	0.852	4.1739***
	[0.78]	[–0.74]	[0.08]	[0.32]	[–0.87]	[0.52]	[3.0087]

(Continued)

Table 4: (Continued)

	Pool OLS	FEM	REM	FGLS	D&K	SGMM	LM by R language
Number of observations	260	260	260	260	260	260	
R	0.980	0.977					
F-Test		*F* test that all u_i = 0: *F* (25, 217) = 2.49 Prob > *F* = 0.0002					
Hausman Test		Test: Ho: difference in coefficients not systematic chi2(16) = (b–B)'[(V_b–V_B)^(–1)](b–B) = 20.80 Prob>chi2 = 0.1863 (V_b–V_B is not positive definite)					
Sargan test						chi2(4) = 0.86 Prob > chi2 = 0.931	
Hansen test						chi2(4) = 1.13 Prob > chi2 = 0.890	

Note: statistics *t* in parentheses [ ]; * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Significant at the 0.05 level.

improve profitability (Mercieca et al., 2007; Stiroh & Rumble, 2006; Le & Pham, 2017; Nguyen, 2020). However, in terms of bank governance, a high equity-to-total asset ratio was not necessarily a good thing, showing that the bank operator was being too cautious in management and ignoring profitable investment opportunities based on leveraged instruments.

Sixthly, the loan loss provision (LLP) ratio had a positive effect on LR. LLP represented a bank's level of credit risk. The higher the cost of LPP was, the higher the liquidity risk was (Chung-Hua Shen et al., 2009). Finally, the lagged variable of liquidity risk had a positive effect on variable LR as well as macro variables including money supply M2 had no statistical significance similar to the study result of Truong (2013).

Finally, NNII has a negative effect on the risk of bank failure. This means the bank is paying out more in interest on its liabilities than its generating from its investments (Fiordelisi & Mare, 2013). These findings are consistent with the empirical work of Dermine and Carvalho (2005), Tang and Yan (2007), Koutsomanoli-Filippaki and Mamatzakis (2009), Bolton and Jeanne (2011), and Shakatreh (2020).

4.3. Testing Stability through Bootstrapping Technique

The study results (Tables 5 & 6 and Figure 1) showed that bank size had an effect on liquidity risk (Valla et al., 2006; Truong, 2013). Study results also confirm nonlinear relation between liquidity risk and bank size as follows:

$$\text{LIQR}_{i,t} = \beta_0 + \beta_1 * \text{SIZE}_{i,t} + \beta_2 * \text{SIZE}^2_{i,t} + \beta_3 * \text{SIZE}^3_{i,t} + e_{i,t}$$

This result was consistent with the theory of total asset size, showing that the effect of the bank size variable (SIZE) on LR has a nonlinear form (U-shaped graph, consistent with signaling theory (Spence, 1973) and the Too big to fail theory (Greg, 2009). This reiterated that the size of commercial banks served as a risk buffer when banks experienced liquidity shocks, but if the size of commercial banks exceeded a certain level, LR would increase. Bank capital had a positive effect on LR, this was consistent with the shiftability theory, banks with bigger capital tended to have less liquidity reserves and higher LR and vice versa.

5. Conclusion

With theoretical frameworks and domestic and international empirical evidence, the study verifies the approach's applicability. The study's findings reveal that the customer deposit-to-total-assets ratio (DEPO) has a negative impact on liquidity risk. In addition, the loan-to-asset (LTA) ratio, commercial bank liquidity (LIQ), credit development (CRD) ratio, external funding (EFD) ratio, and

Table 5: Estimated Study Result

	Value	Std. Error	*t*-value	*p*-value
Variables	4.1739	1.3872	3.008	0.0029
LIQ	0.8577	0.0257	33.2871	0.0000
ETA	–0.0166	0.0584	–0.2858	0.7752
CRD	0.0115	0.0054	2.1313	0.0026
SIZE	–0.2597	0.0855	–3.0355	0.0026
SIZE^2	0.00403	0.0013	3.0443	0.0000
DEPO	–0.9884	0.0262	–37.6095	0.2846
LLP	0.0318	0.02966	1.0721	0.0000
LTA	0.9064	0.0222	40.722	0.0694
EFD	0.05494	0.0301	1.8228	0.6699
ROA	–0.0039	0.0092	–0.42678	0.7181
ROE	0.0065	0.0180	0.3613	0.0836
NNII	–0.0488	0.0281	–1.7364	0.9287
LST	–0.00052	0.00581	–0.08959	0.3413
FCR	0.0085	0.0089	0.9532	0.5909
GDP	–0.2038	0.37875	–0.5382	0.9694
INF	0.00205	0.05353	0.03834	0.1909
M2	0.02619	0.01998	1.3111	0.0029

Table 6: Linear Relation LIQR & SIZE and Non-Linear Relation LIQR & SIZE^2; LIQR & SIZE^3

Min	**1Q**	**Median**	**3Q**	**Max**
–0.33199	0.64609	0.64609	0.64609	0.64609
Coefficients	**Value**	**Std. Error**	***T*-value**	***p*-value**
	1.504410	0.219928	6.840	0.0000
SIZE	–0.04476	0.006873	–6.513	0.0000
Residual standard error: 0.1452 on 284 degrees of freedom Multiple *R*-squared: 0.1299, Adjusted *R*-squared: 0.1269 *F*-statistic: 42.42 on 1 and 284 DF, *p*-value: 0.0000000003342				
Residuals				
Min	**1Q**	**Median**	**3Q**	**Max**
–0.30518	–0.09590	0.00523	0.09207	0.44692
Coefficients	**Value**	**Std. Error**	***T*-value**	***p*-value**
	0.073161	0.008062	9.074	0.0000
SIZE	–0.945336	0.136346	–6.933	0.0000
SIZE^2	0.850002	0.136346	6.234	0.0000
Residual standard error: 0.1363 on 283 degrees of freedom Multiple *R*-squared: 0.235, Adjusted *R*-squared: 0.2296 *F*-statistic: 43.47 on 2 and 283 DF, *p*-value: < 0.00000000000000022				

(Continued)

Table 6: (Continued)

Residuals				
Min	**1Q**	**Median**	**3Q**	**Max**
–0.32123	–0.09656	0.00490	0.09373	0.44430
Coefficients	**Value**	**Std. Error**	***T*-value**	***p*-value**
	0.073161	0.008074	9.061	0.0000
SIZE	–0.945336	0.136550	–6.923	0.0000
SIZE^2	0.850002	0.136550	6.225	0.000000
SIZE^3	–0.053950	0.136550	–0.395	0.693
Residual standard error: 0.1365 on 282 degrees of freedom Multiple *R*-squared: 0.2354, Adjusted *R*-squared: 0.2273 *F*-statistic: 28.94 on 3 and 282 DF, *p*-value: 0.0000000000000002405				

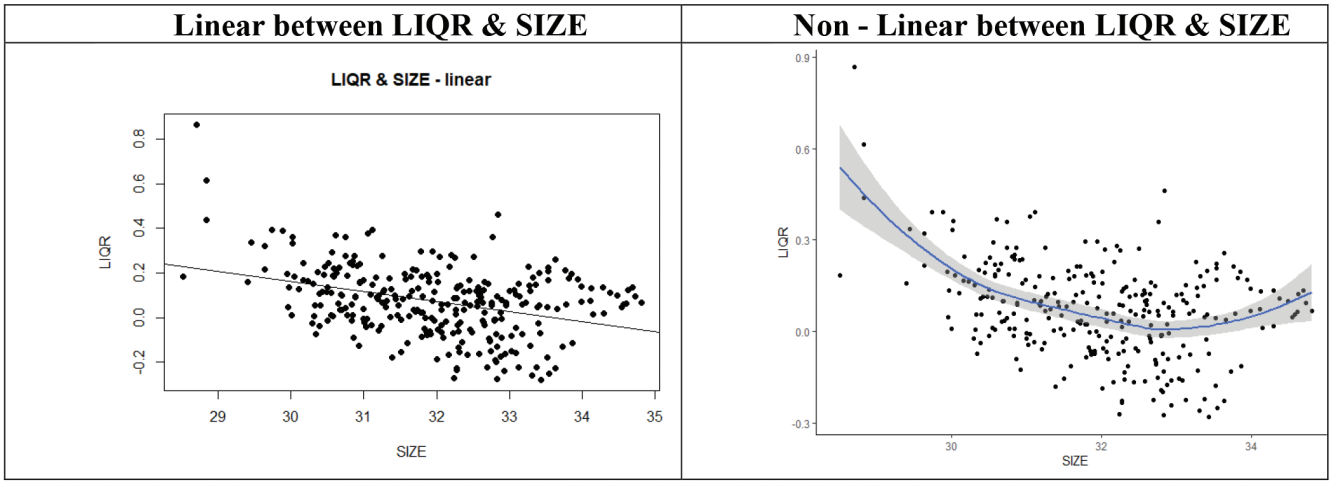

Figure 1: Correlation Between LIQR & SIZE

credit loss provision (LLP) ratio all have a positive impact on liquidity risk. The study's findings focus on commercial banks' internal elements, and there is no empirical evidence that macro variables (inflation, money supply M2, economic growth GDP, or financial crises) affect liquidity risk. The results of the study also show that the lagged variable has an impact on LR. Finally, in accordance with the theoretical framework, the study provides empirical evidence on the nonlinear correlation and U-shaped graph between the size of commercial banks and LR. The function of commercial bank size in absorbing and moderating the effects of liquidity shocks is demonstrated, however, excessive growth in commercial bank size would also increase liquidity risk in commercial bank operations. As a result, the SBV should keep a close eye on the capital increase roadmap and the size of commercial banks to sustainably improve quality and business performance. Furthermore, the study is still limited since it lacks empirical evidence on the macroeconomic impact on liquidity risk as well as the impact of business performance on liquidity risk.

References

Ahmed, A. S., & Duellman, S. (2012). Managerial overconfidence and accounting conservatism. *Journal of Accounting Research*, *51*(1), 1–30. https://doi.org/10.1111/j.1475-679X.2012.00467.x

Akhtar, S. (2007). *Pakistan – changing risk management paradigm – a perspective of the regulato*r. https://www.bis.org/review/r070423c.pdf

Ali, I. (2004). Historical impacts on political economy in Pakistan. *Asian Journal of Management Cases, 54,* 191. https://doi.org/10.1177/097282010400100203

Altman, E. I. (1968). Financial ratios, discriminant analysis, and the prediction of corporate bankruptcy. *The Journal of Finance*, *23*(4), 589–609. https://doi.org/10.2307/2978933

Angora, A., & Roulet, C. (2011). *Transformation risk and its determinants: A new approach based on Basel III liquidity management framework*. Limoges: Universite de Limoges.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models, *Journal of Econometrics*, *68,* 29–52. https://doi.org/10.1016/0304-4076(94)01642-D

Arif, A., & Anees, A. N. (2012). Liquidity risk and performance of banking system. *Journal of Financial Regulation and Compliance*, *20*(2), 182–195. https://doi.org/10.1108/13581981211218342

Aspachs, O., & Nier, E., & Tiesset, M. (2005). Liquidity, banking regulation, and macroeconomics. Proof of shares, bank liquidity from a panel the bank's UK resident. *SSRN Journal, 11,* 140. https://doi.org/10.2139/ssrn.673883

Assfaw, A. M. (2019). Firm-specific and macroeconomic determinants of banks liquidity: Empirical investigation from Ethiopian private commercial banks. *Journal of Accounting Finance and Auditing Studies*, *5*(2), 24. https://doi.org/10.32602/jafas.2019.24

Athanasoglou, P., Delis, M. D., & Staikouras, C. (2006). Determinants of bank profitability in the South Eastern European Region. *Journal of Financial Decision Making, 2*(2), 1–17. https://mpra.ub.uni-muenchen.de/10274/

Bank of International Settlements (BIS). (2009). *International framework for liquidity risk measurement, standards, and monitoring*. Basel Switzerland: BIS.

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*, 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Bolton, P., & Jeanne, O. (2011). Sovereign default risk and bank fragility in financially integrated economies. *IMF Economic Review*, *59*(2), 162–194. https://doi.org/10.3386/w16899

Bonfim, D., & Kim, M. (2014). *Liquidity risk in banking: is there herding*? (Discussion Paper No. 2012–024). Tilburg University: European Banking Center. https://www.eba.europa.eu/sites/default/documents/files/documents/10180/598223/94d7a979-4a5c-4e51-a85a-70a79b948c8b/Bonfim-and-Kim.pdf?retry=1

Bonin, J., & Hasan I., & Wachtel (2008). *Banking in transition countries* (BOFIT Discussion Paper No. 12/2008). Helsinki: Bank of Finland. http://doi.org/10.2139/ssrn.1258830

Brunnermeier, M. K., & Yogo, M. (2009). A note on liquidity risk management. *American Economic Review*, *99*(2), 578–83. https://doi.org/10.1257/aer.99.2.578

Brunnermeier, M., & Pedersen, L. (2009). Market liquidity and funding liquidity. *The Review of Financial Studies*, *22*(6), 2201–2238. https://doi.org/10.1093/rfs/hhn098

Bunda, I., & Desquilbet, J. B. (2008). The bank liquidity smile across exchange rate regimes. *International Economic Journal*, *22*(3), 361–386. https://doi.org/10.1080/10168730802287952

Chaplin, G., Emblow, A., & Michael, I. (2000a). Banking system liquidity: Developments and issues. *Financial Stability Review*, *9,* 93–112. https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2000/december-2000.pdf

Chaplin, W. F., Phillips, J. B., Brown, J. D., Clanton, N. R., & Stein, J. L. (2000b). Handshaking, gender, personality, and first impressions. *Journal of Personality and Social Psychology*, *79*(1), 110–117. https://doi.org/10.1037//0022-3514.79.1.110

Chatterjee, S., & Eyigungor, B. (2009). Maturity, indebtedness, and default risk. *The American Economic Review*, *102*(6), 2674–2699. https://doi.org/10.1257/aer.102.6.2674

Chen, J. S., & Gursoy, D. (2001). An investigation of tourists' destination loyalty and preferences. *International Journal of Contemporary Hospitality Management*, *13*(2), 79–85. https://doi.org/10.1108/09596110110381870

Chen, Y. K., Shen, C.H., Kao, L., & Yeh, C. (2018). Bank liquidity risk and performance. *Review of Pacific Basin Financial Markets and Policies*, *21*(1), 78. https://doi.org/10.1142/S0219091518500078

Chung-Hua, S., Yi-Kai, C., Lan-Feng, K., & Chuan-Yi, Y. (2009). Bank liquidity risk and performance. *Review of Pacific Basin Financial Markets and Policies, 21*(1), 1850007(40). https://doi.org/10.1142/S0219091518500078

Comptroller of the Currency. (2001). *Liquidity: Comptroller's handbook*. Washington, DC: Administrator of the National Banks. https://doi.org/10.1108/13581981211218342

Crowe, C. T. (2009). *Engineering fluid mechanics*. US: Mass Market Paperback. https://doi.org/10.1201/9781315372556

Cucinelli, D. (2013). The determinants of bank liquidity risk within the context of the Euro area. *Interdisciplinary Journal of Research In Business*, *2*(10), 51–64. https://doi.org/10.24018/ejbmr.2021.6.1.729

Decker, P. A. (2000). *The changing character of liquidity and liquidity risk management: A regulator's perspective*. Chicago, IL: Federal Reserve Bank of Chicago.

Delechat, C., Arbelaez, C. H., Muthoora, M. P. S., & Vtyurina, S. (2012). *The determinants of banks' liquidity buffers in Central America*, Washington DC: International Monetary Fund. https://ssrn.com/abstract=2716280

Demirgüç-Kunt, A., & Huizinga, H. (1999). Determinants of commercial bank interest margins and profitability: Some international evidence. *The World Bank Economic Review, 13*(2), 1–40. https://doi.org/10.1093/wber/13.2.379

Dermine, J., & Carvalho, N. C. (2005). How to measure recoveries and provisions on bank lending: Methodology and empirical evidence. In: Altman, E., Resti, A., & Sironi, A. (Eds.), *Recovery risk: The next challenge in credit risk management* (pp. 101–20). London: Risk Books.

Diamond, D. W., & Rajan, R. G. (2005). Liquidity shortages and banking crises. *The Journal of Finance*, *60*(2), 615–47. https://doi.org/10.1111/j.1540-6261.2005.00741.x

Diamond, D.W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy, 91*(3), 401–419. https://doi.org/10.1086/261155

Driscoll, J. C., & Kraay, A.C. (1998). Consistent covariance matrix estimation with spatially dependent data. *Review of Economics and Statistics*, *80*, 549–560. https://doi.org/10.1162/003465398557825

Duttweiler, R. (2011). *Managing liquidity in banks: A top-down approach*. Hoboken: John Wiley & Sons.

Falconer, B. 2001. Structural liquidity: the worry beneath the surface. *Balance Sheet 9*(3), 13–19. https://doi.org/10.1108/09657960110695998

Farrar, D. E., & Glauber, R. R. (1967). Multicollinearity in regression analysis: The problem revisited. *The Review of Economics and Statistics, 49*, 92–107. https://doi.org/10.2307/1937887

Ferrouhi, E. M., Lehadiri, A. (2014). Bank liquidity and financial performance: Evidence from the Moroccan banking industry. *Verslas Teorija ir Praktika*, *15*(4), 351–361. https://doi.org/10.3846/btp.2014.443

Fiordelisi, F., & Mare, D. S. (2013). Competition and financial stability in European cooperative banks. *SSRN, 1*, 1–29. http://doi.org/10.2139/ssrn.2290324

Fisher, R. A. (1930). *The genetical theory of natural selection.* Oxford: Clarendon Press.

Fukuda, S. I., Kasuya, M., & Akashi, K. (2008). *Impaired bank health and default risk. Tokyo: Center for Advanced Research in Finance*. Tokyo: Faculty of Economics, The University of Tokyo.

Giannotti, C. (2010). Liquidity risk exposure for specialized and unspecialized real estate banks: Evidence from the Italian market. *Journal of Property Investment and Finance*, *29*(2), 98–114. https://doi.org/10.1108/14635781111112756

Goddard, J., & Wilson, J. (2009). Competition in banking: A disequilibrium approach. *Journal of Banking & Finance*, *33*, 2282–2292. https://doi.org/10.1016/j.jbankfin.2009.06.003

Gomes, T., & Khan, N. (2011). *Strengthening bank management of liquidity risk: The Basel III liquidity standards*. https://www.bankofcanada.ca/wp-content/uploads/2011/12/fsr-1211-gomes.pdf

Goodhart, C. (2008). Liquidity risk management. *Financial Stability Review*, *11*(6), 39–44. https://publications.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-11_2008-02.pdf

Greg, N. G. (2009). *The banking crisis handbook.* Boca Raton, Florida: CRC Press, Taylor & Francis Group. https://doi.org/10.1201/9781439818541

Holmstrom, B., & Tirole, J. (2000). Liquidity and risk management. *Journal of Money, Credit and Banking*, *32*(3), 295–319.

Jeanne, O., & Svensson, L. O. (2007). A credible commitment to optimal escape from a liquidity trap: The role of the balance sheet. *The American Economic Review*, *97*(1), 474–90. https://doi.org/10.1257/aer.97.1.474

Jenkinson, N. (2008). Strengthening regimes for controlling liquidity risks: Some lessons from the recent turmoil. *Bank of England Quarterly Bulletin*, *2,* 111–121. https://ssrn.com/abstract=1147090

Kashyap, A. K., Rajan, R., & Stein, J. C. (2002). Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking, *The Journal of Finance*, *57*(1), 33–73. https://doi.org/10.1111/1540-6261.00415

Keynes, J. M. (1930). *Economic possibilities for our grandchildren*. New York: Harcourt Brace.

Koutsomanoli-Filippaki, A., & Mamatzakis, E. (2009). Performance and Merton-type default risk of listed banks in the EU: A panel VAR approach. *Journal of Banking & Finance*, *33*(11), 2050–2061. https://doi.org/10.1016/j.jbankfin.2009.05.009

Le, L. H., & Pham, X. Q. (2017). Impact of non-interest income on business performance of Vietnamese commercial banks in the period 2006–2016. *Banking Review, 9,* 13–17. https://gssrr.org/index.php/JournalOfBasicAndApplied/article/view/11935

Lopez, J. A., & Saurina, J. (2007). *How does competition impact bank risk-taking?* (FRB Working Paper 2007–23). San Francisco: Federal Reserve Bank. https://www.frbsf.org/economicresearch/files/wp07-23bk.pdf

Lucchetta, M. (2007). What do data say about monetary policy, bank liquidity, and bank risk-taking? *Economic Notes by Banca Montedei Paschi di Siena SpA*, *36*(2), 189–203. https://doi.org/10.1111/j.1468-0300.2007.00180.x

Mahmood, Z. (2019). An emerging economy perspective on corporate sustainability reporting: Main actors' views on the current state of affairs in Pakistan, *Asian Journal of Sustainability and Social Responsibility, 8,* 5–11. https://doi.org/10.1186/s41180-019-0027-5

Mayes, D. G., & Stremmel, H. (2012). *The effectiveness of capital adequacy measures in predicting bank distress*. Zurich: The European Money and Finance Forum.

McLachlan, G., & Peel, D. (2004). *Finite mixture models*. Hoboken: John Wiley and Sons. https://doi.org/10.1146/annurev-statistics-031017-100325

Mercieca, S., Schaeck, K., & Wolfe, S. (2007). Small European banks: Benefits from diversification. *Journal of Banking & Finance*, *31*(7), 1975–1998. https://doi.org/10.1016/j.jbankfin.2007.01.004

Moulton, H. G. (1918). Commercial banking and capital formation. *The Journal of Political Economy*, *47*(9), 705–731. https://www.jstor.org/stable/i331588

Munteanu, I. (2012). Bank liquidity and its determinants in Romania. *Procedia Economics and Finance*, *3*, 993–998. https://doi.org/10.1016/S2212-5671(12)00263-8

Muntuanu, I. (2012). Bank liquidity and its determinants in Romania. *Procedia Economics and Finance*, *56,* 1178–1183. https://doi.org/10.1016/S2212-5671(12)00263-8

Nguyen, H. C. (2020). The effects of non-interest income on risks and profitability. Empirical evidence from joint stocks commercial banks in Viet Nam. *Asian Journal of Economics and Banking*, *6*(2), 171–181. https://doi.org/ajeb.6.2.171181

Nguyen, M. K. (2011). *Developing an interest rate risk management strategy: A case study of Great Trust JSC Bank*. Hanoi, Vietnam: Hanoi Publishers.

Nguyen, P. C. (2018). A model-based approach for estimation of the crack depth on a massive metal structure, *Asian Journal of Management Cases.*

Nguyen, T. M. L. (2016). Factors affecting liquidity ratio at Vietnamese commercial banks. *Journal of Banking*, *9*, 22–26. https:/doi.org/10.12141/jb.2016.9.2226

Nguyen, T. T. T., & Hoang, A. T. (2019). The impact of income diversification on the risks of Vietnamese commercial banks. *Financial & Monetary Market Review, 20*, 41–56. https://doi.org/10.11121/1223614.231

Pham, T. A. (2019). Government spending and economic growth: Theory and empirical evidence in Vietnam. *Journal of Economics and Development, 5,* 11–15. http://doi.org/10.1108/13581981211218342

Plochan, P. (2007). *Risk management in banking* [Master thesis]. Slovakia: University of Economics, Bratislava.

Praet, P., & Herzberg, V. (2008). Market liquidity and banking liquidity: linkages, vulnerabilities and the role of disclosure, *Financial Stability Review*, *11*, 95–109. https://ideas.repec.org/s/bfr/fisrev.html

Prochnow, H. V. (1949). *Term loans and theories of bank liquidity*. New York: Prentice-Hall.

Puspitasari, D. M., Febrian, E., Anwar, M., Sudarsono, R., & Napitupulu, S. (2021). Determinants of default risks and risk management: evidence from rural banks in Indonesia. *The Journal of Asian Finance, Economics, and Business*, *8*(8), 497–502. https://doi.org/10.13106/jafeb.2021.vol8.no8.0497

Rauch, C., Steffen, S., Hackethal, A., & Tyrell, M. (2010). Determinants of bank liquidity creation. *SSRN Journal, 12,* 111–121. http://ssrn.com/abstract=1343595

Rauch, C., Steffen, S., Hackethal, A., & Tyrell, M. (2009). Savings bank, liquidity creation, and monetary policy. *SSRN Journal, 1,* 1–10. http:// doi.org/10.2139/ssrn.1343595

Rychtarsik, S. (2009). *Liquidity scenario analysis in the Luxembourg banking sector* (BCL Working Paper No. 41) Luxembourg City: Central Bank of Luxembourg. https://ideas.repec.org/s/bcl/bclwop.html

Saunders, A., & Cornett, M. M. (2006). *Financial institutions management: A risk management approach.* New York: McGraw-Hill/Irwin.

Shah, D. (2018). Etiology and risk factors determining the poor outcome of severe pneumonia in under-five children. *The Indian Journal of Pediatrics*, *85*(1), 251. https://doi.org/10.1007/s12098-017-2514-y

Shakatreh, M. (2020). The effect of liquidity risks on the relationship between earnings and stock return on Jordanian public shareholding industrial companies. *The Journal of Asian Finance, Economics, and Business*, *7*(4), 21–28. https://doi.org/10.13106/jafeb.2020.vol7.no4.21

Spence, M. (1973). Job market signaling. *Quarterly Journal of Economics*, *87*(3), 355–374. https://doi.org/10.1016/B978-0-12-214850-7.50025-5

Stiroh, K., & Rumble, A. (2006). The dark side of diversification: The case of US financial holding companies. *Journal of Banking & Finance*, *30*(8), 2131–2161. https://doi.org/10.1016/j.jbankfin.2005.04.030

Sumani, S., & Roziq, A. (2020). Reciprocal capital structure and liquidity policy: Implementation of corporate governance toward corporate performance. *The Journal of Asian Finance, Economics, and Business*, *7*(9), 85–93. https://doi.org/10.13106/jafeb.2020.vol7.no9.085

Tang, D. Y., & Yan, H. (2007). Market conditions, default risk, and credit spreads. *Journal of Banking & Finance*, *34*(4), 743–753. https://doi.org/10.1016/j.jbankfin.2009.05.018

Toby, A. (2006). An empirical study of liquidity risk management in Nigerian Banks. *Journal of Financial Management and Analysis*, *3*(5), 51. https://ssrn.com/abstract=932516

Tram, T. X. H., & Tran, T. T. N. (2021). Liquidity risk and bank performance in Southeast Asian countries: a dynamic panel approach. *Quantitative Finance and Economics, 5*(1), 111–133. https://doi.org/10.3934/QFE.2021006

Truong, Q. T. (2012). *The SCP Paradigm in banking sector – The case of Vietnam*, Edition Universitaire Europeenne. https://EconPapers.repec.org/RePEc:dpc:wpaper:2512

Truong, Q. T., & Pham, M. T. (2014). Factors affecting liquidity risk in the case of joint-stock commercial banks in Viet Nam. *Financial and Monetary Market Review*, *21*(414).

Truong, Q. T. (2013). Factors affecting liquidity risk of Vietnamese commercial banking system. *Journal of Economic Development*, *276*, 50–62. http://www.cesti.gov.vn/thu-vien-khoa-hoc-cong-nghe-by-source/TUDIEN53/848297

Valla, N., Saes-Escorbiac, B., & Tiesset, M. (2006). Bank liquidity and financial stability. *Financial Stability Review*, *9,* 89–104. https://www.bis.org/ifc/publ/ifcb28g.pdf

Van den End, J. W. (2010). Liquidity stress-tester: A model for stress-testing banks' liquidity risk. *CESifo Economic Studies*, *56*(1), 38–69. https://doi.org/10.1093/cesifo/ifp005

Vodová, P. (2011). Liquidity of Czech commercial banks and its determinants. *International Journal of Mathematical Models and Methods in Applied Sciences*, *6*(5), 1060–1067. https://doi.org/10.2212/ijmmmap.2011.6.5.1060

Vodová, P. (2013). Determinants of commercial banks' liquidity in Hungary. *E-Finanse, 9*(3), 64–71. https://doi.org/10.25142/aak.2013.016

Vo, X. V., & Mai, X. D. (2017). Foreign ownership and liquidity risk of commercial banks in Vietnam. *Economics and Business, 33*(3), 111–127. https://doi.org/10.25073/2588-1108/vnueab.4086

Vu, T. H. (2012). Factors affecting the liquidity of Vietnamese commercial banks. *Journal of Development and Integration*, *23*(33), 32–49. https://doi.org/10.1221225/44123132.x

Wilson, J. O., Casu, B., Girardone, C., & Molyneux, P. (2010). Emerging themes in banking: Recent literature and directions for future research. *The British Accounting Review, 42*(3), 153–169. https://doi.org/10.1016/j.bar.2010.05.003

Wooldridge, J. (2002). *Econometric analysis of cross-section and panel data*. Cambridge: The MIT Press.

Xiaoqing, F., & Hefferman, S. (2005). *Cost X-efficiency in China's banking sector* (Cass Faculty of Finance Working Paper No 334). London: Cass Business School, City University. London. http://doi.org/10.2139/ssrn.903346