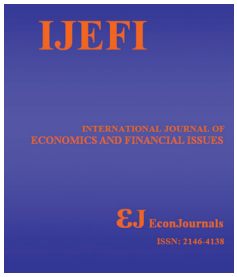

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The Impact of Funding Liquidity on Risk-taking Behaviour of Vietnamese Banks: Approaching by Z-Score Measure

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ABSTRACT

The study analyses the impact of funding liquidity risk on risk-taking behaviour of Vietnamese commercial banks from 2002 to 2016, using the systematic generalized method of moment estimation method. The main finding is that liquidity risk (represented by deposit ratio) has a negative correlation to risk-taking behaviour (captured by Z-score). The study also examines the effects of a big bank and financial crisis on the relationship between liquidity risk and the risk-taking behaviour of banks. The results suggest that big banks will have lower risk-taking behaviour than small banks when the liquidity risk of banks is still low. However, the study cannot find the empirical statistic evidence to confirm impact of funding liquidity risk and risk-taking behaviour in during a global financial crisis. Our results are consistent with all estimation equations with or without attendance of macroeconomic factors.

Keywords: Liquidity, Risk, Behaviour, Vietnamese Banks, Z-score
JEL Classifications: C23, G21, G40

1. INTRODUCTION

Banking sector is known as an important role in growth of economics of a nation. Regarding with "*capital transformation*," a fundamental role of banks in the short-term as well as long-term, makes banks inherently vulnerable to liquidity. They impact not only on nature of banks specify but also the whole of markets. Liquidity, according to Yeager and Seitz (1989), is defined as the ability of a financial institution to cope with all legitimate liability obligations, unless it fells risk. The European Central Bank (in Drehmann and Nikolaou, 2009) considers that liquidity is a binary concept, meaning that a bank can either settle its obligations or cannot. It implies that funding liquidity is associated with one particular point in time. Meanwhile, the risk of financial liquidity may be infinite because it is related to the probability of future results. According to the Basel Committee of Banking Supervision (in Drehmann and Nikolaou, 2009), liquidity is defined as an ability of a bank to increase both its assets and liabilities which meets its debt obligations at maturity without causing significant losses. In this view, liquidity mixes the concepts of funding liquidity and funding liquidity risk.

It, therefore, can be seen that when a bank faces low liquidity, it may face many risks in its business which can lead to bankruptcy in the near future unless they are resolved. In addition, liquidity risk has also been acknowledged as a threat to the governance of financial institutions and the financial stability of the banking system (Khan et al., 2017). Banks are often advised to maintain a liquidity buffer for liquidity risk management as well as to act as a tool against small liquidity shocks that may occur in the near future. Recently, Hong et al. (2014) have been shown that systematic liquidity risk is an essential factor contributing to the failure of the bank in 2009–2010 after the financial crisis of 2007–2008. The authors reveal that liquidity risk can lead to bank failures through systemic and non-systemic risk. Meanwhile, the studies of Acharya and Naqvi (2012) and Wagner (2007) indicate that the higher the level of bank liquidity might increase the bank taking-risk behaviours. Banks with high deposits are considered as banks' low liquidity risk because they have sufficient funds to carry out their obligations (Khan et al., 2017). It is more dangerous when banks become overly confident, They can adventure in higher risk behaviours and reduce market discipline (Khan et al., 2017). Similarly, deposit insurance can cause a moral hazard to

excessive risk-taking behaviours of banks when there is an increase in deposit insurance (Keeley, 1990).

Although the relationship between the funding liquidity and the risk-taking behaviours of banks is considered by many researchers around the world, there are few related studies in Vietnam. Like other countries, banks also play a vital role in the Vietnamese economic. It can be expected that our study of the impact of funding liquidity on risk-taking behaviours of banks will add more literature as well as practical contributions in Vietnam. The objective of this study is examining the effect of funding liquidity on the risk-taking behaviours of Vietnamese banks from 2002 to 2016. As for recommendations of Acharya and Naqvi (2012) and Khan et al. (2017), this study measures the funding liquidity which is associated with the ratio of customer deposits and total bank assets. This study also uses Z-score as a proxy variable of bank risk-taking behaviour (Boyd and Graham, 1986; Hannan and Hanweck, 1988; and Boyd and Runkle, 1993). Moreover, the study also examines the effects of size and financial crisis on the relationship between liquidity and risk-taking behaviours of banks in Vietnam by replacing risk measure and using macroeconomic factors or dummy variables. We expect that the results will provide empirical evidence about the impact of size, financial crisis, funding liquidity on taking-behaviour of banks.

2. LITERATURE REVIEWS

IMF defines funding liquidity as *"the ability of a solvent institution to make agreed-upon payments in a timely fashion*" (Drehmann and Nikolaou, 2009). A bank's funding liquidity is defined by its ability to cover all its predicted expenses, such as funding deposits or making payments on debt, by ensuring liquid assets. According to theory in the bank management, an asset is liquid if it has low risk (such as government bonds) and it is less sensitive to interest rate volatility (Garber and Weisbrod, 1992). Liquid assets also have been known as transforming to cash quickly without significant troubles (Alger et al., 1990; Melese, 2015). Borio (2000); Brunnermeier and Pedersen (2007) and Strahan (2008) (in Drehmann and Nikolaou, 2009) give their definition *"funding liquidity as the ability to raise cash at short notice either via asset sales or new borrowing."* However, most people believe that bank funding liquidity strongly relatives with deposit money. Bordo et al. (2001) suggest when the economy goes into recession or depression, income is expected to fall. Borrowers will have difficulty in repaying loans. Meanwhile, depositors will try to protect their wealth by withdrawing bank deposits because of anticipating a decrease in effectiveness of investments or loans. Banks, therefore, are stuck between the illiquidity of assets (loans) and the liquidity of liabilities (deposits) and may become insolvent. Hence, Basel Committee of Banking Supervision (in Drehmann and Nikolaou, 2009) considers funding liquidity may include funding liquidity risk.

Banking risk is risks of bank activities or their assets risk which is confronted during bank operating. There are many different ways to measure bank risk in the literature. The most common ways to measure riskiness of financial institutions are VaR, ES and Z-score. VaR is a standard risk measure for bank risk management which is recommended by Basel II. ES is a better risk measure than VaR, and it is recommended in Basel III. However, both VaR and ES focus on the risk of an individual institution, and cannot adequately capture systemic risk (Li and Malone, 2016). Meanwhile, we focus on the overall riskiness of banks, and the Z-score is a suitable approaching. Z-score has now become a common indicator of bank risk-taking and has been used widely by academics (Laeven and Levine, 2009; Houston et al., 2010; Delis et al., 2014). By measuring the distance to default as well as the size of capital buffers and standard deviation of its return, Z-score is simple in computation and it can be computed by using available accounting data only.

Risk of funding liquidity has long been seen as a cause of financial institutions crisis as well as financial system instability. In order to manage liquidity risk and against small liquidity shocks, banks are advised to maintain a liquidity buffer (Khan et al., 2017). Hong et al. (2014) found that systematic liquidity risk was an important contributor to bank failures through systematic and idiosyncratic channels. According to Acharya and Naqvi (2012), funding liquidity can potentially affect bank risk-taking and stability. Consistantly, Vazquez and Federico (2015) found that stability of capital (according to Basel III) can reduce the probability of bank's failure and increase funding liquidity. However, to maintain a higher of funding's stability, banks have to pay a higher long-term cost of capital to borrowers (King, 2013), leading to a reduction in bank's profitability. Therefore, liquidity and profitability of bank maybe have an adverse relationship. It implies that once banks follow high profitability, it may go up taking-risk behaviours.

The level of funding liquidity has significantly influenced the bank during the operating period and maintaining a higher level of funding liquidity can lead to bank crises (Adrian and Shin, 2010 and Khan et al., 2017). Under stress of using surplus funds, Adrian and Shin (2010) show that banks would look for potential borrowers, even they do not have enough liquidity capacity. The result is that there is potential hazard comes from reducing in lending standards to push the use of surplus funds. Also, Wagner (2007) 's theoretical model describes the relationship between bank liquidity and bank stability. It is found that an increase in the bank's liquid assets may reduce the bank's stability during the financial crisis but it will not affect in the normal period. Besides that, changes in bank liquidity may be caused by interest rates movement through changes in monetary policy. Lucchetta (2008) argues that banks will face more risk when they have over-investments in risk-free bonds due to increasing of risk-free interest. It will increase liquidity supply and lending in the interbank market. Its turn, the increase in liquidity also push banks investing in riskier assets. According to Acharya and Naqvi (2012), 73% of the failed banks had caused by overlending was found by the OCC (Comptroller of the Currency). Authors implied that bank managers often tend to engage in "overly aggressive risk-taking behaviour," as a problem of principal-agent theory.

Because investors prefer insured deposit than risky direct investment during the financial crisis, Khan et al. (2017) also indicated that banks could obtain funds by issuing insured deposits and investing in riskier assets. It contains a moral hazard for

excessive risk-taking by banks (Keeley, 1990). Hence, banks having excessive deposits can take more risk at the cost of the deposit insurer (Khan et al., 2017). Funding liquidity is also negatively associated with market liquidity risk (Drehmann and Nikolaou, 2013). It means the market liquidity is low when the funding liquidity risk is high. Theories and empirically studies, therefore, it may suggest that there is a correlation between funding liquidity and risk-taking behaviour of the bank. Basing on Acharya and Naqvi (2012) and Khan et al. (2017) views, our first hypothesis in this study is:

Hypothesis H_1: The banks with high funding liquidity have incentives to take more risk-taking behaviours.

We also believe that relationship between risk-taking behaviours and funding liquidity of banks is affected by macroeconomic conditions. This is known widely in literature and empirical studies. Berger and Udell (1994), for example, use the macroeconomic variables such as real growth rate of the gross national product, national and state unemployment rate and real national income growth rate, etc. to investigate the link between risk and lending behaviour of U.S. banks. Buch et al. (2014) use the log differences of real gross domestic product (GDP), the GDP deflator, real house prices and the level of effective federal funds rate to investigate the risk-taking behaviour of banks. Similarly, Khan et al. (2017) use growth of the GDP, the unemployment rate and changes in the house price index as macroeconomic factors to measure the effect of funding liquidity on risk-taking behaviour of banks. To check robustness, we use the growth of the GDP, the unemployment rate, and deposit interest as macroeconomic conditions that impact on risk-taking behaviour.

Demsetz and Strahan (1997) also suggested that an increase in total bank assets could reduce the bank's risk and positively correlate with the diversification of the bank. Similarly, large banks maybe accept the lower risk-taking because the size will help to improve the bank stability, presented by Z-score (Stiroh, 2004; Mercieca et al., 2007). Hence, Khan et al. (2017) consider that large banks do not need to take riskier. Earlier, Bertay et al. (2013) reveal the bank size was not correlated with bank risk which is measured by the Z-score. Meanwhile, Boyd and Runkle (1993) found that bank size was inversely correlated with volatility in returns rate. Large banks, therefore, the smaller volatility in profit they have, the lower risk-taking they convey. Similarly, Kwan (2010) found that large and medium-sized banks tightened their loan rates more than small banks; while small banks tended to loosen more. In comparing with large banks, the application of Basel II makes more risk-taking for small banks because large banks have two choices between Standardized Approach and Internal Ratings Based Approach (Hakenes and Schnabel, 2011). Moreover, bank size also was found to negatively correlated with income fluctuations and this relationship was stronger during the global financial crisis (De Haan and Poghosyan, 2012). According to Khan et al. (2017), this study expects that the size of the bank has an impact on the risk-taking behaviours of banks by the following hypothesis:

Hypothesis H_2: The large banks with high funding liquidity take less risk-taking behaviours.

Delis et al. (2014) presented in their study that the risk of U.S. banks was quite stable until 2001, and it rose sharply before the global financial crisis from 2007 to 2008. Cornett et al. (2011) found that banks hold illiquid assets continuously cut lending and investment as well as increased asset liquidity during the financial crisis. Similarly, Ivashina and Scharfstein (2010) found that banks reduced their new loans rapidly during the peak of the financial crisis. During this period, U.S. banks raised deposit rates to attract deposits in order to improve their liquidity (Acharya and Mora, 2015). Valencia (2013) analyses the relationship between loan supply and uncertainty for a sample of U.S. commercial banks and the period 1984–2010. He found that banks with relatively low levels of capitalisation decrease lending more if uncertainty increases. Therefore, this study expects that banks will not adventure in high risk-taking when their liquidity risk is low during the financial crisis.

Hypothesis H_3: Banks reduce risk-taking behaviour to reserve their funding liquidity in the global financial crisis.

3. METHODOLOGY AND DATA

3.1. Methodology

This study uses Z-score and as a proxy of bank risk-taking (Laeven and Levine, 2009; Houston et al., 2010; Delis et al., 2014; Khan et al., 2017). The basic idea of the Z-score is to set up a relationship between bank's capital level and volatility of its returns so that one can know how much variability in returns could be absorbed by bank capital without the bank fall into insolvency (Li and Malone, 2016). The standard deviation of return on assets (ROA) presents the variability in returns, while the numerator of the ratio is presented by the ratio of equity capital to assets plus ROA. From the Z-score formula, it can be seen that when the Z-score value increases, it may be due to increased from ROA, bank capital or a decrease in the volatility of standard deviation of ROA. The assumption is that bank's capital level falls to zero, it becomes insolvent. It is implied that bank is highly stable when Z-score value is high and a lower value of Z-score indicates a higher risk of the bank (Nicolo et al., 2004; Berger et al., 2008; Beck, 2008).

$$\text{Z-score}=\frac{\text{ROA}+\text{E/TA}}{\sigma\text{ROA}}$$

Where ROA is the ratio of net profit and total assets, E/TA is the ratio of equity and total assets, and σROA is the Standard deviation of ROA. The Z-score is calculated based on the bank's accounting data. Basing on Khan et al. (2017) model, we set up the relationship between the liquidity risk and the risk-taking behaviour of banks by following equations:

$$\text{Z-score}_{it}=\beta_0+\beta_1*\text{Deposit}_{it}+\beta_2*\text{Asset}_{it}+\beta_3*\text{Loans}_{it}+\varepsilon_{it} \quad (1)$$

Where Z-score_{it} is the natural logarithm of the Z-score which is presented bank risk at t time of i bank. Independence variable is Deposit_{it} which is measured its liquidity risk. Deposit_{it} is calculated by the ratio between total customer deposits and total assets at t time of i bank (Acharya and Naqvi, 2012; Khan et al., 2017). Banks with surplus deposits are less likely to face liquidity risk in

the near future. The control variables are added to describe bank characteristics. They are used in typical previous studies about bank risk, including bank asset ($Asset_{it}$), loan outstanding balance ($Loans_{it}$). ($Asset_{it}$) of the bank is taked the natural logarithm of total assets, and ($Loans_{it}$) is ratio of total loan and total assets (Shrieves and Dahl, 1992; González, 2005; Laeven and Levine, 2009; Casu et al., 2011; Distinguin et al., 2013). We emphasize that equity-to-asset ratio (Equity) and net profit on total assets (ROA) are not considered as control variables in our model because the (**Z-score**) (dependent variable) is calculated based on these two indices. They, therefore, cause spurious regression.

To exam the impact of liquidity risk on risk-taking behaviours of banks in large banks and financial crisis, our study also extends Equation (1) by adding two interaction variables between the liquidity risk and bank size in Equation (2), between liquidity risk and financial crisis in Equation (3). Dummy variables represent the large banks (Big_{it}) and the financial crisis (Gfc_{it}), respectively. First, (Big) is the dummy variable equal to 1 for banks whose average total assets are larger than the median size of the sample and it is 0 in vice versa. (Gfc) is also a dummy variable with value 1 when time is 2008 or 2009 and vice versa is 0.

$$Z\text{-score}_{it}=\beta_0+\beta_1*Deposit_{it}+\gamma*Deposit_{it}*Big_{it}+\beta_2*Assetit+\beta_3*Loans_{it}+\varepsilon_{it} \quad (2)$$

$$Z\text{-score}_{it}=\beta_0+\beta_1*Deposit_{it}+\gamma*Deposit_{it}*Gfc_{it}+\beta_2*Assetit+\beta_3*Loans_{it}+\varepsilon_{it} \quad (3)$$

We test whether relationship between the risk-taking behaviour and funding liquidity of banks is changed under effect of macroeconomic factors, we also use growth of GDP, the unemployment rate (Unemploy) and deposit interest (Interest). These macroeconomic factors have been widely used by many authors in period studies (Berger and Udell, 1994; Buch et al., 2014; Khan et al., 2017). The macroeconomic data was collected from World Indicators development database of World Bank and Asian development Bank database. We have Equation (4):

$$Z\text{-score}_{it}=\beta_0+\beta_1*Deposit_{it}+\beta_2*Asset_{it}+\beta_3*Loans_{it}+\beta_4*GDP_{it}+\beta_5*Unemploy_{it}+\beta_6*Interest_{it}+\varepsilon_{it} \quad (4)$$

$$Z\text{-score}_{it}=\beta_0+\beta_1*Deposit_{it}+\gamma*Deposit_{it}*Big_{it}+\beta_2*Asset_{it}+\beta_3*Loans_{it}+\beta_4*GDP_{it}+\beta_5*Unemploy_{it}+\beta_6*Interest_{it}+\varepsilon_{it} \quad (5)$$

$$Z\text{-score}_{it}=\beta_0+\beta_1*Deposit_{it}+\gamma*Deposit_{it}*Gfc_{it}+\beta_2*Asset_{it}+\beta_3*Loans_{it}+\beta_4*GDP_{it}+\beta_5*Unemploy_{it}+\beta_6*Interest_{it}+\varepsilon_{it} \quad (6)$$

Typically, studies in Vietnam use widely fixed effect method (FEM) and random effect method (REM) regression in panel data. However, the FEM and REM do not overcome the problem of heteroskedasticity and autocorrelation up to second orders. The feasible generalized least squares (FGLS) can deal with above issues. However, there is still the problem of endogeneity or reverse causality that FGLS cannot deal, especially with macroeconomic variables. So generalized method of moment (GMM) is a better method than FGLS in two features: (1) It can maximise the efficiency of regression models through a solution of the problems of serial correlation and heteroscedasticity as well as endogeneity and reverse causality. (2) We can control lags of dependent and independent variables through the creation of a weight matrix of internal instruments.

However, an issue of GMM estimator is that the variance of the estimates may increase asymptotically and create considerable bias. Blundell and Bond (1998) and Blundell et al. (2000) show that estimation in first differences has a significant bias and low precision, even in studies with a large number of individuals (n). The poor performance of difference GMM estimator can be worse with the degree of persistence of series because as persistency increases, lagged levels can be less correlated with current first differences, so they become weak instruments (Soto, 2009). The system GMM estimator is likely to exhibit its best features regarding small sample. In the system GMM estimation, the equation in differences is instrumented by lagged differences. Hence, the system GMM works better than the first differenced GMM, they are moderately or highly persistent, the system GMM estimator will display the lowest bias and highest precision (Soto, 2009).

3.2. Data

To examine the impact of bank liquidity risk on bank risk-taking behaviours, we use a set of data of commercial banks in Vietnam from 2002 to 2016. Financial reports are collected and aggregated by Stoxplus.com[1]. Moreover, the last sample excluded banks that had been bought by the State Bank of Vietnam, as well as the merged and consolidated banks in the study period. Finally, collected banks include 30 commercial banks, in which one bank is 100% state-owned, 3 state-private commercial banks and 26 private commercial banks. All data are extracted from financial reports, they are organised to unbalanced panel data with 326 observations due to lack of some observation in several years.

First, statistical results are presented in Table 1. It can be seen that the mean value of the (Z-score) is 3.174 to indicate that the risk-taking behaviour of the banks in the sample is not high. However, based on the standard deviation (0.542) and the minimum value (0.543), it can be seen that there are significant differences between banks in risk-taking behaviours. Similarly, (Llp) gets mean value (0.009) and standard deviation (0.008), while mean and standard deviation of ($Depos_{it}$) are 0.591 and 0.157, respectively. Mean of (GDP) is 0.062, (Interest) is 0.086 and (Unemploy) is 0.027 in the sample.

The correlation matrix is shown Table 2. It can be seen that customer deposits ($Depos_{it}$) and the size of banks (Size) have an inverse linear correlation with risk-taking behaviour as measured by the (Z-score). Similarly, (GDP) also have a negative relationship with (Z-score). Finally, (interest) and (Unemploy) and (Loans) correlated positively with (Z-score). The correlation coefficients between the independent variables are <0.8, so according to Franke (2010), we can determine the multicollinearity problem does not exist in our model.

1 StoxPlus, an associate company of Nikkei Inc. and QUICK Corp., is known a leading financial and business information corporation in Vietnam, website: http://stoxplus.com.

4. FINDINGS

4.1. Relationship between Funding Liquidity Risk and Risk-taking Behaviour

Tables 3 shows the results of the estimated effects of funding liquidity risk on the bank risk-taking behaviours, respectively from Equation (1) to (3). Firstly, based on the test results of the GMM estimation method, it can be seen that the p-value values of both AR (2) and Hansen tests are insignificant, indicating that the GMM method used is appropriate, our estimates are reliable and not biased. Meanwhile, the AR (2) test receive a p-value higher than 0.1, indicating no self-correlation in our model (Hansen, 1999). Hansen's test results in each equation cannot be disproved by the null hypothesis or the tool variables in this study are valid (robust, but weakened by many instruments).

It can be seen that the funding liquidity risk (presented by Deposit) is negatively correlated with the risk-taking behaviour (is captured by Z-score) in all equations. Our findings are consistent with the results which are found by Acharya and Naqvi (2012) and Khan et al. (2017). According to our finding in Equation (1), the bank risk-taking will increase average 0.654 points when liquidity risk decreases average 1 point at 1% significance statistic. Our results confirm again our hypothesis (H1) is supported. It means banks are facing lower funding liquidity risk will take more risk. It can be explained that banks with higher deposits will not have liquidity problems in short-term as well as the possibility of being audited. Under pressure of higher deposits, banks will lend aggressively. Banks managers, therefore, will have more risk-taking behaviour to respond profitable expectations of owners, investor, or related others.

We also find that interactive variable (Deposit*Big) between deposits and the big bank dummy is positively related to risk-taking behaviours at 1% significance. This interactive factor decreases the level of risk-taking of banks 0.389 points when it forwards up 1 point. Therefore, larger banks take less risk in comparison with smaller banks when they have more deposits. Our finding strongly supports our hypothesis (H2). Scatter business model, tight supervision and regulatory constraints are reasons which make barriers for big banks to take more risk-taking behaviours. Meanwhile, we cannot conclude about bank risk-taking behaviour in a global financial crisis (Deposit*Gfc). There is no empirical statistic evidence to confirm or deny our hypothesis (H3), although the sign of interactive variable of deposits and the global financial crisis shows that banks still have more risk-taking behaviour when their funding liquidity risk reduce even in crisis time.

Other findings of our study are consistency, regarding with bank characteristics. (Asset) impacts undoubtedly on bank risk-taking behaviours, level of risk behaviour is increased average 0.08 point when the logarithm of total asset increase 1 point at 1% significant statistic. It implies that bank size reduces the overall riskiness of banks. Besides that, the ratio of total loans to total assets (Loans) is positively related to Z-score at 1% significance level. It indicates that the banks have larger of loan portfolio, the lower the risk-taking behaviours will be.

4.2. Effect of Macroeconomic Factors

As a robustness check, we examine the relationship between the risk-taking behaviour and funding liquidity of banks under the effect of macroeconomic factors. We extend three above equations by adding macro factors such as the growth of GDP, the unemployment rate (Unemploy) and deposit interest (Interest) as control variables. We also use GMM estimation method for extended equations. Our results are presented in Table 4.

Robustness check results are similar to the results without macroeconomic factors. It can be seen that risk-taking behaviour still have a negative relationship with funding liquidity risk at 1% significant level and larger banks still take less risk in comparison with smaller banks when they have more deposits. It implies that our findings are entirely sustainable. Table 4 shows that GDP growth rate will increase risk-taking behaviour of banks whereas unemployment and interest will decrease bank risk-taking behaviours at 1% significant level. It can be explained that GDP growth rate often a positive signal for a rich in the future. Banks, therefore, will become more reckless in lending activities because they believe that the economy will flourish in the future. Meanwhile, the increase in unemployment rate and deposit interest make banks to consider their activities carefully.

Table 1: Summary statistic

Variable	Obs	Mean	Standard deviation	Minimum	Maximum
Z-score	326	3.174	0.542	0.543	4.609
Deposit	326	0.592	0.157	0.001	0.892
Asset	326	31.503	1.461	26.655	34.545
Loans	326	0.527	0.141	0.114	0.880
Gdp	326	0.062	0.007	0.052	0.075
Interest	326	0.086	0.029	0.047	0.140
Unemploy	326	0.027	0.010	0.017	0.049

Source: Authors calculated

Table 2: Correlation matrix

	Z-score	Deposit	Asset	Loans	GDP	Interest	Unemploy
Z-score	1.000						
Deposit	−0.117*	1.000					
Asset	−0.167*	0.324*	1.000				
Loans	0.158*	0.416*	0.123*	1.000			
Gdp	−0.038	0.028	−0.205*	0.106*	1.000		
Interest	0.157*	−0.428*	−0.097*	−0.186*	−0.270*	1.000	
Unemploy	0.206*	−0.134*	−0.394*	0.097*	0.571*	0.010	1.000

*,**,***indicate significant at 10%, 5%, 1%. Source: Authors calculated, GDP: Gross domestic product

Table 3: Funding liquidity risk and risk-taking behaviour (is captured by Z-score) (dependent variable: Z-score)

Variables	Equation (1)	Equation (2)	Equation (3)
Deposit	−0.654***	−1.071***	−0.452**
	(−3.990)	(−2.390)	(−1.810)
Deposit*Big		0.389**	
		(1.870)	
Deposit*Gfc			−0.038
			(−0.410)
Asset	−0.082***	−0.089***	−0.143***
	(−3.150)	(−2.410)	(−6.060)
Loans	0.817***	0.957	0.994**
	(3.490)	(1.070)	(1.950)
Const.	5.739***	6.005***	7.417***
	(6.980)	(5.100)	(10.990)
Ar (1)	0.194	0.179	0.224
Ar (2)	0.257	0.346	0.279
Hansen test	0.105	0.721	0.211

*,**,***indicate significant at 10%, 5%, 1%. The value statistic in ( ). Source: Authors calculated

Table 4: Funding liquidity and risk-taking behaviour including macroeconomic factors (dependent variable: Z-score)

Variables	Equation (4)	Equation (5)	Equation (6)
Deposit	−0.627***	−0.756***	−0.793***
	(−3.420)	(−6.200)	(−3.220)
Deposit*Big		0.424***	
		(5.220)	
Deposit*Gfc			−0.128
			(−1.050)
Asset	−0.060***	−0.066***	−0.076**
	(−2.630)	(−3.670)	(−2.160)
Loans	1.263***	0.862***	1.346***
	(4.850)	(6.350)	(4.140)
GDP	−9.534***	−9.171***	−17.874***
	(−7.890)	(−10.910)	(−4.350)
Interest	1.445***	1.277***	2.671***
	(5.380)	(4.010)	(3.920)
Unemploy	11.955***	10.280***	10.830**
	(7.780)	(6.100)	(1.970)
Const.	4.900***	5.295***	5.917***
	(7.210)	(9.660)	(5.190)
Ar (1)	0.201	0.075	0.257
Ar (2)	0.960	0.581	0.798
Hansen test	0.139	0.226	0.121

*,**,***indicate significant at 10%, 5%, 1%. The value statistic in ( ). Source: Authors calculated

5. CONCLUSION

The study analyses the impact of funding liquidity risk on risk-taking behaviours of Vietnamese commercial banks from 2002 to 2016, using the systematic GMM estimation method. The main finding is that liquidity risk has a negative correlation to risk-taking behaviours; in other words the higher deposit rates are, the higher risk-taking behaviour will be. Our study implies that banks have more surplus deposits will have more potential risk-taking behaviours in looking for under-standard borrowers (Adrian and Shin, 2010). Moreover, this study also examines the effects of massive bank and financial crisis on the relationship between liquidity risk and the risk-taking behaviours, using the interaction variables. The results suggest that big banks will have lower risk-taking behaviours than small banks when they have low liquidity risk. Our results are consistent with all estimation equations with or without attendance of macroeconomic factors. However, we cannot find the empirical statistic evidence to confirm or deny the relationship between funding liquidity risk and risk-taking behaviour in a global financial crisis. Other findings include total loans, unemployment ratio and deposit interest will decrease risk-taking behaviours while the growth rate of the GDP will increase risk-taking behaviours of banks.

The findings of the study also provide some recommendations for bank executives in the context of competition today. We consider that banks should not rely on short-term funding, such as deposits, to ensure their behaviours. Bank managers should carefully consider their lending activities although their liquidity risk of bank financing is not high. The capital should be not used indiscriminately and carefully appraise to avoid the possibility riskiness and failures in the future. Our study provides empirical evidence of the link between funding liquidity risks such as deposit ratios and bank risk-taking behaviour which may bring usefulness to redesign the Vietnamese banking regulatory framework. Banks should be continuously reviewed liquidity risk, business strategies to ensure discipline and change in the deposit ratio. According to our findings, large banks should take risks less than smaller ones, although their liquidity risk could be low. It implies that large banks do not need to focus and compete with small banks in traditional business operations. In sum, we support that regulations and tight control are necessary to reduce taking-risk behaviour of banks.

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