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FACTORS AFFECTING LIQUIDITY OF COMMERCIAL BANKS IN VIETNAM

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A B S T R A C T

The article assesses the impact of internal and external factors affecting the liquidity of Vietnamese commercial banks. Observational data was collected from 28 commercial banks for the period from 2009 to 2020. The use of Multiple linear regression algorithm under the Supervised learning group of Machine learning on python platform for observed data with results $R^2 \approx 70\%$ and very small MSE demonstrate the fit of the model, and Seaborn data visualization will give a visual view of the research results. Model results and regression coefficients show that ROA, CAP, LLD, INF have a negative impact and SIZE, LDR, GDP have a positive impact on liquidity of commercial banks in Vietnam in the sample. Thereby, we propose recommendations for commercial banks in Vietnam to manage liquidity well, improve the efficiency of the bank's business operations such as increasing capital size to ensure CAR according to Basel II standards, strengthen handling of bad debts and improve credit quality, comply with regulations and ensure capital adequacy in liquidity.

1. INTRODUCTION

After the world financial crisis (2007-2009), the Basel Committee issued regulations on liquidity management to improve the liquidity of banks. In addition, countries have strengthened liquidity risk control in the banking sector. Since 2010, due to the influence of the world market as well as the consequences of the network expansion process and the rapid credit growth, the banking system has revealed some inadequacies such as credit quality. decline, bad debt increases, liquidity of the system is unstable, the risk of system breakdown ... In Vietnam, the commercial banking system has undergone two system restructuring times. From 2012 to 2015, the commercial banking system decreased by 5 joint stock commercial banks through mergers and acquisitions (Ficom Bank, TinNghia Bank, Habu Bank, Western Bank, DaiA Bank). The State Bank of Vietnam (SBV) has bought 3 old commercial banks at the price of "0" dong (VNC Bank, OceanBank and GPBank).

The crisis from US subprime lending occurred in August 2007 engulfed the entire US economy as well as the global financial system. The Basel Committee on Banking Supervision (BCBS 2004) pointed out that one of the main causes of the crisis was liquidity problems, which had been largely ignored in the past. The crisis showed that banks that relied heavily on short-term money markets to fund their operating assets tended to suffer from huge liquidity problems.

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In recent years, although the liquidity situation of commercial banks is less stressful, banks still have to face with increasing bad debts, inefficient credit financing, etc. Therefore, the liquidity of banks still has many potential risks. Although there are many studies in Vietnam and abroad on the liquidity of commercial banks, but in the research process, the authors found that no research on the factors affecting the liquidity of commercial banks has been conducted by machine learning algorithms. This is an application of artificial intelligence (AI) that gives systems the ability to automatically learn and improve from experiences so that it can discover and use data more efficiently.

2. EMPIRICAL RESEARCHS

There are many studies on the factors affecting the liquidity of commercial banks in the world. The following sections are typical studies on factors affecting liquidity.

Aspachs et al. (2005) investigated the liquidity determinants of 57 banks in the UK, using quarterly data from 1985 to 2003. They found that interest margin and lending growth rate negatively affects bank liquidity, while profitability and bank size have no impact. They also found that liquidity is negatively related to real GDP growth.

Research by Valla et al. (2008) on the factors affecting the liquidity of banks in the UK shows that the size of the bank can have a negative or positive impact on the liquidity of the bank. Meanwhile the probability of getting support from the last resort lender, interest margin, bank profitability, loan growth, gross domestic product, monetary policy interest rates have negative effects to bank liquidity.

Research by Bunda & Desquilbet (2008) analyzed the liquidity of 1107 commercial banks in 36 emerging countries from 1995 to 2000, using bank-specific variables, markets and macroeconomic variables and exchange regimes. They find that liquidity is negatively related to (i) bank size as measured by total assets, (ii) lending rates, (iii) and the presence of a financial crisis. On the other hand, liquidity is positively related to (i) capital adequacy ratio as measured by equity divided by total assets, (ii) the presence of regulations that require banks to liquidation, (iii) public expenditure divided by GDP, (iv) inflation rate, and (v) Regime exchange rate. Banks in extreme mode (floating or fixed anchor) have more liquidity than countries in intermediate mode.

The effect of the financial crisis on the liquidity of commercial banks in Latin America and the Caribbean countries studied by (Moore, 2009) shows that liquidity depends on many factors. Inside, customers' cash requirements, macroeconomic situation such as GDP, inflation rate have a positive influence on the bank's liquidity; Money market interest rates have a negative effect on bank liquidity.

Vodová, P. (2013) studies to determine the factors affecting the liquidity system of banks in Hungary from 2001 to 2010. The panel data regression results show that bank liquidity has a positive relationship with capital adequacy, loan interest rate and profit; has a negative relationship with bank size, interest margin, interbank interest rate and monetary policy interest rate.

According to research by Hong (2015), the quantitative method FEM was used to determine the factors affecting the liquidity of 35 joint stock commercial banks in Vietnam in the period 2006-2011. The results show that equity ratio, bad debt ratio and profit ratio are positively correlated; on the contrary, the ratio of loans to deposits has a negative correlation with liquidity. However, this study did not find the effect of credit risk provision ratio, bank size on liquidity.

Singh & Sharma (2016) studied to determine the intrinsic factors and macro factors affecting the liquidity of 59 banks in India from 2000 to 2003 through OLS, FEM estimation methods. Research results show that factors such as bank size and GDP have a negative effect on bank liqulity. In contrast, deposits, profitability, capital adequacy, and inflation have a positive effect on liquidity.

Sopan and Dutta (2018) analyzed panel data on 45 banks in India from 2005 to 2016. The results show that size, profitability, funding cost and asset quality have a negative impact on risk. Liquidity. Meanwhile, rate of deposit, capitalization rate has a positive effect.

3. RESEARCH METHOD AND MODEL

3.1 Research model

The model of this paper is mainly based on the inheritance of previous authors Vodová (2013), Singh & Sharma (2018). Similar to the previous research, in this study, the authors have selected the dependent variable representing the liquidity of commercial banks which is the variable "The ratio of liquid assets to total assets". And the independent variables that the authors use in the model are bank size (SIZE) and equity ratio (CAP) as well as macro-independent variables including economic growth rate (GDP) and inflation rate (INF) as factors affecting the liquidity of commercial banks.

At the same time, many studies show that the credit risk provision ratio affects the liquidity of commercial banks such as Munteanu (2012), Sopan and Dutta (2018), Hong (2015). Meanwhile, many researches have demonstrated the impact of profitability (ROA) on the liquidity of commercial banks, namely the studies of Rauch et al. (2010), Aspachs et al. (2005), ect. Therefore, in order to increase the accuracy and stability of the research model,

the author has selected 2 more variables including the credit risk provision ratio (LLD) and profitability (ROA) are independent variables in the model to analyze their impact on liquidity of commercial banks in Vietnam.
In this study, data was collected from 28 commercial banks in Vietnam from 2009 to 2020 The experimental research model is as follows:

$$LIQ_{it} = \alpha + \beta_1 ROA_{it} + \beta_2 SIZE_{it} + \beta_3 CAP_{it} + \beta_4 LDR_{it} + \beta_5 LLD_{it} + \beta_6 INL_{it} + \beta_7 GDP_{it} + u_{it} \quad (1)$$

Where:
α: Intercept.
β1, … β7: The individual regression coefficients of the independent variables.
i: Symbol for banks
t: Symbol for years
u: Represents the error of the model.

Dependent variable

LIQ: Ratio of Liquid assets to Total assets (as a percentage)

Independent variables

ROA: Return on total assets, representing profitability (calculated as a percentage)

SIZE: Represents the size of the bank (calculated in base 10 logarithms of total assets)

CAP: Represents equity ratio (calculated as a percentage)
LDR: Ratio of outstanding loans to total deposits (calculated as a percentage)

LLD: Represents the provision for credit losses (as a percentage)

INF: Represents Vietnam's inflation rate (as a percentage)
GDP: Represents GDP growth rate (as a percentage)

3.2 Research hypothesis of independent variables on liquidity

ROA: Shows a bank's ability to use its assets to generate profits. The more profitable the bank, the higher the profitability.

ROA = (Profit after tax)/(Average total assets of the bank)

Hypothesis H_1: ROA is positively related to the liquidity of commercial banks in Vietnam.

SIZE: The variable represents the absolute size measured by the base 10 logarithm of total assets (LogA - Logarith Total Asset), showing that the size of the bank removes the time factor and becomes a linear variable. It is expressed by the formula:

Bank Size(SIZE) = Log (Total Assets)

Hypothesis H_2: The larger the bank size, the higher the liquidity.

CAP: Equity ratio is measured by equity divided by total assets, this ratio shows the capital adequacy and financial strength of a bank. A low ratio of this index indicates that the bank uses a lot of financial leverage leading to high risk, which can reduce the bank's profitability when the cost of capital decreases. Research on this factor has high significance for liquidity. This ratio has the formula:

CAP = (Equity)/(Total Assets)

Hypothesis H_3: The ratio of equity to total assets has a positive effect on the liquidity of commercial banks in Vietnam.

LDR:

LDR = (Total outstanding loans) / (Total deposits)

Hypothesis H_4: The ratio of loan outstanding balances to total deposits has a negative impact on the liquidity of commercial banks in Vietnam.

LLD: Provision ratio for credit risk is measured by provision for credit losses on total value of loans. Provision is calculated on bad debts in group 3, group 4 and group 5 according to the regulations of the State Bank, so the higher this ratio, the higher the credit risk.

LLD = (Provision for credit losses)/(Total outstanding loans)

Hypothesis H_5: The credit risk provision ratio has a positive impact on the liquidity of commercial banks in Vietnam.

INF: The inflation rate is usually measured by the growth rate of the consumer price index CPI.

Hypothesis H_6: The inflation rate has a negative effect on the liquidity of commercial banks in Vietnam.

GDP: Many previous studies have had different results on the correlation of GDP to liquidity. However, in this study, the authors expect the positive relationship of GDP to liquidity.

Hypothesis H_7: GDP growth rate has a positive impact on liquidity of commercial banks in Vietnam.

3.3 Research Methods

The research is done on Python 3.6.8 programming language along with libraries and machine learning algorithms.

The model is performed through the following steps:
Step 1: Performing descriptive statistics, clean data.
Step 2: Finding the appropriate algorithm for the model and data on the python programming language platform
Step 3: Determining the performance and reliability of the model, regression coefficients, visualize the results.

4. RESEARCH RESULTS AND DISCUSSION

4.1 Descriptive statistical analysis of the research variables

Information about observed data of 28 commercial banks in Vietnam from 2009 to 2020 is shown in Table 1.

Table 2 shows information about variables on the python programming language.

Because the data has many outliers, it needs to be processed to balance the data. The result of this process is showed in Figure 1.

Only the SIZE variable has no outliers, the remaining variables all have outliers, so it needs to be processed to balance the data. The method used to handle these outliers is the Three-Sigma Limits, the results after processing are shown in Table 3.

Table 1. Information on observational data (Compiled by the authors)

	YEAR	BANK	LIQ	ROA	SIZE	CAP	LDR	LLD	INF	GDP
0	2009	ABB	0.480446	0.004337	7.423542	0.169297	0.607272	0.0058	0.0652	0.0532
1	2010	ABB	0.521031	0.015376	7.579963	0.122376	0.658169	0.004759	0.1175	0.0678
2	2011	ABB	0.476789	0.007719	7.618487	0.113694	0.661876	0.029086	0.1813	0.0589
3	2012	ABB	0.496638	0.009121	7.662887	0.106495	0.56377	0.009295	0.0681	0.0503
4	2013	ABB	0.640403	0.002712	7.760631	0.099683	0.618522	0.014905	0.0604	0.0542
...	...	...	...	...	...	...	...	...	...	...
331	2016	VPB	0.646427	0.018621	8.359401	0.075086	1.03905	0.037263	0.0474	0.0621
332	2017	VPB	0.654615	0.025431	8.443658	0.106914	1.269714	0.044569	0.0353	0.0681
333	2018	VPB	0.679354	0.024476	8.509594	0.107488	1.137498	0.051527	0.0501	0.0708
334	2019	VPB	0.683223	0.023584	8.576576	0.111902	1.119446	0.05408	0.0753	0.0702
335	2020	VPB	0.696961	0.026158	8.622242	0.125991	1.179243	0.051068	0.0323	0.0291

Table 2. Info of data (Infor in python)

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 336 entries, 0 to 335
Data columns (total 10 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   YEAR    336 non-null    int64
 1   BANK    336 non-null    object
 2   LIQ     336 non-null    float64
 3   ROA     336 non-null    float64
 4   SIZE    336 non-null    float64
 5   CAP     336 non-null    float64
 6   LDR     336 non-null    float64
 7   LLD     336 non-null    float64
 8   INF     336 non-null    float64
 9   GDP     336 non-null    float64
dtypes: float64(8), int64(1), object(1)
memory usage: 26.4+ KB
```

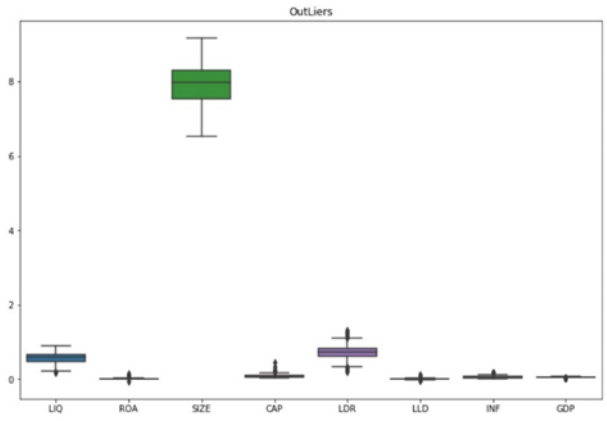

Figure 1. Outliers
Source: boxplot in seaborn

Table 3. Descriptive statistics of variables in the research sample (Summary statistics in Python)

	LIQ	ROA	SIZE	CAP	LDR	LLD	INF	GDP
count	336	336	336	336	336	336	336	336
mean	0.568972	0.009654	7.966055	0.097545	0.731631	0.008286	0.063138	0.059275
std	0.127281	0.014795	0.527998	0.049448	0.176565	0.013217	0.045268	0.011277
min	0.16972	-0.059929	6.522437	0.026214	0.189948	-0.032843	0.006	0.0291
0.25	0.484249	0.003221	7.536113	0.065725	0.627669	0.003641	0.03455	0.05395
0.5	0.58777	0.006763	7.986724	0.083793	0.725519	0.007077	0.05525	0.06095
0.75	0.657192	0.012062	8.306889	0.113814	0.822945	0.013259	0.0753	0.067875
max	0.909702	0.141359	9.180896	0.462446	1.318359	0.127381	0.1813	0.0708

The results in Table 3 show that the average value of LIQ liquidity as measured by the ratio of Liquidity to Total Assets is 0.568860 standard deviation 0.127371. The largest value is 0.909702 (Saigon - Hanoi Commercial Joint Stock Bank in 2012) and the smallest value is 0.169720 (Tien Phong Commercial Joint Stock Bank in 2008). Depending on the economic fluctuations in each period, commercial banks in Vietnam have variable liquidity. Thereby, it can be seen that the liquidity situation of banks is relatively stable.

ROA bank profit has an average value of 0.009653, standard deviation is 0.014795, reaching the maximum value of 0.141359 (Technical and Commercial Joint Stock Bank in 2016) while the smallest value is Tien Phong Commercial Joint Stock Bank in 2011 with - 0.059929. With this negative number, TPBank's business activities at that time were facing difficulties and needed remedial measures.

Bank size SIZE as measured by Log (Total Assets) has a mean value of 7.965428 and this is the variable with the largest mean of the analyzed variables. The standard deviation is 0.528580 and the largest value is 9.180896 belonging to the Joint Stock Commercial Bank for Investment and Development of Vietnam in 2020. While the smallest value is 6.522437 which is the Viet Capital Commercial Joint Stock Bank in 2009.

The average value of the Equity to Total assets ratio CAP is 0.097545, the standard deviation is 0.049448, the largest value is 0.462446 (Lien Viet Post Commercial Joint Stock Bank in 2012), the minimum value is 0.026214. is Saigon Commercial Joint Stock Bank in 2020.

The average value of LLD credit provision is 0.008282 with a standard deviation of 0.013216, with the smallest value being - 0.032843 of Techcom Bank in 2015. Meanwhile, in 2012 LienViet potst Bank has the highest provision for credit risks with 0.127381. At the same time, through these values, we can see that banks are continuing to increase provisions for credit risks to ensure the safety of their operations.

The ratio of outstanding loans to Total deposits LDR has an average value of 0.731493 with a standard deviation of 0.176662, the maximum value is 1.318359 of Viet Capital Bank in 2009, the minimum value is 0.189948 of TP Bank in 2011.

The INF inflation rate has a mean of 0.063138 with a standard deviation of 0.045268. In 2015, Vietnam had the lowest inflation rate of 0.60% and the highest in 2011 with an inflation rate of 18.12%. This ratio shows that the State Bank has proactive and flexible management policies of monetary policy tools as well as a close combination with fiscal policy, making an important role in controlling and stabilizing inflation.

The average economic growth rate GDP over the years of banks is 0.059275 with a standard deviation of 0.011277. The highest economic growth rate in 2018 with the rate of 7.08% and the lowest growth rate of 2.91% in 2020. Over the past time, Vietnam is one of the countries with the fastest growth rate. The economy is quite good and stable, especially, it is a very difficult year in 2020 for the economies of countries around the world, but Vietnam is a country with impressive economic growth during the year of the global Covid 19 pandemic.

4.2 Algorithm used and model results

The algorithm used for the model is Multiple linear regression, this algorithm is used for multivariate regression analysis under Supervised learning of Machine learning.

4.2.1 Analyzing the relationship between variables through Pearson's coefficient

Correlation between variables through Pearson's coefficient are shown in Table 4.

Table 4. Correlation between variables through Pearson's coefficient (Corr in Python)

	LIQ	ROA	SIZE	CAP	LDR	LLD	INF	GDP
LIQ	1.000000	0.071932	0.317712	-0.115591	0.771236	-0.102189	-0.309179	-0.024318
ROA	0.071932	1.000000	0.130563	0.172373	0.156476	-0.1513	0.071732	0.063327
SIZE	0.317712	0.130563	1.000000	-0.657194	0.237282	-0.165905	-0.186431	0.009647
CAP	-0.115591	0.172373	-0.657194	1.000000	0.082193	0.336948	0.146431	-0.104916
LDR	0.771236	0.156476	0.237282	0.082193	1.000000	0.031747	-0.048387	-0.038791
LLD	-0.102189	-0.1513	-0.165905	0.336948	0.031747	1.000000	-0.048676	-0.11399
INF	-0.309179	0.071732	-0.186431	0.146431	-0.048387	-0.048676	1.000000	0.08896
GDP	-0.024318	0.063327	0.009647	-0.104916	-0.038791	-0.11399	0.08896	1.000000

Table 4 results show that LDR has a strong positive correlation with LIQ, SIZE has a positive correlation with LIQ while CAP, LLD, INL have a negative correlation with LIQ. In addition, the variables ROA, GDP have a very weak correlation with LIQ.

4.2.2 Finding the best test size to build model

Test size to build model are shown in table 5. The results of Table 5 show that with test size 0.20 is optimal for the model and is selected to build the model.

Table 5. Test size to build model (Test size in Python)

Round:1 With [0.65 : 0.35], score train is 0.65 ,score test is 0.77 diff is 0.12 With [0.7 : 0.3], score train is 0.66 ,score test is 0.76 diff is 0.11 With [0.75 : 0.25], score train is 0.67 ,score test is 0.76 diff is 0.09 With [0.8 : 0.2], score train is 0.7 ,score test is 0.69 diff is 0.01
Round:2 With [0.65 : 0.35], score train is 0.65 ,score test is 0.77 diff is 0.12 With [0.7 : 0.3], score train is 0.66 ,score test is 0.76 diff is 0.11 With [0.75 : 0.25], score train is 0.67 ,score test is 0.76 diff is 0.09 With [0.8 : 0.2], score train is 0.7 ,score test is 0.69 diff is 0.01
Round:3 With [0.65 : 0.35], score train is 0.65 ,score test is 0.77 diff is 0.12 With [0.7 : 0.3], score train is 0.66 ,score test is 0.76 diff is 0.11 With [0.75 : 0.25], score train is 0.67 ,score test is 0.76 diff is 0.09 With [0.8 : 0.2], score train is 0.7 ,score test is 0.69 diff is 0.01
Round:4 With [0.65 : 0.35], score train is 0.65 ,score test is 0.77 diff is 0.12 With [0.7 : 0.3], score train is 0.66 ,score test is 0.76 diff is 0.11 With [0.75 : 0.25], score train is 0.67 ,score test is 0.76 diff is 0.09 With [0.8 : 0.2], score train is 0.7 ,score test is 0.69 diff is 0.01
Round:5 With [0.65 : 0.35], score train is 0.65 ,score test is 0.77 diff is 0.12 With [0.7 : 0.3], score train is 0.66 ,score test is 0.76 diff is 0.11 With [0.75 : 0.25], score train is 0.67 ,score test is 0.76 diff is 0.09 With [0.8 : 0.2], score train is 0.7 ,score test is 0.69 diff is 0.01

4.2.3 Model results

The results of the Multiple linear regression model are shown in Table 6.

Table 6. The results of the Multiple linear regression model (Multiple linear regression in Python)

X_train, X_test, y_train, y_test = train_test_split(X,y,random_state=42,test_size=0.2)
lm_m = LinearRegression()
lm_m.fit(X_train, y_train)
yhat_train = lm_m.predict(X_train)
yhat_test = lm_m.predict(X_test)
#R2
tr=lm_m.score(X_train, y_train)
te=lm_m.score(X_test, y_test)
fuda=lm_m.score(X,y)
print('R Square train: ', tr)
print('R Square test: ', te)
print('R Square full:', fuda)
print('Mse_train: ', mean_squared_error(y_train, yhat_train))
print('Mse_test: ', mean_squared_error(y_test, yhat_test))

R Square train: 0.6979640824034271 R Square test: 0.6908754689361744 R Square full: 0.6975728222993508 Mse_train: 0.004856328902828501 Mse_test: 0.004997342543185578

4.2.4 Regression coefficients

Regression coefficients are shown in Table 7. The model results show that the model performance is quite good (R Square ≈ 70%), the difference between train and test is not much, and Mean Squared Error (MSE) and Root mean squared error (RMSE) coefficients are quite low. This means that the built linear model fits the data set to 69.75% or 7 independent variables (ROA, SIZE, CAP, LDR, LLD, INL, GDP) explain 69.75% of the variation of the dependent variable LIQ, while the remaining 31.25% is explained by other factors not mentioned in this study.

Table 7. Regression coefficients (Multiple linear resgression in Python)

α 0.201220601
β array([-0.41475248, 0.00469836, -0.28361419, 0.55150818, -0.97556693, -0.71286696, 0.22598901])

The model is expressed in the form of a regression equation as follows:

$LIQ_{it} = 0.2012206 – 0.41475248ROA_{it} + 0.00469836SIZE_{it} – 0.28361419CAP_{it} + 0.55150818LDR_{it} – 0.97556693LLD_{it} – 0.71286696INL_{it} + 0.22598901GDP_{it}$ (2)

4.2.5 Visualizing the results

The general results are visualized through the Seaborn library to make them simpler and easier to understand. And at the same time, it is possible to visually see the model's predicted results (indicated by the red line) compared to the reality (indicated by blue line). Visualizing the results ars shown in Figure 2.

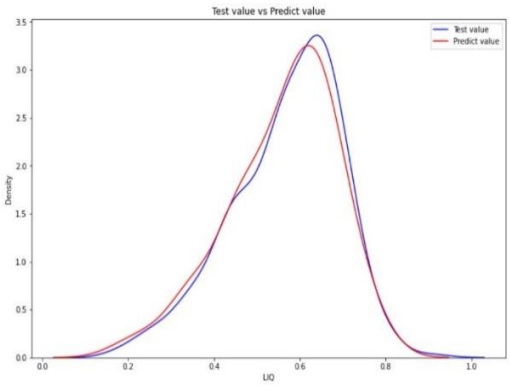

Figure 2. Visualizing the results
Source: Seaborn in Python

Figure 2 shows that there is not much difference between the predicted and actual results expressed by the Mean Squared Erorr (MSE) coefficient which is very small and the R Square is quite good.

4.3 Analysis results

Model results and regression coefficients in equation (2) show that ROA, CAP, LLD, INF have a negative impact and SIZE, LDR, GDP have a positive impact on liquidity of commercial banks in Vietnam in the research sample. The results of the study are clearly shown in Table 8.

Table 8. Analysis results (Compiled by the authors)

Variable	Result	Accept/reject	Prior researches result	Empirical evidences
SIZE	+	Accept	+	Valla & Escorbiac (2006), Sopan & Dutta (2018), Vodova (2013), (O. Aspach và cộng sự (2005)
CAP	-	Reject	+	Munteanu (2012), Singh & Sharma (2016), Vũ Thị Hồng (2015), Bunda và Desquilbet (2008), Vodova (2013)
LDR	+	Accept	+	Vodová (2013), Aspachs và cgt. (2003)
LLD	-	Reject	+	Munteanu (2012), Sopan và Dutta (2018), Vũ Thị Hồng (2015)
ROA	-	Reject	+	Vodová (2013)
INF	-	Accept	-	Munteanu (2012)
GDP	+	Accept	+ -	Bunda and Desquilbet (2008); Valla et al. (2008)

5. CONCLUSION AND SOME RECOMMENDATIONS

5.1 Conclusion

This study is researched by the authors, collecting data from 28 commercial banks in the period after the economic crisis from 2009 to 2020. With the initial objectives the authors set is to identify the factors which affect the liquidity of commercial banks, thereby proposing recommendations as well as policies to commercial banks. Model results and regression coefficients show that ROA, CAP, LLD, INF have a negative impact and SIZE, LDR, GDP have a positive impact on liquidity of Vietnamese commercial banks in the research sample.

5.2 Recommendations for Vietnamese commercial banks

5.2.1 Growing in bank size and liquidity balance

Research results in the model of bank size (SIZE) have a positive impact on liquidity. However, in fact in Vietnam, banks with large asset scale such as BIDV, Vietin Bank, Vietcom Bank, Agri Bank have had the advantage in gaining the trust of customers and easily access loans from SBV, credit institutions or on the interbank market. At the same time, commercial banks with large capital scale have a wide network, so they have many advantages in mobilizing capital and transferring capital internally to ensure liquidity. Therefore, commercial banks need to increase capital and expand the bank's scale. Besides increasing the scale, the banks also have to pay attention to

control the scale expansion and improve operational efficiency. When implementing scale growth, it is necessary to focus on the human factors, improve the qualifications and quality of the staffs because people are a very important factor in deciding and driving for the development of the economy in general and the banking industry in particular.

5.2.2. Growing in equity size (CAP) and using efficiently capital

Of all the sources of capital, equity is the most flexible and the bank has the most autonomy. However, banks need to use equity effectively to improve their liquidity management capacity.

Banks can increase their equity in many ways: raising capital from internal sources from undivided profits, raising capital from external sources such as issuing common shares, issuing preferred shares, converting debt securities into shares. However, in the research results, equity increases inversely with the liquidity ratio. This is consistent with the reality of Vietnam, small banks often actively maintain a high liquidity ratio to meet liquidity requirements from The State Bank, and cope with market fluctuations. Small banks, with a small transaction network, a later establishment time and a low reputation, are difficult to attract abundant deposits. Therefore, this group of small banks will maintain a higher liquidity ratio. In contrast, banks with large scale and extensive branch network will easily cope with liquidity fluctuations from the market, and at the same time, this group of banks will have more advantages from the incentives of The State Bank.

5.2.3 Handling bad debts and improving credit quality (LLD)

The bad debt problem will affect the bank's provision for credit risks and profits as well as hinder the bank's credit growth and liquidity. Although the research results show that the provision for credit risk (LLD) is inversely related to liquidity, this is consistent with the actual situation of Vietnamese commercial banks, which in the past 10 years have undergone 02 restructuring times. However, bad debt is still a core issue in commercial banks' operations that needs to be paid attention and resolved to minimize risks, including liquidity risk. In addition to dealing with bad debts, special attention should be paid to credit quality and improving credit risk management. Some measures need to be implemented such as implementing the capital adequacy ratio and risk management system as recommended by Basel, actively looking for good customers, promptly supporting difficult customers to restore production, fully, accurately and timely make provision for credit risks.

5.2.4 Complying with regulations and ensuring safety in liquidity

Commercial banks must absolutely comply with regulations on ensuring safety in liquidity in particular and comply with regulations on business activities in banks in general. For liquidity ratios, even in practice, commercial banks need to maintain a higher level of safety than the minimum prescribed by authorities. This will help commercial banks have more opportunities to avoid risks from anomalous business factors. As for compliance with regulations on business activities, legal violations, sometimes by just one member of the executive board, can also seriously affect the liquidity safety of the whole bank. Therefore, supervision and inspection activities in the bank need to be carried out regularly. From there, it is possible to promptly detect errors and make adjustments.

5.2.5 Fair competition activity

Commercial banks need to avoid racing in deposit interest rates and unfair competition on prices. This competitive method will cause damage to the commercial banks themselves the most. The turbulence in the residential crowdfunding market during periods of system stress has also partly worsened the overall situation. Instead, commercial banks can compete through non-price policies such as improving product quality and strengthening customer relations.

5.2.6 Well managed liquidity gap

Implement well management of liquidity gap and issues related to interest rate risk. Commercial banks need to complete regulations related to mobilization and lending (especially medium and long-term deposits and loans) at market interest rates; It is necessary to have a scientific solution to prevent customers from depositing and withdrawing money before maturity when market interest rates rise or when other competitors offer high interest rates that are more attractive to customers. In addition, managing the maturity mismatch between the bank's liabilities and assets is an important content for effective liquidity management./.

References:

Aspachs, O., Nier, E., Tiesset, M. (2005). Liquydity, Banking Regulation and macroeconomics. Proof of shares, bank liquydity from a panel the bank's UK. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.673883

Bunda, I., & Desquilbet, J. B. (2008). The bank liquidity smile across exchange rate regimes. *International Economic Journal*, *22*(3), 361-386.

Basel,C.(2008). Principles for sound liquidity risk management and supervision. Basel Committee on Banking Supervision

Hong,V. T. (2015). Factors affecting the liquidity of Vietnamese commercial banks. *Journal of Development and Integration*, *23*(33), 32- 49.

Moore, W. (2009). How do financial crises affect commercial bank liquidity? Evidence from Latin America and the Caribbean.

Munteanu (2012). Bank liquidity and its determinants in Romania. *Procedia Economics and Finance*, 3, 993-998.

Singh, A., & Sharma, A. K. (2016). An empirical analysis of macroeconomic and bank-specific factors affecting liquidity of Indian banks. *Future Business Journal*, *2*(1), 40-53.

Sopan, J., & Dutta, A. (2018). Determinants of liquidity risk in Indian banks: A panel data analysis. *Asian Journal of Research in Banking and Finance*, *8*(6), 47-59.

Rauch, C., Steffen, S., Hackethal, A., & Tyrell, M. (2010). Determinants of bank liquidity creation. *SSRN Electronic Journal*. doi: 10.2139/ssrn.1343595

Valla, N., Saes-Escorbiac, B., & Tiesset, M. (2008). Bank liquidity and financial stability. *IPM24 with IAOS: Measuring Productivity*, *40.*

Vodová, P. (2013). Determinants of commercial bank liquidity in Hungary. *Finansowy Kwartalnik Internetowy E-Finanse*, *9*(4), 64-71.

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